Globalizing Physics: One Hundred Years of the International Union of Pure and Applied Physics

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GLOBALIZING *Physics*

One Hundred Years of
THE INTERNATIONAL UNION OF
PURE AND APPLIED PHYSICS

edited by
ROBERTO LALLI AND JAUME NAVARRO

Globalizing Physics

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One Hundred Years of the International Union of Pure and Applied Physics

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Preface

The year 2022 marked the centenary of the International Union of Pure and Applied Physics (IUPAP), the only international scientific union for all branches of physics, organized and run by the physics communities of the world. The centenary provided an opportunity to celebrate, to reflect on the Union's past and present, and to discuss its future. Reflection on the past played a key role. Knowledge on an organization's history helps to shape its collective identity, to create a sense of community and continuity, to develop an appreciation of those who have come before, and to point the way to improvement and informed decisions. In this context, the publication of the book *Globalizing Physics: One Hundred Years of the International Union of Pure and Applied Physics*, edited by Roberto Lalli and Jaume Navarro, marks a milestone in the history of our Union, which will undoubtedly be of great value to the communities of physicists and historians, as well as to the general public. We are indebted to Roberto, Jaume and all the authors who have explored the steps taken by IUPAP since its foundation, highlighting the key role of physics in the development of new technologies and the relevance of our Union for science diplomacy throughout its century of existence.

This book is the result of a somewhat unexpected combination of events that came together perfectly, leading to its publication and other results with implications for our Union. In 2018, we approached Roberto Lalli, who had, among other things, written an article on the foundation of the European Physical Society,[1] to see if he could be interested in working on some aspects of the history of the Union on the occasion of the centenary. Roberto immediately showed great interest in the project, which was closely related to his research activities. At the time, however, he was involved in other research projects, and it was not at all clear whether he would be able to commit to working on the history of IUPAP. Luck was on our side and Roberto was finally able to join the effort. It was immediately clear that access to IUPAP's digitized archival material was essential to progress. Under Roberto's guidance and thanks to his extensive professional network, in about a year we were able to complete the full digitization and indexing of the IUPAP institutional archives, which were located in several places around the world: from the IUPAP Gotheborg Secretariat at the Royal Swedish Academy of Sciences, Stockholm, to the Larkin Kerwin Fund at Laval University, Quebec, and other diverse printed materials available in various collections at the University Sapienza, Rome, at the Massachusetts Institute of Technology (MIT), and at Caltech. These invaluable resources for historical research will soon be made openly available on the web. Separately, the officers of IUPAP have been discussing the possibility of creating a new Commission on the History and

[1] Roberto Lalli, "Crafting Europe from CERN to Dubna: Physics as Diplomacy in the Foundation of the European Physical Society," Centaurus 63, no. 1 (2021), 103–31 https://doi.org/10.1111/1600-0498.12304.

Philosophy of Physics. The History of Science and Technology Division of the International Union of History and Philosophy of Science and Technology (IUHPST) and IUPAP decided to join forces to promote research in the history and philosophy of physics and established the Inter-Union Commission on the History and Philosophy of Physics (IUCHPP). The 30th General Assembly of IUPAP in October 2021 then approved the resolution by which the IUCHPP became the sixth Affiliated Commission of the Union (AC6). In 2023, AC6 has awarded the first Early Career Prize on the history and philosophy of physics.

This is yet another story of chance and purpose, like the whole story of humanity, in its continuity and discontinuity. A story that led to the publication of the insightful and beautiful book that we are celebrating today.

Monica Pepe-Altarelli,
IUPAP Vice-President at Large for the Centenary

Silvina Ponce Dawson,
IUPAP President Designate

Acknowledgments

This book could not have been realized without the support of the International Union of Pure and Applied Physics (IUPAP), which funded the digitization of its entire institutional archive and made the documents available to all researchers involved in this project. We would like to thank the entire IUPAP board for the support and encouragement, with special gratitude to the President Michel Spiro, the President-Designate Silvina Ponce Dawson, the Vice-President Elect at Large for the IUPAP Centenary Monica Pepe Altarelli, and the General Secretary for Legal and Financial Affairs Jens Vigen. We are likewise extremely grateful to Karl Grandin, the Director of the Center for the History of Science of the Royal Swedish Academy of Sciences, where the institutional archives of IUPAP are stored, for the fundamental support in the digitization process. We are also grateful to the archives of the University of Laval for their support in the digitization of the folders of the personal papers of Larkin Kerwin related to IUPAP. IUPAP also co-sponsored, together with the Donostia International Physics Center (DIPC), the international hybrid workshop "One Hundred Years of the International Union of Pure and Applied Physics: A Workshop" held in San Sebastian (Spain) on October 20–22, 2023. We are grateful to IUPAP and DIPC for their generous support. Two international commissions have also supported this project from the scientific and logistic perspective: the Inter-Union (IUHPST/IUPAP) Commission on the History and Philosophy of Physics (IUCHPP) and the IUHPST/DHST Commission on Science, Technology and Diplomacy (STAND) whose President, Simone Turchetti, gave a substantial contribution in various phases of the project. Various authors of the book's chapters are members of one of the two commissions. We thank the other members of both commissions for their scientific support that greatly advanced the project. We also thank Gordon Barrett, Dieter Hoffmann, Adele La Rana, Waqar Zaidi, as well as five anonymous referees from Oxford University Press, for their insightful comments. In addition to the IUPAP archives, each chapter is based on research on specific historical archives, but here we wish to mention and thank the Archives of the Physics Department of the Sapienza University of Rome for digitizing and making available to the scholars involved several boxes related to IUPAP in various relevant historical collections stored therein. We are also very grateful to the Caltech Archives for having provided digital copies of the microfilms of the Robert A. Millikan papers concerning the activities of Millikan in international scientific institutions.

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Introduction
Globalizing Physics: One Hundred Years of the International Union of Pure and Applied Physics. An Introductory Essay

Roberto Lalli and Jaume Navarro

Physics played a major role throughout the 20th century in both wartime and peacetime. It underwent a major conceptual reconfiguration at the turn of the century with massive and long-lasting cultural and philosophical impacts. After World War II, physics came to be perceived, especially because of the atom bomb project, as the discipline whose development was decisive to national security, hence shaping the politics of the Cold War. Authoritative physicists became part of national Advisory Boards, thus playing crucial roles in the configuration of national and foreign policies, as well as acquiring enormous scientific prestige internationally.

Given the relevance of physics in contemporary history, it is perhaps surprising that the scholarly literature overlooks the history of the most authoritative international organization devoted to physics that globally unites professionals of this discipline: the International Union of Pure and Applied Physics (IUPAP). As of 2022, the year of IUPAP's centenary, the only work exploring its past is a short booklet issued for the 70th anniversary of the Union and listing major events and figures. Former officers of this international organization have written short articles on its history too, but none extensive enough to shed light on its origins and evolution.[1] This volume therefore fills an important gap in our knowledge of the Union's history. It does so through contributions addressing both general developments and specific cases that highlight key aspects of IUPAP's role in both physics and international affairs. All the contributions display how the Union pursued its mission in a changing historical context, shaped by a variety of external social and political factors.

IUPAP's current officials played a key role in the project leading to this volume as, while preparing for the centenary celebrations, they promoted the digitization of its entire institutional archive so that the scholars involved in the project could share and analyze these historical documents.[2] In COVID times, this proved invaluable since contributors to the collection worked in institutions located in four different continents and, due to the pandemic, could not travel to archives either. IUPAP also

[1] *IUPAP 1922–1992*, available at https://archive2.iupap.org/wp-content/uploads/2013/04/history.pdf; Pierre Fleury, "The International Union of Pure and Applied Physics from 1923 to 1972," in *Physics 50 Years Later: [Papers] as Presented to the XIV General Assembly of the International Union of Pure and Applied Physics on the Occasion of the Union's Fiftieth Anniversary, September 1972* (Washington, DC: National Academies Press, 1973), 3–12.

[2] Available at https://iupap.org/centennial/iupap-100-project/.

Roberto Lalli and Jaume Navarro, *Globalizing Physics*. In: *Globalizing Physics*. Edited by: Roberto Lalli and Jaume Navarro, Oxford University Press. © Oxford University Press (2024). DOI: 10.1093/oso/9780198878681.003.0001

co-financed, together with the Donostia International Physics Center (DIPC), the hybrid workshop held in San Sebastian in October 2022 where, at the end of the pandemic, these scholars met to discuss the drafts of their original articles. IUPAP's support was thus immensely important, though not alone in supporting the project. The combined efforts of the newly established Inter-Union (IUHPST/IUPAP) Commission on the History and Philosophy of Physics (IUCHPP), and the International Union of History and Philosophy of Science and Technology (IUHPST)/Division of History of Science and Technology (DHST) Commission on Science, Technology and Diplomacy (STAND) further contributed to the completion of this project.[3]

This volume charts the history of IUPAP as a crucial case study of the institutionalization of international science through the setting up of scientific unions and its umbrella organization, the International Council of Scientific Unions (ICSU). Originally conceived as the International Research Council (IRC), in 1931 it was re-named as ICSU and has since then been the main forum to coordinate international activities of various scientific unions.[4] Volumes written on the history of ICSU and its unions have been a valuable reference, but our approach has been considerably different. Such historical studies are monographs that seek to provide an overall perspective of the activities of the unions. Often written by scientists and officers, they usually offer a first-hand perspective of the organizations in which they had been personally involved.[5] Other monographs written by professional historians still offer synthetic narratives of the inner workings of scientific unions.[6] And some projects assembling both scientists and historians have provided interesting collections devoted to a variety of aspects of some unions' institutional history.[7]

This edited collection adds a historical analysis to these views that situates the history of IUPAP in the broader literature on science and international relations, also building on the bourgeoning literature on transnational historiography of science and technology.[8] In this respect, the volume also draws on a recent edited volume

[3] Available at https://www.iuchpp.org/; https://sciencediplomacyhistory.org/.

[4] For brevity's sake, in this introductory essay we will refer to ICSU as the umbrella organization, whatever the historical period under discussion. Since 2018, ICSU has merged with the International Social Science Council to form the International Council for Science (ICS), available at https://council.science/.

[5] Adriaan Blaauw, *History of the IAU: The Birth and First Half-Century of the International Astronomical Union* (Dordrecht; Boston: Kluwer Academic Publishers, 1994); Roger Fennell, *History of IUPAC, 1919–1987* (Oxford; Boston: Blackwell Science Ltd, 1994); Frank Greenaway, *Science International: A History of the International Council of Scientific Unions* (Cambridge, [England]; New York: Cambridge University Press, 1996); Olli Lehto, *Mathematics without Borders: A History of the International Mathematical Union* (New York: Springer, 1998).

[6] Johannes Andersen, David Baneke, and Claus Madsen, *The International Astronomical Union: Uniting the Community for 100 Years* (Cham: Springer International Publishing, 2019); Norbert Schappacher, *Framing Global Mathematics: The International Mathematical Union between Theorems and Politics* (Cham: Springer International Publishing, 2022).

[7] Christiaan Sterken, John Hearnshaw, and David Valls-Gabaud, eds., *Under One Sky: The IAU Centenary Symposium* (Cambridge, UK: Cambridge University Press, 2019). Brigitte Van Tiggelen, ed., "Special IUPAC100," Special issue. *Chemistry International* 41 (2019).

[8] On the transnational historiography of science and technology, see John Krige and Kai-Henrik Barth, eds., "Global Power Knowledge: Science and Technology in International Affairs," Special issue, *Osiris* 21 (2006); Simone Turchetti, Néstor Herran, and Soraya Boudia, "Introduction: Have We Ever Been 'Transnational'? Towards a History of Science across and beyond Borders," *The British Journal for the History of Science* 45, no. 3 (2012): 319–36; Jeroen van Dongen, Friso Hoeneveld, and Abel Streefland, eds., *Cold War Science and the Transatlantic Circulation of Knowledge* (Leiden; Boston: Brill, 2015); John Krige, ed., *How*

focusing on the relationship between science and diplomacy in the context of the International Astronomical Union (IAU).[9] All these new narratives shed light on the important role that scientific unions have played not just within the scientific world, but also in addressing, as a sort of "parallel" or track-II diplomatic forum, the relations between states and international political organizations globally.[10]

In 1963, a key figure in IUPAP's history, the Canadian physicist and IUPAP Secretary General Larkin Kerwin, stated that "the Union's purpose is to foster international physics meetings, more rapid dissemination of information and the establishment of international standards, units and nomenclature;" but crucially added that "[i]ts *unofficial* goal is to make a contribution to general international understanding."[11] As our research moved on, we realized that this science diplomacy component was a major driving factor in the development of the Union.

Thus, our approach in writing the history of IUPAP has been different and more ambitious than previous historical accounts of international unions. In addition to in-depth analyses of case studies and themes, some contributors (including the two co-editors) carried out the task of writing articles that address the historical unfolding of the institution in more general and synthetic terms, thus placing specific themes and analyses into a long-term narrative. Overall, we collectively aimed at interpreting the history of IUPAP as a case study to investigate the complex dynamic relations between science and international politics in its historical unfolding and global repercussions. Contributors have thus focused on critical questions such as the roles IUPAP played in the scientific and political arenas (and the interaction thereof); or the Union's dependency on broader historical transformations connected to globalization. The following synthetically recalls some of the general themes that have emerged in addressing these questions.

What Kind of Institution is IUPAP?

IUPAP was part of a network of scientific organizations that, strictly speaking, operated outside the sphere of governmental affairs but that, in fact, integrated in the activities and policies of governments and multilateral organizations. In examining these operations, IUPAP reveals itself as an organization practicing what we call today science diplomacy.

While many international scientific institutions have attracted the interest of historians of science, most accounts focus on project-oriented organizations, often operating in the European context. United Nations Educational, Scientific and Cultural Organization (UNESCO) has also received overwhelming attention as the

Knowledge Moves. Writing the Transnational History of Science and Technology (Chicago: University of Chicago Press, 2019); John Krige, *Knowledge Flows in a Global Age: A Transnational Approach* (Chicago: University of Chicago Press, 2022).

9 Thierry Montmerle and Danielle Fauque, eds., *Astronomers as Diplomats: When the IAU Builds Bridges Between Nations* (Cham: Springer International Publishing, 2022).

10 For the concept of Track II diplomacy, see Peter L. Jones, *Track Two Diplomacy in Theory and Practice* (Stanford, California: Stanford University Press, 2015).

11 Larkin Kerwin, "The International Union of Pure and Applied Physics," *Physics Today* 22, no. 5 (1969): 53–5, on 53.

main intergovernmental body devoted to the promotion of scientific and cultural exchanges (as well as education).[12] Over the last decade, interest in the history of international scientific institutions has grown, catering for a broader coverage, and offering readings that have also challenged the conventional understanding of the Cold War as a bipolar conflict through analyses of the global impacts of science and technology.[13] The emergence of science diplomacy as a key aspect in international affairs in both scientific and political circles has further increased historians' interest in the activities and functions of international organizations.[14] The parallel historical reflection on the notions of scientific internationalism and universalism has shed light on the institutions that negotiated, defined, and operationalized these notions in the international arena.[15] Finally, the increasing interest on transnational networks in connection with the growth of application of social network analysis as a methodological tool, has also led to reconsidering international scientific institutions as primary objects of investigation.[16]

One key issue is whether international scientific institutions depend on the official involvement of governments. The 1945 United Nations (UN) Charter sanctioned a

[12] James Patrick Sewell, *UNESCO and World Politics: Engaging in International Relations* (Princeton, NJ: Princeton University Press, 1975); Clare Wells, *The UN, UNESCO and the Politics of Knowledge* (London: Palgrave Macmillan UK, 1987); Jean-Jacques Renoliet, *L'Unesco oubliée: la Société des Nations et la coopération intellectuelle, 1919–1946* (Paris: Publications de la Sorbonne, 1999); Aant Elzinga, "UNESCO and the Politics of International Cooperation in the Realm of Science," in *Internationalism and Science*, eds., Aant Elzinga and Catharina Landstrom (London: Taylor Graham, 1996), 89–131; Daniel Laqua, "Transnational Intellectual Cooperation, the League of Nations, and the Problem of Order," *Journal of Global History* 6, no. 2 (2011): 223–47; Corinne A. Pernet, "Twists, Turns and Dead Alleys: The League of Nations and Intellectual Cooperation in Times of War," *Journal of Modern European History* 12, no. 3 (2014): 342–58.

[13] See references in note 8. For new perspectives on the global Cold War, see, Melvyn P. Leffler and Odd Arne Westad, eds., *The Cambridge History of the Cold War*, 3 vols (Cambridge: Cambridge University Press, 2010).

[14] Recent journals' special issues showing the increasing interest of science historians in science diplomacy are Simone Turchetti and Giulia Rispoli, eds., "Science Diplomacy," Special issue, *Historical Studies in the Natural Sciences* 50, no. 4 (2020); Lif. L. Jacobsen and Doubravka Olšáková, eds., "Diplomats in Science Diplomacy: Promoting Scientific and Technological Collaboration in International Relations," Special issue, *Berichte zur Wissenschafts-geschichte* 43, no. 4 (2020); Roberto Lalli and Matthew Adamson, eds., "Global Perspectives on Science Diplomacy," Special issue. *Centaurus* 63, no. 1 (2021); Kenji Ito and Maria Rentetzi, eds., "Nuclear Diplomacies," Special issue. *History and Technology* 37, no. 1 (2021); Maria Rentetzi and Kenji Ito, eds., "The Material Culture and Politics of Artifacts in Nuclear Diplomacy," Special issue, *Centaurus* 63, no. 2 (2021); Simone Turchetti and Matthew Adamson, eds., "Science, Technology and Visual Diplomacy," Special issue, *British Journal for the History of Science* 56, no. 2 (2023).

[15] Elisabeth Crawford et al., eds., *The Nationalization and Denationalization of the Sciences*, Sociology of the Sciences A Yearbook 16 (Netherlands: Springer, 1993); Aant Elzinga and Catharina Landstrom, eds., *Internationalism and Science* (London: Taylor Graham, 1996); Simone Turchetti et al., "On Thick Ice: Scientific Internationalism and Antarctic Affairs, 1957–1980," *History and Technology* 24, no. 4 (2008): 351–76; Geert J. Somsen, "A History of Universalism: Conceptions of the Internationality of Science from the Enlightenment to the Cold War," *Minerva* 46, no. 3 (2008): 361–79; Robert Fox, *Science without Frontiers: Cosmopolitanism and National Interests in the World of Learning, 1870–1940* (Corvallis, OR: Oregon State University Press, 2016); Waqar H. Zaidi, *Technological Internationalism and World Order* (Cambridge: Cambridge University Press, 2021).

[16] See, e.g., Christine von Oertzen, *Science, Gender, and Internationalism: Women's Academic Networks, 1917–1955* (New York, NY: Palgrave Macmillan, 2014). On historical analyses of international scientific organizations explicitly based on social network analysis, see Roberto Lalli, *Building the General Relativity and Gravitation Community During the Cold War* (Cham: Springer International Publishing, 2017); Martin Grandjean and Marco H. D. van Leeuwen, *Mapping Internationalism: Congresses and Organisations in the Nineteenth and Twentieth Centuries* (London: Bloomsbury, 2019).

distinction between intergovernmental and non-governmental organizations (IGOs and NGOs) also setting general principles for their operations.[17] Works charting the history of scientific IGOs seem prevalent when compared to those looking into that of scientific NGOs, but it is important to emphasize that their evolution is marked by networking activities enmeshing one group of organizations into the other and establishing ties that complicate any effort to easily define the constellation of international scientific organizations departing from this distinction.[18] So, like all other unions and ICSU itself, IUPAP is categorized as an NGO, even if over the post-war period it was lavishly funded through the intergovernmental UNESCO. Moreover, the legalistic characterization of IUPAP as an NGO works mainly from 1945, since the status of the Union as an international body was by and large undefined in previous decades.[19]

Historians and sociologists of science interested in international scientific institutions have put forward alternative taxonomies of such institutions partly in an effort to overcome the theoretical impasse that a strict distinction between scientific NGOs and IGOs outlines, and have looked into their modes of operation in scientific internationalism instead. Crawford et al., for instance, distinguish between *spontaneous* and *bureaucratic* institutions.[20] Spontaneous are "institutions motivated by the interests of individual scientists who draw on national resources to hold world congresses, committees, coordinate projects," while the bureaucratic institutions are organizations whose "cooperative schemes are [...] outgrowths of government programs and therefore strongly influenced by national interests."[21] The authors consider scientific unions and ICSU as aligned with the former model, while UNESCO exemplifies the latter. Aant Elzinga, similarly, differentiates between *autoletic* and *heteroletic* organizations, the former serving "science as an end in its own right" and the latter supporting "transnational scientific cooperation on extra-scientific grounds."[22]

Although IUPAP legally identifies as an NGO and should fit the definition of a spontaneous or autoletic mode of operation, various chapters in this volume show that this was hardly ever the case. In most part of the interwar period, all unions of the ICSU family were the embodiment of a political project extending World War I military alliances into post-war scientific cooperation. The institutionalized boycott of German physics discussed in the chapters by Fauque and Fox and Navarro, demonstrates that during the 1920s and 1930s IUPAP was fully implicated in the geopolitical dynamics of allied governments. Similarly, most chapters dealing with the history of IUPAP in the post-World War II period explicitly frame the Union as a venue for science diplomacy exercises, which had implications for the interactions between

[17] Kerstin Martens, *NGOs and the United Nations: Institutionalization, Professionalization and Adaptation* (Basingstoke [England]: Palgrave Macmillan, 2005).

[18] For recent historical studies of IGOs see, e.g., Simone Turchetti, *Greening the Alliance: The Diplomacy of NATO's Science and Environmental Initiatives* (Chicago; London: The University of Chicago Press, 2019); Elisabeth Roehrlich, *Inspectors for Peace: A History of the International Atomic Energy Agency* (Baltimore: Johns Hopkins University Press, 2022).

[19] Martens, *NGOs and the United Nations*.

[20] Elisabeth Crawford, Terry Shinn, and Sverker Sörlin, "The Nationalization and Denationalization of the Sciences: An Introductory Essay," in *Denationalizing Science*, ed. Elisabeth Crawford, Terry Shinn, and Sverker Sörlin (Netherlands: Springer, 1993), 1–42.

[21] Crawford et al. "Nationalization and Denationalization," 23–4.

[22] Aant Elzinga, "Modes of Internationalism," in *In Internationalism and Science*, ed. Aant Elzinga and Catharina Landstrom (London: Taylor Graham, 1996), 3–20.

individual governments, multilateral organizations, and in some cases,—e.g., the German Democratic Republic (GDR), the People's Republic of China (PRC), and the Republic of China (ROC) in Taiwan—even for the international recognition of these countries.

As mentioned previously, science diplomacy has recently emerged as a powerful buzzword at the intersection of studies on science, science policy, and international relations.[23] Historians have contributed to explore its past dimensions hence providing new analytical frameworks and key case studies.[24] This new literature (partly elaborated in connection with initiatives of the STAND Commission) has contributed to appraise the conventional understanding of science diplomacy as an inevitably beneficial tool in international relations. This idealized view, as Science and Technology Studies (STS) scholars Charlotte Rungius and Tim Flink contend, reiterates a simplistic understanding of science as inherently neutral and apolitical.[25] Many chapters in this volume capture historically contextualized science diplomacy exercises in which IUPAP was involved or featured as main actor, often explicitly using science diplomacy as an analytical framework.

Silva Neto and Kojevnikov show, for instance, that the Soviet entrance in IUPAP marked an appraisal of the notion of socialist internationalism and, contingently, of Soviet participation in international organizations. While membership to socialist multilateral organizations continued to be a key asset for the USSR, Soviet policymakers now embraced a parallel policy of acceptance of organizations uniting representation from both blocs. This recognition transformed international scientific cooperation in a device of Cold War détente, implicitly reiterating the stance of peaceful co-existence of communist and capitalist blocs. Within this co-existence, as Hof's chapter shows, new dynamics of competition and cooperation emerged, as evidenced by the setting up (in parallel with the USSR joining IUPAP) of a commission on high-energy physics. Hof argues that it was the rhetoric of "purity"—implemented by labeling high-energy particle physics as a pure research branch in opposition to applied nuclear physics—that enabled this cooperation.

[23] Daryl Copeland, "Science Diplomacy," in *The SAGE Handbook of Diplomacy*, ed. Costas M. Constantinou, Pauline Kerr, and Paul Sharp (SAGE, 2016), 628–41; Tim Flink and Ulrich Schreiterer, "Science Diplomacy at the Intersection of S&T Policies and Foreign Affairs: Toward a Typology of National Approaches," *Science and Public Policy* 37, no. 9 (2010): 665–77; Pierre-Bruno Ruffini, *Science and Diplomacy: A New Dimension of International Relations* (New York, NY: Springer Berlin Heidelberg, 2017).

[24] For historical analytical perspectives, see Simone Turchetti et al., "Introduction: Just Needham to Nixon? On Writing the History of 'Science Diplomacy,'" *Historical Studies in the Natural Sciences* 50, no. 4 (2020): 323–39; Lif Lund Jacobsen and Doubravka Olšáková, "Diplomats in Science Diplomacy: Promoting Scientific and Technological Collaboration in International Relations," *Berichte Zur Wissenschaftsgeschichte* 43, no. 4 (2020): 465–72; Matthew Adamson and Roberto Lalli, "Global Perspectives on Science Diplomacy: Exploring the Diplomacy-Knowledge Nexus in Contemporary Histories of Science," *Centaurus* 63, no. 1 (2021): 1–16; Simone Turchetti and Matthew Adamson, "Introduction: Power to the Image! Science, Technology and Visual Diplomacy," *The British Journal for the History of Science* 56, no. 2 (2023): 135–46. For the case of nuclear diplomacy, see Kenji Ito and Maria Rentetzi, "The Co-Production of Nuclear Science and Diplomacy: Towards a Transnational Understanding of Nuclear Things," *History and Technology* 37, no. 1 (2021): 4–20; Maria Rentetzi and Kenji Ito, "The Material Culture and Politics of Artifacts in Nuclear Diplomacy," *Centaurus* 63, no. 2 (2021): 233–43.

[25] Charlotte Rungius and Tim Flink, "Romancing Science for Global Solutions: On Narratives and Interpretative Schemas of Science Diplomacy," *Humanities and Social Sciences Communications* 7, no. 1 (2020): 1–10.

Science diplomacy features preeminently in the chapters discussing long-standing issues regarding membership in IUPAP, mainly because of the controversies surrounding acceptance of national committees from the GDR (discussed in the chapter by Olšáková), and those from the PRC and the ROC (analyzed in the chapter by Hu, Liu, and Yin). The participation of these committees evolved into tense diplomatic issues since it happened at the time when the GDR and the PRC had no official recognition in the West as independent countries. Both ICSU and IUPAP attempted to manage the ensuing controversy by staying away from explicitly political claims and deliberating that a union's acceptation of a national committee had no implication for the international recognition of the respective states or governments. Yet, since this recognition was highly contested in the Cold War climate, it transformed IUPAP into a parallel diplomatic arena adjacent the UN forum where the debate on their status was articulated. These requests of admission into IUPAP arrived all within a few months in the period 1958–59 and implicated even more actors, such as for instance the members of the West German National Physics Committee unwilling to accept another German committee. US Department of State officials were deeply involved too (and anxious), given their support for ROC's recognition and the parallel opposition to that of the PRC which they avowedly opposed (as argued by Hu, Liu, and Yin).

Even when these controversies ended, they had ramifications in another international conflict between IUPAP and the North Atlantic Treaty Organization (NATO) over the banning to travel of individual scientists from East Germany to NATO countries. As argued in Turchetti's chapter, the tensions produced by the ban were formative of IUPAP as a science diplomacy organization in that the strong position taken by its President, the Indian physicist Homi Bhabha, marked the beginning of a more visible presence of the Union, globally, in the political arena through campaigning for the free circulation of scientists. In turn, this transformation defined one of the primary goals of IUPAP and ICSU in later years as a specific pledge in favor of East German scientists turned into a global one for any world scientist who could not travel to international conferences.

This science diplomacy framework also helps to capture many other instances when IUPAP's activities had implications for state affairs, from Latin America to East Asia, such as in the case of the organization of the International Conference of Theoretical Physics in 1953 Japan (as discussed by Ito), and that of the Soviet-Italian physicist Gleb Wataghin (portrayed in Da Silva's chapter). All these analyses challenge the simplistic division of international collaborative work into IGOs and NGOs, and uncover the existence of an extensive network comprising both. They also reveal IUPAP as a decisive cluster of this global network.

In turn, they lend further support to the view that over the last one hundred years IUPAP was more than just an organization devoted to assembling physicists internationally for the sake of advancing physics. Indeed, they display that IUPAP, as an international organization, built bridges (and at times tensions) between governments, regardless of its institutional status as an NGO. Globalization was a factor in this transformation. There is a bourgeoning literature in international relations studies explaining the deep impact of non-state actors—defined as actors whose actions are not necessarily officially endorsed by Governments—in international affairs.[26] Non-governmental institutions are among those non-state actors that transnational historians have recently considered as key in influencing world affairs especially with the weakening power of traditional state-to-state interactions and the opening of a new global sphere of decision-making mediated by multilateral organizations.[27] Science studies scholars have contributed to the effort to chart this transformation by arguing for the co-production of global scientific knowledge and global political order.[28]

To sum up, we have studied IUPAP by breaking up conventional separations distinctive of international scientific organizations. Consequently, we contend that it is impossible to understand the Union as purely spontaneous or autoletic. Indeed, we show that the history of IUPAP displays a constant oscillation between autoletic and heteroletic modes of operation, depending on the political contexts that shaped these relations and the function of science in wider international issues debated at the time. As Lalli argues, IUPAP should rather be understood as a *hybrid* science diplomacy agent, constantly balancing between governmental and non-governmental interactions. In what follows, we show how this new approach assists in better understanding IUPAP's scientific attainments over the one hundred years of its existence.

IUPAP in the Scientific Realm

Historical theories of knowledge evolution see scientific institutions as regulative infrastructures that allow codifying, embodying, enabling, and transmitting knowledge across human society.[29] The dimension of internationality complicates this picture because the kind of social structure related to such institutions necessarily require to take into consideration the dimension of international politics. Crawford et al. have argued that the primary function of international scientific institutions has been to negotiate and define standards at the international level, at least in the period between the second half of the 19th century and the first decades of the 20th century. In their view, these standardization efforts acted at three levels: the pursuit of cognitive homogeneity within disciplines or emerging research areas, the establishment of shared communication standards within the largest scientific or disciplinary communities, and negotiations about technical standards often related to commercial needs in an increasingly global market.[30]

[26] Thomas Risse-Kappen, ed., *Bringing Transnational Relations Back In: Non-State Actors, Domestic Structures and International Institutions* (Cambridge: Cambridge University Press, 1995).

[27] Akira Iriye, *Global Community: The Role of International Organizations in the Making of the Contemporary World* (Berkeley: University of California Press, 2002).

[28] Sheila Jasanoff, *The Idiom of Co-Production, States of Knowledge* (Routledge, 2004), https://doi.org/10.4324/9780203413845-6; John Krige, "Hybrid Knowledge: The Transnational Co-Production of the Gas Centrifuge for Uranium Enrichment in the 1960s," *The British Journal for the History of Science* 45, no. 3 (2012): 337–57; Ito and Rentetzi, "The Co-Production of Nuclear Science and Diplomacy." For employment of science diplomacy as a framework to interpret non-governmental international scientific organizations, see Roberto Lalli, "Crafting Europe from CERN to Dubna: Physics as Diplomacy in the Foundation of the European Physical Society," *Centaurus* 63, no. 1 (2021): 103–31.

[29] Jürgen Renn, *The Evolution of Knowledge* (Princeton: Princeton University Press, 2020).

[30] Crawford, Shinn, and Sörlin, "The Nationalization and Denationalization of the Sciences."

Our investigations into IUPAP's history further complicates this picture. Standardization, at the cognitive and communication levels, was indeed one of the Union's primary goals since its establishment in 1922, as demonstrated especially by the setting up of its Working Commission on Symbols, Units, and Nomenclature (SUN) in 1931 (discussed in the chapters by Fauque and Fox, and Navarro). In particular, the mission of the commission was perfectly in line with the description of the pursuit of cognitive homogeneity in physics as described by Crawford et al. Before 1947, the other existing commission was the one on publications which, though rather irrelevant, confirms the centrality of standardization processes in IUPAP's actions, in this case in the search for standards in the main scholarly communication venue in physics, namely, scientific journals. Standardization also remained a major focus of attention for IUPAP after World War II, with the SUN Commission becoming one of the most relevant within the Union (from 1966 in connection with other ventures, such as the establishment of the Committee on Data of the ICSU, CODATA).[31] Doran's chapter further exemplifies the importance of this aspect by looking at how light instruments enabled precision measurement and how IUPAP became a venue, albeit not the only one, where metrological negotiations took place.

That said, standardization was far from being the only area of intervention of IUPAP after it restarted its activities in 1947. As shown by Lalli, while the refoundation centered on re-establishing clear and well-defined relations between physics and politics in IUPAP actions, the result was the blossoming of topical commissions devoted to specific sub-fields of research (Figure I.1). In part, the creation of commissions might be interpreted as a standardization process of an international community defining the sub-disciplinary architecture of physics. However, what was being produced was a social disciplinary structure of physics with definitions of hierarchies, both social and cognitive. In addition, commissions had often the ambition to organize the field of research in a project-oriented fashion. Overall, the chapters in the volume demonstrate how standardization gradually lost its primary position in the framework of IUPAP activities since the early Cold War period. Lalli argues that the creation of topical commissions was the activity that most characterizes a radical shift in IUPAP's role from an organization primarily aimed at providing standards into an organization that aspired to lay the conditions for scientific exchanges and actual cooperation.

Boundary work was being pursued in the process of forming commissions, in the negotiations within a commission, and in the relations between commissions, often leading to recognizing the necessity of cooperation among commissions for addressing specific topics.[32] Intra- and inter-commission negotiations could actually be problematic, as shown by Fauque and Van Tiggelen in the case of the Joint Commission on Radioactivity, which IUPAP shared with the International Union of Pure and Applied Chemistry (IUPAC). Indeed, the boundary between disciplines (physics

[31] This is a preliminary result of the ongoing international ERC AdG research project "Negotiating World Research Data: A Science Diplomacy Study" led by Simone Turchetti, available at https://neworldata.org/.

[32] For the notion of boundary work, see Thomas F. Gieryn, *Cultural Boundaries of Science: Credibility on the Line* (Chicago: University of Chicago Press, 1999).

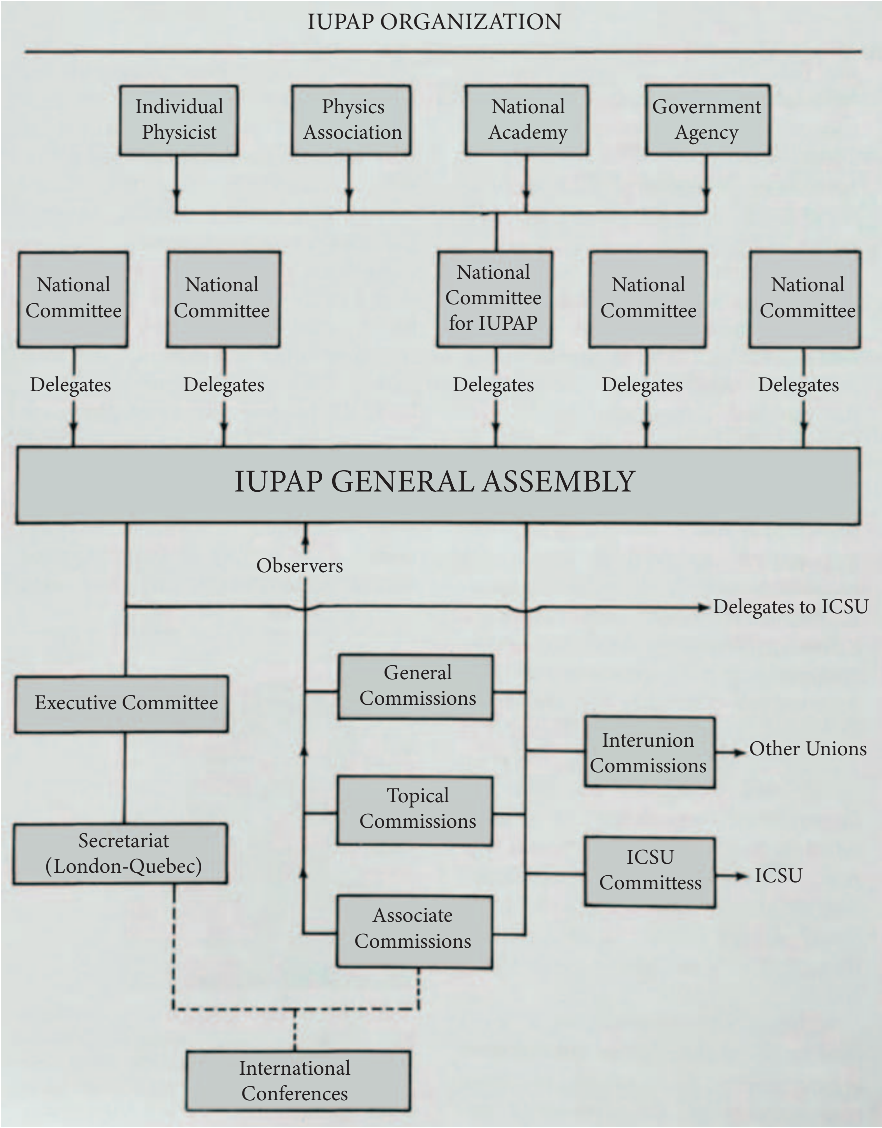


Figure I.1 IUPAP organizational chart in 1969

Source: Reproduced from Larkin Kerwin, "The International Union of Pure and Applied Physics," *Physics Today* 22, no. 5 (1969): 53–5, on 54, with the permission of the American Institute of Physics.

and chemistry), between epistemic traditions (in the evolving field of radioactivity), between institutional interests (the claims to preserve the pre-eminence of Curie's laboratory), as well as the affinity or animosity between individual scientists (Frédéric Joliot-Curie), shaped the formation, evolution, and in this case, the demise of commissions and inter-union commissions.

IUPAP was also an instrument to globally navigate the relations between pure and applied physics. Martin shows how the emergence of a distinction between putative pure and applied realms depended on an ambition, especially in the US context, to motivate investments in basic research. This distinction did have an impact on IUPAP activities defining an imbalance in favor of non-applied research. Cold War imperatives, as shown in Hof's chapter, heightened this imbalance further in the name of "purity" in relation to high-energy particle physics, whereas support to physics activities in developing countries, in line with UNESCO's agenda, tipped the balance slightly in favor of applied (industrial) physics.

Support to developing countries, when combined to another key item in UNESCO's agenda, i.e., education, also shows the widening scientific interests within IUPAP in the post-war period as a matter of diplomatic engagement with the UN agency, which can be seen in the proceedings of the Union's Commission on Physics Education. As Simon's chapter shows, however, there was a significant mismatch between preconceived views on what IUPAP wished to prioritize and the actual status of physics education in developing countries. Moreover, IUPAP's efforts to promote industrial physics at the end of the century reflected the Union's ambition to become a global actor.

But since IUPAP was part of an organizational structure for international science, with all unions integrated in an umbrella organization centered in ICSU (see Figure I.2), and this umbrella organization faced similar issues related to changing political context, it is legitimate to wonder to what extent IUPAP's attainments, in the scientific and policy realms, were unique. Various chapters in the volume reveal this to be the case.

The Specificity of IUPAP History

A premise is in order. The relations between ICSU and the unions changed considerably over the years. Until the creation of ICSU in 1931, unions were essentially IRC sections. After its establishment, unions had a greater degree of autonomy. The 1946 agreement between ICSU and UNESCO changed these relations again, for while decision-making within unions remained largely autonomous, UNESCO funding was made available for international conferences and joint commissions, hence shaping their initiatives and instigating competition between unions.

However, while sharing an interest in taking part in this race, IUPAP shaped an almost unique profile as a science diplomacy organization by embracing critical decisions regarding membership and the free circulation of scientists that other unions (or even ICSU at large) would not endorse so wholeheartedly. Why physicists were more ready than other kinds of scientists to take bold stances on matters of global relevance regarding international science is difficult to say. It is worth reminding, however, that since the end of World War II physicists have played politically relevant roles in various other arenas. Many had been involved in the campaign against nuclear proliferation and paid the price for this involvement through McCarthy's

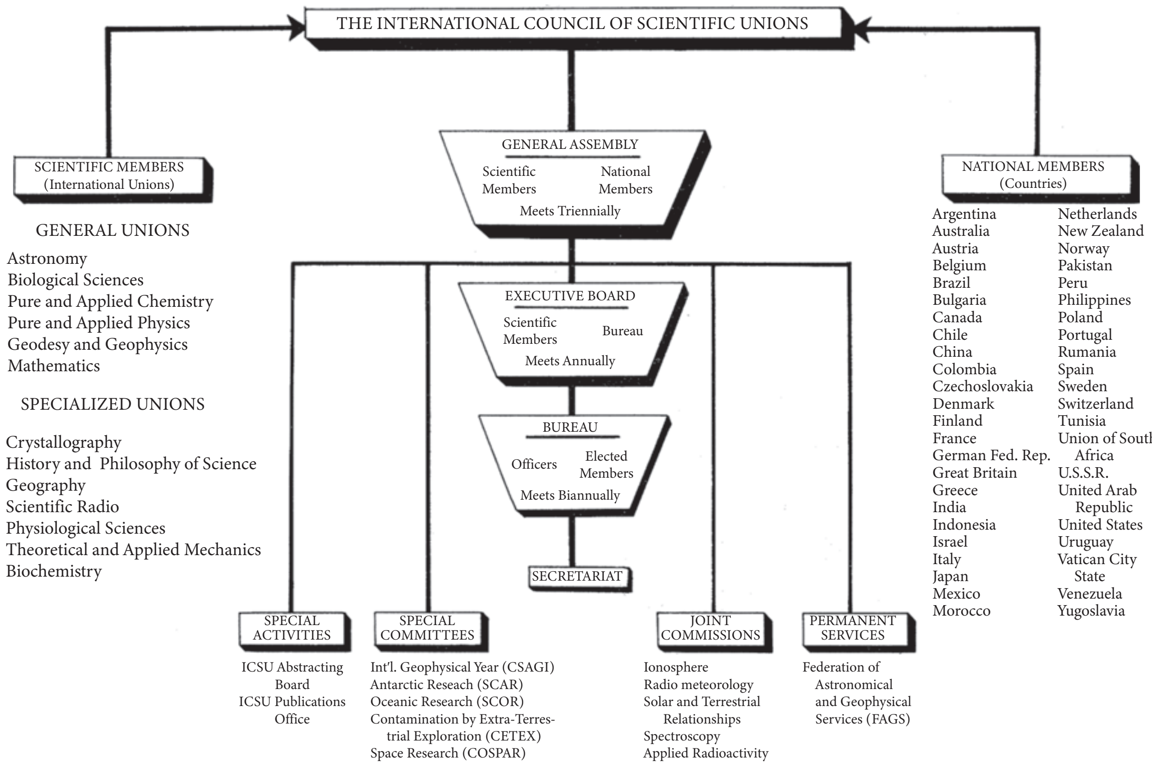


Figure I.2 Organizational chart of ICSU in 1958

Source: Reproduced from Atwood, Wallace W. "International Council of Scientific Unions," *Science* 128, no. 3338 (1958): 1558–61, on 1559, with the permission of the American Association for the Advancement of Science.

witch-hunt.[33] Some institutionalized this campaigning through transnational political organizations like Pugwash.[34] Especially during the war in Vietnam, the physics community split over the contribution that physicists should have given to the conflict, some advocating advising US government while others considering these advisory roles as contributing to a genocide in Vietnam.[35]

It should not be a surprise therefore that IUPAP officials were virtually at the forefront of a number of campaigns eventually endorsed by ICSU and the other unions. IUPAP was, for instance, the first union to offer national membership to an East German scientific organization. It is true that, as Olšáková shows, in so doing IUPAP was simply the first union to fully implement the principle of political non-discrimination that ICSU had already approved at its 1958 general assembly. Even so, its leaders displayed a considerable level of boldness, given that the matter of acceptance of an East German organization was highly contentious at an international level due to the non-recognition of the East German state in the "free world." As discussed in Cozzoli's chapter, the then President Edoardo Amaldi in particular must have been aware that IUPAP's move would produce a domino effect, with East German committees separately requesting acceptance in ICSU and other unions, and making it difficult for their officials to refuse it in light of the precedent set by IUPAP.

Likewise, the IUPAP Executive Committee agreed to accept the Physical Society of Taiwan without waiting the formal indication by ICSU, in spite of proposals to wait for ICSU's decisions on these matters. As shown by Hu, Liu and Yin, the controversy regarding the PRC and ROC membership extended to other unions, but in the combined acceptance of Taiwan and GDR as national members in 1959, IUPAP pioneered an argument based on a symmetry in relation to the opposite pressures of Cold War blocs.

The highly divisive issue of the free circulation of scientists displays once again a pioneering role for IUPAP. As shown in Turchetti's chapter, IUPAP took the lead in forwarding an official protest to NATO for the ban to East German scientists travelling to Western countries. Bhabha's letter to the NATO Assistant Secretary General for Scientific Affairs informed further correspondence by the ICSU Secretary and Executive Board who extended the Indian physicist's pledge, paving the way to the establishment, in 1963, of an ICSU Standing Committee on the Free Circulation of Scientists.

IUPAP's development as a scientific organization also differed from that of other unions. As discussed in the chapters by Fauque and Fox, and Navarro, IUPAP often operated according to a discipline-specific agenda. It was mostly inactive in the period between the two World Wars, and the only two scientific commissions established

[33] Jessica Wang, *American Science in an Age of Anxiety: Scientists, Anticommunism, and the Cold War* (Chapel Hill, NC: University of North Carolina Press, 1999); David Kaiser, "The Atomic Secret in Red Hands? American Suspicions of Theoretical Physicists During the Early Cold War," *Representations* 90, no. 1 (2005): 28–60.

[34] Alison Kraft and Carola Sachse, *Science, (Anti-) Communism and Diplomacy: The Pugwash Conferences on Science and World Affairs in the Early Cold War* (Leiden; Boston: Brill, 2020).

[35] Gerardo Ienna and Simone Turchetti, "JASON in Europe: Contestation and the physicists' dilemma about the Vietnam War," *Physics in Perspective* 25 (2023): 85–105.

were general in scope, primarily dealing with standardization. This was in stark contrast to the IAU, which by the early 1920s had already created thirty-two commissions dedicated to specific research topics. It remained in the middle ground between unions that put forward scientific agendas despite the limitation of the international participation due to the exclusion of Central Powers' scientists, like the IAU, and those unions that were completely dismantled because of the political issue of exclusion of Germans, like the International Mathematical Union (IMU). In a way, the interwar period saw IUPAP failing in many respects, especially in the involvement of Germans, but it was precisely the decision to continue maintaining the existence of the organization despite these failures that allowed IUPAP to resurge from its ashes after World War II and gain a central place in the international re-organization of physics.

Hence IUPAP was not simply and not only a manifestation of broader processes of international scientific coordination applied to the physics realm. It was a venue for autonomous decision-making processes where physicists were the primary actors in relations to governments, other institutions, and networks of similar organizations under the ICSU umbrella.

Individuals in IUPAP

The issue of autonomous decision-making calls into question another key issue that this volume posits; namely, to what extent individuals informed institutional decisions at IUPAP. Drawing on works that have revealed the multiple roles that some scientists could play in the international arena (as policymakers and at times even intelligence agents), the chapters in the volume display the significance of individual interventions in era-defining issues for IUPAP's history.[36]

The role of IUPAP Presidents in designing and implementing specific agendas is particularly evident in these analyses. For instance, Navarro shows how the energetic US physicist Robert Millikan saw IUPAP as an important platform for extending a US hegemony over the physical sciences during the 1930s, and his promotion of an enlargement of IUPAP to former enemy countries further confirms this ambition. Millikan's attempts were largely unsuccessful, but they show how individual agendas modelled actions and membership in the Union.

Edoardo Amaldi had an equally central role in shaping Italian physics in the decades after World War II and in institution-building at the European level. Amaldi's personal political stances and his central position in Italian policy-making in physics made him the ideal figure to lead IUPAP into a fundamental transition of its history, when the Union transformed into an institution based on the balance between Cold War blocs with the Soviet membership of 1957. As discussed by Cozzoli,

[36] Ronald E. Doel, "Scientists as Policymakers, Advisors, and Intelligence Agents: Linking Contemporary Diplomatic History with the History of Contemporary Science," in *The Historiography of Contemporary Science and Technology*, ed. Thomas Söderqvist (Amsterdam: Harwood Academic, 1997), 215–44. A particular relevant case was the Pugwash movement, see Kraft and Sachse, *Science, (Anti-)Communism and Diplomacy*; and Alison Kraft, *From Dissent to Diplomacy: The Pugwash Project During the 1960s Cold War* (Cham: Springer International Publishing, 2022).

Amaldi's views in the negotiation opened the entrance of both Taiwan and the GDR as a manifestation of symmetry between Western and Soviet blocs. In addition, he proposed rules and norms that govern the functioning of IUPAP to this day.

In these negotiations, Amaldi was also responsible for promoting the election of Indian nuclear physicist Homi Bhabha as the next President, opening the presidency to representatives of developing and non-aligned countries. Bhabha then played a central role in his political protest of the NATO ban against East German physicists, which had momentous consequences for IUPAP as an international organization (as shown by Turchetti). The Soviet physicist Dmitry Ivanovich Blokhintsev, who was the IUPAP President in the period 1966–69, helped to implement a change of the notion of scientific internationalism that would enable Eastern bloc countries to join the Union more readily, as shown by Silva Neto and Kojevnikov. While only the activities of a few Presidents are discussed in detail in the volume, they reveal the continuous interplay between broader historical forces and the responses of individuals in positions of responsibility in the organization in particularly crucial historical transitions.

IUPAP meant a lot for individual physicists outside the organization's leadership too. IUPAP is thus revealed in Da Silva's chapter to have played a key role in the Russian-Italian physicist Gleb Wataghin's attempt to establish cultural and scientific contacts with his former homeland Russia, exactly in the period when the Soviet Union joined international cooperation. Alignment of individual and institutional agendas is also central in the organization of the International Conference of Theoretical Physics in Japan that Ito discusses in his chapter. "The almost invisible 'Japanese guy[s],'" Ito tells us, spent a considerable amount of their time in organizing the meeting to restore contacts with the international physical community after World War II, aware of the political implications of this opening. These efforts had scientific consequences as well, for the Japanese physicists themselves eventually got international scientific recognition, also through IUPAP.

Conclusion: Why a History of IUPAP?

IUPAP was not a simple manifestation of broader processes or implementation of decisions made elsewhere. IUPAP was a venue and an engine for negotiations at different levels in which individual agendas, institutional processes, and governmental imperatives interacted within the broader global political and scientific contexts to define the policies of the organization. Like other unions, and in relation to ICSU and the other unions, IUPAP then represents a privileged window to investigate two challenging and interconnected problems in the history of science.

The first problem concerns the dichotomy of universalism and contextualism in the natural sciences: while, on the one hand, natural sciences aspire to universality by virtue of their rigorous formal and experimental methods, on the other hand, like any human activity, they depend on situated historical and political contexts. The second involves the historical transformations of the ideal and practices of scientific internationalism and their impacts on science diplomacy during the twentieth century, namely, how the contextually dependent contrast between internationalist views and national constraints shaped scientific activities and, consequently, the function of scientific cooperation in international political relations.

Beyond the relevance of physics, the reasons for making IUPAP such a privileged point of observation of the previously mentioned issues is the fact that IUPAP is, and was, legally an NGO. This implies that its decision-making processes had necessarily to be discussed by individuals whose status was of non-state actors, whatever their covert or open connection with governmental agendas of their nations might have been. In addition, IUPAP is a generalist organization that is not dedicated to specific projects but to a discipline tout court, in this way allowing to study how the discipline has been built at the global level and how politics and science interacted in the socio-institutional process of discipline making.

IUPAP officers had to take their multiple roles in national and international science (and science policymaking) into account in all discussions related to scientific matters as well as to their relation to the broader political, economic, social, and cultural contexts. Clearly, the global promotion and advancement of physics was their main preoccupation, but it could not be the only one. They had to interpret physics tout court, and its evolving branches, as part of a complex global dimension, and a crucial one. By looking at IUPAP as a hybrid science diplomacy agent, and by discussing the interactions between scientists, other organizations, and governments in shaping its activities, the chapters in this volume have reconstructed key transitions in these negotiations, showing the non-trivial connections between global political and scientific orders.

It was not our intent to write a complete history of IUPAP since its inception to this day. Many relevant actors, events, and processes could not be discussed in detail. But we hope that the chapters dealing with case studies and the analytic views offered in this introduction and various chapters provide a framework both for interpreting the broad scopes of these scientific international organizations in their historical unfolding and for capturing the specific role IUPAP played in some key moments.

PART I
IUPAP BETWEEN THE TWO WORLD WARS

1
IUPAP and the Interwar World of Science

Danielle Fauque and Robert Fox

The International Union of Pure and Applied Physics (IUPAP) was a product of the fundamental reorganization of international science that the victorious Allied nations put in place in the years immediately after the Great War. The foundations for what was conceived as a new world order for science were laid in three interallied conferences, held successively in London, Paris, and Belgium between October 1918 and July 1919.[1] It was at the third of these conferences, in Brussels between July 18 and 28, 1919, that delegates from twelve nations put the finishing touches to the statutes of the new International Research Council (IRC) and the administrative structure for the disciplinary unions that were to be established under its control.[2] The tone of the conferences and the decisions taken at them bore the stamp of the Allies' punitive attitudes towards the Central Powers. It was agreed that the defeated nations—Germany, Austria, Hungary, Bulgaria, and what remained of a now highly unstable Ottoman Empire—would be excluded from membership of both the IRC and the unions for a fixed term of twelve years. To carry its work forward, the IRC was to elect an Executive Committee (EC) of five members and to organize a General Assembly of delegations from adhering countries, normally every three years. Individual unions, too, were expected to elect their own ECs and hold General Assemblies, broadly along the lines of the IRC.

Foundation: Vision and Reality

The decisions that the twelve national delegations present endorsed at the IRC's constitutive assembly in Brussels in July 1919 drew on months of careful preparation and

[1] The three conferences took place on October 9–11, 1918 (London), November 26–29, 1918 (Paris), and July 18–28, 1919 (Brussels). Among recent studies of this aspect of the aftermath of the war, see Marie-Ève Chagnon, "Nationalisme et internationalisme dans les sciences au XX[e] siècle: l'exemple des scientifiques et des humanistes français et allemands dans la communauté scientifique internationale (1890–1933)" (PhD diss, Université Concordia, Montreal, 2012), and Danielle Fauque and Robert Fox, "Binding the Wounds of War: Internationalism, National Interests, and the Order of World Science, 1919–1931," in *Blockades of the Mind: Science, Academies, and the Aftermath of the Great War* [*Acta Historica Leopoldina*, no. 78], ed. Wolfgang U. Eckart and Robert Fox (Halle: Deutsche Akademie der Naturforscher Leopoldina, 2021), 41–68. In an abundant older literature, Brigitte Schroeder-Gudehus, *Les scientifiques et la paix: La communauté scientifique internationale au cours des années 20* (Montréal: Presses de l'Université de Montréal, 1978; reissued [2014]) and Frank Greenaway, *Science International: A History of the International Council of Scientific Unions* (Cambridge: Cambridge University Press, 1996), esp. chs 1 and 2, remain indispensable sources.

[2] For the proceedings of the Brussels conference, see Arthur Schuster, ed., *International Research Council. Constitutive Assembly held at Brussels, July 18th to July 28th 1919. Reports of Proceedings* (London: Harrison & Sons, 1920).

Danielle Fauque and Robert Fox, *IUPAP and the Interwar World of Science*. In: *Globalizing Physics*. Edited by: Roberto Lalli and Jaume Navarro, Oxford University Press. © Oxford University Press (2024). DOI: 10.1093/oso/9780198878681.003.0002

discussions at the earlier conferences in London and Paris. In sustaining the necessary momentum, a provisional Executive Committee, meeting in the spring, was a powerful driving force.[3] Its membership, in its provisional as in its definitive form, reflected the IRC's origins as a product of Allied solidarity during the war and in the peace settlements that followed. The choice of the mathematician Émile Picard as the EC's President and the physicist and Secretary of the Royal Society Arthur Schuster as General Secretary grew naturally from a special bond that had been forged as early as 1916 not only between the two men personally but also between the scientific academies of France and Britain in their conception of what was to become the IRC.[4] With the EC's three other members—George Ellery Hale from the USA, Vito Volterra (Italy), and Georges Lecointe (Belgium)—Picard and Schuster worked tirelessly to advance and control decisions. They laid the ground well and, at the constitutive assembly, had the satisfaction of seeing the IRC firmly established after five sessions of engaged but never acrimonious debate.

The new organization bore the indelible stamp of its origins as a preserve of the Allied nations. France, Britain, and the USA were clearly in the driving seat, and the exclusion of the Central Powers was an unchallenged principle. But the immediate decision to offer membership to thirteen other nations conveyed a readiness for cautious and always carefully managed enlargement: of the thirteen, Czechoslovakia was a post-war creation, China and Siam had been distant allies, and the rest had taken no part in the conflict.[5] By the time of the celebratory closing session on July 28, 1919, plans for the IRC's constituent unions had also advanced. Following exchanges in disciplinary groups that had continued throughout the assembly, the statutes of three unions had been formally endorsed: the International Astronomical Union (IAU), the International Union of Geodesy and Geophysics (IUGG), and the International Union of Pure and Applied Chemistry (IUPAC).[6] Discussion of those of two other unions—the International Mathematical Union (IMU) and the International Union of Scientific Radio Telegraphy (usually abbreviated to URSI, its French acronym)—was also sufficiently advanced for subsequent ratification (in 1920 for the IMU and 1922 for URSI) to be a formality.[7]

In the course of the assembly, hopes of finalizing the plans for a union for what was variously referred to as "la physique" in French and "physical sciences" in English, began promisingly but finally stumbled. This was not for want of resolve or lengthy preparation. Statutes modelled closely on those of the IAU and the IRC had been approved by the IRC's EC as early as May 1919, and these went forward for discussion in Brussels two months later.[8] There, however, a special meeting of the physicists present, chaired by Charles Mendenhall, later professor of physics at the University of Wisconsin, judged that too many leaders of the discipline were absent and too

[3] Ibid., 76–7; also (for the statutes governing the IRC's work) 156–7 and 223–4.

[4] Fauque and Fox, "Binding the Wounds of War," 44–6.

[5] Schuster, *IRC: Constitutive Assembly 1919*, 8. The other ten countries were the Argentine Republic, Chile, Denmark, Spain, Mexico, Monaco, Norway, the Netherlands, Sweden, and Switzerland.

[6] Ibid., 160–84 and 232–46.

[7] Ibid., 185–9, 195–9, 247–50, and 256–60.

[8] Ibid., 76, where Schuster refers to a meeting of the IRC's provisional Executive Committee, held in Paris, May 20–24, 1919.

few nations were represented for the Union to be formed.[9] For Mendenhall's working party, it would be premature even to appoint a provisional EC: all that could be done, pending further planning, was to formulate recommendations ("*vœux*") for the future Union's activities.

In brief, codified form, the recommendations appeared as Article I of the Union's draft statutes. They included broadly cast aims similar to those of other unions and the IRC itself: the promotion of international cooperation, the advancement of research, and the mounting of conferences, including international congresses.[10] Such aspirations were unobjectionable, but the physicists attending the special meeting articulated other, more specific objectives, which they saw as the discipline's immediate priorities. Among these, two stood out. One was the need for improvements in documentation. Less than a fortnight after the first interallied conference, in London in October 1918, leading members of the *Société française de physique*, including Louis de Broglie, Marie Curie, Aimé Cotton, Paul Langevin, and Pierre Weiss, had already made the case for the better coordination of bibliographical information. This would extend, as they hoped, to a new bi-monthly international journal that would ensure the speedy circulation of information and be available in both French and English editions, perhaps in Italian as well.[11] The presence at the meeting of Volterra and Henry Bumstead, the future Chairman of the National Research Council but already a well-known figure in Europe through his wartime service as Scientific Attaché at the US Embassy in London, had brought the proposals firmly into the orbit of the Union. By the time of the IRC's Constitutive Assembly in the following July, the proposals were central to a broader push extending to cooperation between abstracting journals, the preparation of annual reports on progress in physics, the systematic exchange of offprints and doctoral theses, and ways of encouraging the movement of physicists between laboratories, especially those with costly specialized apparatus, such as Kamerlingh Onnes' cryogenic laboratory in Leiden and the large electromagnet planned for construction at Bellevue near Paris.

The second of the physicists' priorities found its expression in the draft statutes as the aim of establishing "international agreements on questions of units, standardization, nomenclature, and notation."[12] On this objective, there was a history going back to the early days of physics as a discipline in the mid-19th century. In Britain, the establishment by the British Association for the Advancement of Science of a Committee on Standards of Electrical Resistance in 1861 was an early advance in what soon became a proliferation of initiatives in the quest for an internationally accepted system of standards, especially though not only in electricity. The *Bureau International des Poids et Mesures* (founded near Paris in 1875), Germany's *Physikalisch-Technische Reichsanstalt* (Berlin, 1887), the British government's National Physical Laboratory (Teddington, 1900), and the US National Bureau of Standards (Washington, DC, 1901) were all responses to the quest, and all contributed to the unprecedented exactitude of precision physics in the half-century

[9] Ibid., 27–31 ("*Séances spéciales. E. Union internationale de physique*").
[10] Ibid., 190–4 (French version) and 251–5 (English).
[11] Ibid., 28–9.
[12] Ibid., 190 and 251.

before the foundation of IUPAP. Despite the efforts of individual laboratories and nations, however, consensus on the standards to be used and the definition of units remained elusive. Exchanges at the first electrical congress in Paris in 1881 and in the context of successive universal exhibitions, notably the World's Columbian Exposition in Chicago in 1893, had achieved a great deal. A quarter of a century on, however, it was not just that much remained to be done, but also that any initiatives taken under the aegis of the IRC entailed a new understanding of the term "international."

The physicists who attended the special meeting in Brussels in July 1919 were keenly aware of the transformation in their community. They knew, for example, that the existing annual tables of physical constants, for which they advocated IRC support, had assumed a new political dimension in the postwar world. Still edited by Charles Marie in Paris, the tables were now very much an Allied production, supported by the neutrals but no longer the truly international initiative they had been before 1914. Then, the German physical chemist Max Bodenstein had been a leading light and the governments of Germany, Austria, and Hungary had been among the national contributors to the cost.[13] In 1919, such participation had become a thing of the past, and triumphalism was an all too present snare. Even the innocuous recommendation for the founding of a journal devoted to the techniques of precise measurement was laced with the gratuitous observation that (contrary to common belief) such a journal would demonstrate that the Allied nations' achievements in instrumentation surpassed those of the Central Powers.[14]

The care with which IUPAP's founders prepared the statutes and the accompanying recommendations is a measure of the hopes they invested in the new Union. But the very scale of their ambitions made the decision to move immediately on the foundation of the Union that much more difficult. In the event, postponement proved a wise course, and it had the desired effect of engaging the attention of several of the world's leading physicists who had been absent in 1919. By the time the IRC gathered for its second General Assembly, in Brussels between July 25 and 29, 1922, new figures had emerged. Among them was Robert Millikan, in his prime as a physicist and with career ambitions of his own. He was already known for the oil-drop experiment by which he measured the charge of a single electron, and in the following year he was to receive the Nobel Prize for physics. His credentials, internationally as well as nationally, were strong: during the war he had had a prominent role in the founding of the NRC and begun the association with George Ellery Hale that took him, in 1921, from his Chair at the University of Chicago to the Throop College of Technology, soon to become the California Institute of Technology, in Pasadena. In Brussels, in 1922, he was an attractive choice

[13] *Tables annuelles de constantes et données numériques de chimie, de physique et de technologie*, published annually since 1910, with Charles Marie as Secretary General of a Paris-based permanent committee. After Marie's resignation from the position in 1936, a specially appointed committee continued to publish the tables into the mid-1940s. It was a mark of the weakening of the Allied boycott that Bodenstein resumed his involvement in the work at the International Chemical Conference in Liège in 1930.

[14] Schuster, *IRC: Constitutive Assembly 1919*, 30.

as Chairman of another preparatory meeting of physicists at which, "after discussion," his proposed title of International Union of Pure and Applied Physics was approved on July 25.[15] The work of an eight-man committee appointed to review the draft statutes of 1919 led to only marginal changes. At a second meeting, on the following day, the IRC's General Secretary Arthur Schuster could announce that the Union would be formally constituted as soon as three countries had become members.[16]

It would be hard to imagine a smoother passage to what appears to have been an easy consensus. Yet decisions taken at successive meetings of the physicists present between July 25 and 27 reflected far-reaching changes that had occurred within the IRC since 1919.[17] One change was simply that of growth. Following the invitations issued in 1919, eight new members had been admitted to the IRC, including Denmark, Sweden, the Netherlands, Norway, and Switzerland, all of which had been neutral during the war.[18] The extension of the IRC's membership, now to a total of twenty nations, had a knock-on effect in a modest extension of the Union's Executive Committee, described in the draft statutes of 1919 as consisting of a President, Secretary General, and a maximum of five Vice-Presidents. In the definitive statutes, approved on July 26, 1922, no limit was specified for the number of Vice-Presidents.[19] This created a flexibility that allowed for the presence of Hendrik Lorentz (from the Netherlands) and Martin Knudsen (from Denmark), representing the new wave of "neutrals," among an enlarged total of eight Vice-Presidents. Even so, the Allies retained a powerful hold. The election of the Nobel Prize winner Sir William Bragg as President, and Henri Abraham, professor of physics at the *École normale supérieure* (see Figure 1.1) and already an active participant in the work of URSI, as Secretary General, secured the two most important positions for Britain and France. And all six of the Vice-Presidents who were elected to serve with Lorentz and Knudsen came from Allied countries (see Table 1.1).[20]

With the administrative structure in place, thoughts turned to action. In the spirit of the union's long-standing objectives, resolutions urging the systematic inclusion of summaries with papers published in scientific journals and the extension of the IRC's support for Charles Marie's annual tables to include patronage for the NRC's tables of constants for physics, chemistry, and technology, won unqualified approval.[21] So too, and in the same spirit, did the proposal for an international congress of physics, to be held in the following year. Possible venues were either Cambridge, where IUPAC was due to meet in June, or Paris, where later in the year the *Société française de*

[15] Arthur Schuster, ed., *International Research Council. Second Assembly held at Brussels, July 25th to July 29th, 1922: Reports of Proceedings* (London: Harrison & Sons, April 1923), 26.

[16] Ibid. The condition that a union could only be formed when three countries had adhered was modelled on a similar condition for the constitution of the IRC, agreed at the constitutive assembly in 1919; see Schuster, *IRC: Constitutive Assembly 1919*, 8. In fact, with Belgium and the United Kingdom already approved as members, only one more country was required.

[17] Schuster, *IRC: Second Assembly 1922*, 26–8.

[18] Ibid., 68.

[19] Ibid., 102–6 (statutes in French) and 107–11 (in English).

[20] Ibid., 27.

[21] Ibid., 28.

Table 1.1 Membership of the Executive Committee of IUPAP (1923–1947)

Function	1923[a]	1925	1931	1934	1947
President	Bragg (GB)	Bragg (GB)	Millikan (USA)[b]	Millikan (USA)	Kramers (Nl)
Secretary General	Abraham (Fr)	Abraham (Fr)	Abraham (Fr)	Abraham (Fr)	Fleury (Fr)
Vice-Presidents	Corbino (It) Knudsen (Dk) Lorentz (Nl) Millikan (USA) Nagaoka (Jp) Rateau (Fr) Van Aubel (Be)	Cabrera (Sp) Guye (Sw) Knudsen (Dk) Lorentz (Nl) Nagaoka (Jp) Natanson (Pol) Siegbahn (Sw) Von Aubel (Be)	Cabrera (Sp) Cotton (Fr) Glazebrook (GB) Keesom (Nl) Knudsen (Dk) Nagaoka (Jp) Posejpal (Cz) Siegbahn (Sw) Van Aubel (Be) Vegard (No)	Bragg (GB) Cotton (Fr) Fermi (It) Glazebrook (GB) Keesom (Nl) Posejpal (Cz) Vegard (No)	Bialobrzeski (Po) Darrow (USA) Darwin (GB) Ewald (GB)[c] Gorter (Nl) Jacobsen (Dk) Scherrer (Swi)
Secretary General	Abraham (Fr)	Abraham (Fr)	Abraham (Fr)	Abraham (Fr)	Fleury (Fr)
Former Presidents					Millikan (USA) Siegbahn (Swe)
Treasurer[d]	Abraham (Fr)	Abraham (Fr)	Abraham (Fr)	Abraham (Fr)	Pérard (Fr)
Audit/Finance Committee	*No Committee*	*Guillaume (Swi)* *Janet (Fr)*	*Guillaume (Swi)* *Janet (Fr)*	*Janet (Fr)*	*Bauer (Fr)* *Gorter (Nl)*

Note: (a) Pending the IUPAP constitutive assembly of 1923, the committee had remained unchanged since the preliminary meeting of the union during the IRC General Assembly of 1922, except for the replacement of Maurice Leblanc (deceased) with Auguste Rateau.
(b) Following Bohr's refusal of the invitation to become President, Millikan fulfilled the essential functions of President as Chairman of the Executive Committee until the rather irregular procedure that led to Siegbahn's appointment in 1937.
(c) Ewald took British nationality in October 1939, on his appointment to Queen's University Belfast.
(d) Throughout the interwar years, there was no formal position of treasurer, and it was left for Abraham to manage the accounts. In 1925, Charles-Édouard Guillaume (BIPM) and Paul Janet (CIPM) were appointed to audit Abraham's Financial Report. But, as auditors, they were never members of the Executive Committee.

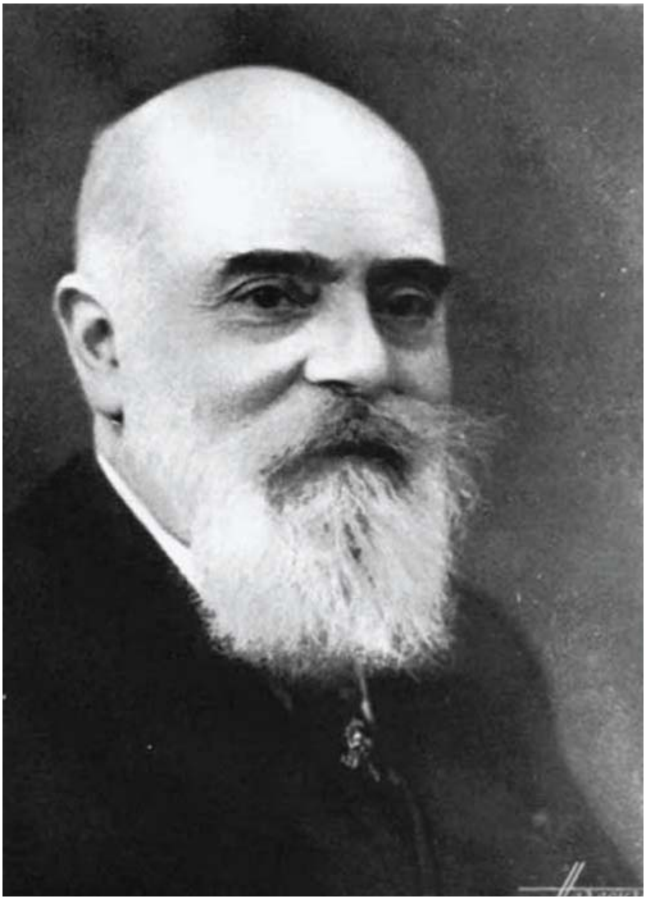


Figure 1.1 Henri Abraham (1868–1943), Secretary General of IUPAP from 1922

Source: Portrait by Studio Harcourt, c. 1935. Wikimedia Commons. Public Domain, available at https://books.openedition.org/editionsulm/756.

physique (SFP) would be marking the fiftieth anniversary of its founding in 1873. What Abraham subsequently referred to as "*difficultés matérielles d'organisation*" seem soon to have tipped the scale against Cambridge, and the choice fell on Paris.[22]

What kind of "congress" the IUPAP envisaged is unclear. But expectations seem to have been modest. And the reality, as an adjunct to the SFP's celebrations in

[22] Report of the first General Assembly, December 1923, 8, series B2aa "General Reports," vol. 1 "1923–1966," IUPAP, Gothenburg secretariat (hereafter IUPAP Gothenburg), Center for the History of Science, Royal Swedish Academy of Science. See also Arthur Schuster, ed., *International Research Council: Third Assembly held at Brussels, July 7th to July 9th, 1925. Reports of Proceedings* (London: Harrison & Sons, no date), 30.

December 1923, was even more so. The event had little in common with the intense six days of the *Congrès international de physique* of 1900, when a gathering of over 800 physicists (almost forty percent of them from outside France) had yielded four volumes of reports systematically reviewing the state of seven main areas of the discipline.[23] In 1923, the tone was light and ceremonial, though certainly not parochial. Almost thirty academies and societies from around the world submitted congratulatory addresses; a week of lectures at the Sorbonne gave distinguished foreign physicists the opportunity of addressing a broad public on their particular areas of interest; and toasts at a dinner on December 12 by Lorentz, Knudsen, and Volterra (all of whom appeared on the lecture program) and by Picard (as President of both the IRC and the SFP) conveyed the society's support for IUPAP's international mission.[24] The holding of IUPAP's constitutive General Assembly on December 10, in the rooms of the Cercle de la Renaissance française in Paris, further reinforced the international dimension, albeit in a gathering dominated by a French presence in excess of that of any other country.[25]

If only as a festive occasion and a reinforcement of the close early bonds between IUPAP and the SFP, the program of events in Paris was a success. Lorentz, attending both the SFP's celebrations and (despite the Dutch Physical Society's refusal to be involved) the IUPAP General Assembly, wrote warmly to Einstein about the personal contacts he had made there.[26] The fact remained, however, that IUPAP's ambition for a full-scale congress had still not been realized, and its claim to be a body representative of world physics remained fragile. At the heart of the Union's shaky start was an emerging crisis within the IRC as a whole. This turned on continuing differences of opinion on the desirability of admitting the former Central Powers as members of the IRC and hence (since membership of the IRC had been a prerequisite for adherence to a union since 1922) of IUPAP itself.[27] The opposition was essentially between, on the one hand, the representatives of France and Belgium, determined to maintain the boycott for as long as possible and, on the other, a growing body of opinion, led by a vociferous group of neutrals, that urged the admission of Germany and the other excluded nations without waiting for the anticipated review in 1931. While the most determined criticism of the boycott was voiced by delegates from the Netherlands, Sweden, and Denmark, there were also those among the once united

[23] Guillaume and Lucien Poincaré eds., *Rapports présentés au Congrès international de physique réuni à Paris en 1900 sous les auspices de la Société française de physique*, 4 vols (Paris: Gauthier-Villars, 1900–1).

[24] *Le livre du cinquantenaire de la Société française de physique* (Paris: Éditions de la Revue d'optique théorique et instrumentale, 1925), 19–37.

[25] At sixteen, the size of the French delegation was far bigger than that of any other country, the Swiss delegation of four being the next largest. For the proceedings at this first formal Assembly of the union, see Report of the first General Assembly, 6, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg. See also Schuster, *IRC: Third Assembly 1925*, 34. The rooms of the Cercle de la Renaissance française, in the former *Hôtel Poulpry, 12 rue de Poitiers*, had been a favorite venue for international gatherings since the Cercle's foundation in 1919.

[26] Lorentz to Einstein, December 20, 1923, in A. J. Kox, ed. *The Scientific Correspondence of H. A. Lorentz*, vol. 1 (New York: Springer, 2008), 562–3.

[27] Membership of the IRC had been formalized as a precondition for admission to a union at the IRC's second General Assembly, in Brussels in July 1922; see Schuster, *IRC: Second Assembly 1922*, 9. On the years of crisis, see Schroeder-Gudehus, *Les scientifiques et la paix*, chs 4–7; Chagnon, "Nationalisme et internationalisme," chs 5 and 6; Fauque and Fox, "Binding the Wounds of War," 48–62.

Allies, in particular the Americans, whose frustration at what they saw as French and Belgian obduracy bred at least some sympathy for the neutrals' cause.

Conflict and Compromise

The gathering tide of support for the amendment of the statutes put the IRC and its unions under intense pressure, and the cracks showed. In 1924, in protest against the council's exclusionist policy, the American Mathematical Society withdrew its offer to organize the International Mathematical Union's congress and so precipitated the embarrassment of the hasty removal of the congress and the IMU's General Assembly from New York to Toronto, where further tensions surfaced.[28] In the General Assembly of the IAU in Cambridge in July 1925, it was the Yale astronomer Ernest W. Brown who led the charge, warning that unless the IRC modified its position, there could be no guarantee of American participation in the IAU's future activities.[29]

The tensions surfaced turbulently in two of the four sessions of the IRC's General Assembly (its third) in Brussels in the same month. Both sessions were structured around a succession of votes on proposals and counterproposals on the burning issue of the admission or exclusion of the Central Powers. In keen exchanges, the argument in favor of the abandonment of all restrictions on membership of the IRC met determined opposition. This came mainly, and unsurprisingly, from Émile Picard, as the IRC President, and the Belgian zoologist and permanent Secretary of the Belgian Academy Paul Pelseneer, who argued that the premature removal of the barriers to membership would jeopardize the cordiality and common purpose which, as they believed (rather generously), had characterized the work of the IRC since 1919.[30] Feelings ran high, and the official report, by the IRC's conspicuously even-handed General Secretary, Arthur Schuster, did what it could to gloss over the intensity of sentiment on both sides. In the event, a combination of the resolute position of the French and Belgian delegates and the complexity of the voting rules made amendment of the statutes virtually impossible, and the challenge to the status quo failed.[31] Lorentz, who had led the case for reform in a letter signed by himself and three other Dutch Nobel Prize winners (including the physicists Heike Kamerlingh Onnes and Pieter Zeeman), had every reason to be disappointed.[32] So, too, did Sir Richard Glazebrook, supporting the case in the name of the Royal Society, and the permanent

[28] Olli Lehto, *Mathematics without Borders: A History of the International Mathematical Union* (New York: Springer, 1998), 33–7 and Norbert Schappacher, *Framing Global Mathematics: The International Mathematical Union between Theorems and Politics* (Cham: Springer and IMU, 2022), 120–1.

[29] Adriaan Blaauw, *History of the IAU: The Birth and First Half-Century of the International Astronomical Union* (Kluwer: Dordrecht, 1994), 76–82 and Fauque and Fox, "Binding the Wounds of War," 53 and 63.

[30] Schuster, *IRC: Third Assembly 1925*, 6–13, on the morning and afternoon sessions on July 8.

[31] See especially the vote of twenty-eight in favor and nineteen against the deletion of the passages in the statutes restricting membership; ibid., 12–13. For the motion to be passed, it would have had to receive two-thirds of the number of votes held by all the member countries combined, some of which held as many as five votes by virtue of the subscriptions they paid. Of a total of seventy-six votes, fifty-one would have been required for any change to take effect.

[32] For the letter, see ibid., 6–7. The fourth signatory was the physiologist Willem Einthoven.

Secretary of the National Research Council, Vernon Kellogg, speaking and voting in the same vein on behalf of his American colleagues.[33]

The decisions reached in Brussels served to highlight rather than heal the divisions. Within two weeks, Ernst Cohen, recently elected as President of IUPAC, warned Picard and IUPAC's General Secretary, Jean Gérard, that certain countries, including his own, the Netherlands, were so upset that they were contemplating resignation from the IRC; such withdrawals, as he put it, would signal "*le commencement de la dissolution totale du C.I.d.R. ainsi que des unions.*"[34] In IUPAP, Lorentz too saw trouble ahead. With the authority of a universally respected figure who was not only a Vice-President of the Union but also Chairman of both the International Committee on Intellectual Cooperation (ICIC) and the Solvay Conferences for Physics (since their inauguration in 1911), he conveyed his foreboding in a letter to Max Planck in August. As he told Planck, IUPAP was resolved to postpone any congress under its auspices until German physicists could be freely admitted.[35] The Union's firm line in favor of German participation had received support at the highest level: Bragg and Abraham, as President and General Secretary, along with Lorentz, were its leading advocates, and it was approved unanimously at the Union's second General Assembly, held on July 7, to coincide with the IRC's own assembly.[36] It was to be almost another decade before IUPAP organized its first true congress.

On through the autumn and the winter months of 1925–26, correspondence between leading critics of the IRC's stance continued to echo the disquiet that had surfaced in Brussels. There is evidence that both the German scientific community and the German government followed the exchanges closely, in a political context that was successively transformed by the Locarno agreements of October 1925 and the moves to reconciliation culminating in Germany's entry into the League of Nations in the following September. Discussions within the Cartel of the leading German academies, already in train in the spring of 1925, gradually crystallized into a sincere interest in joining the IRC. Interest, however, did not imply acquiescence in the IRC's tone, which many in the academies saw as tarred by the triumphalism of the immediate postwar years, despite clear evidence that Allied solidarity was faltering.

Agreement among German scientists on the preconditions they would set before embarking on negotiations for membership of the IRC was not easily achieved. The principle that questions touching on the sensitivities of national pride would have to be addressed was an uncontroversial starting point. But how that principle might best be interpreted in a manner that did not foster an excess of patriotic sentiment divided opinion. In difficult circumstances, the Cartel of academies assumed the role of honest broker. As it agreed in January 1926 and confirmed in May, German would have to be admitted as a language of the IRC and the unions, on an equal footing with French and English; the IRC would be expected to take the initiative and launch an

[33] Ibid., 9–10.

[34] Cohen to Gérard, July 25, 1925, following his earlier letter to Picard, July 11, 1925 (copy, enclosed with the letter to Gérard); Series II, Bureau correspondence, 1924–1927, Box 4, IUPAC archives, Othmer Library of Chemical History, Science History Institute, Philadelphia.

[35] Lorentz to Planck, August 20, 1925, in *Scientific Correspondence of Lorentz*, vol. 1, 575–6 (576).

[36] Report of the second General Assembly (1925), § 9, 9, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

invitation in terms that conveyed the falsity of the Council's reasons for excluding the Central Powers; and consideration would have to be given to moving the Council's headquarters from their politically charged location in Brussels.[37] Independently of the Cartel, there were even some calls for the resurrection of the International Association of Academies (IAA), whose German origins (in Wiesbaden in 1899) and openness to all nations had made it a natural target for suppression by the Allies and its replacement by the IRC.[38] For those working towards reconciliation rather than confrontation with the IRC, such calls went too far. They smacked dangerously of attitudes circulating in a patriotically inspired "counter-boycott" movement that champions of compromise on both sides saw as unhelpful. As one such champion, the chemist Fritz Haber, insisted in the light of a discussion with Cohen, his fellow Dutch chemist Hugo Kruyt, and the President of the Royal Dutch Academy of Sciences Friedrich Went, the demise of the IAA had simply to be accepted as irreversible, if progress was to be made.[39]

Within the IRC, a meeting of the Executive Committee, requested by Cohen and convened by Picard on October 13, 1925, did nothing to clear the air.[40] A further meeting, on June 26, 1926, in Brussels, promised rather more.[41] But in the end a shared determination to find a solution bore meagre fruit. The contentious principle that only countries belonging to the IRC could join a union survived intact. And even a cautious extension of eligibility for membership of the IRC, now amended to allow countries that were members of the League of Nations to apply, had disappointing results. Invitations were issued to Germany, Austria, Hungary, and Bulgaria, all of which qualified by the new criterion. The replies, though, betrayed a clear lack of enthusiasm. Bulgaria declined the invitation, Austria prevaricated, and no "definite reply" of any kind came from Germany, despite indications that the German government would have been happy to see the invitation taken seriously.[42] Only Hungary responded favorably, though with an accompanying statement of regret that while it wished to join the IRC, Hungarian membership of any of the unions was out of the question, for financial reasons.

The coolness of the response to the overtures from the IRC again shone an unforgiving light on the standing of the council and its unions as a force in international

[37] Decisions of a meeting of the Cartel, January 14, 1926, cited in Chagnon, "Nationalisme et internationalisme," 399–401. Cf. the more elaborate statement of conditions at a meeting of the Cartel on May 7, 1926, evidently informed by hardline input it had received from three of the four secretaries of the Prussian Academy of Sciences: Max Planck, the physiologist Max Rubner, and the philologist Hainrich Lüders: ibid.; Schroeder-Gudehus, *Les scientifiques et la paix*, 275–9; and Einstein to Lorentz, April 12, 1926, in *Scientific Correspondence of Lorentz*, vol. 1, 598–9, esp. note 4.

[38] Schroeder-Gudehus, *Les scientifiques et la paix*, 42–8 and "Division of Labour and the Common Good: the International Association of Academies, 1899–1914," in *Science, Technology, and Society in the Time of Alfred Nobel*, eds. Carl Gustaf Bernhard, Elisabeth Crawford, and Per Sörbom [Nobel Symposium 52] (Oxford: Pergamon Press for the Nobel Foundation, 1982), 3–20.

[39] See his letter to Richard Willstätter, January 29, 1926, cited in Chagnon, "Nationalisme et internationalisme," 399.

[40] Schroeder-Gudehus, *Les scientifiques et la paix*, 267.

[41] In the absence of formal proceedings of the meeting, see Schuster's report to the IRC's fourth General Assembly in 1928 and Picard's reflexions in his opening address to the assembly; Schuster, ed., *International Research Council: Fourth Assembly held at Brussels, July 13th, 1928. Reports of Proceedings* (London: Harrison & Sons, no date), 1–4 and 18–20.

[42] Ibid., 19.

science. This is not to say, however, that all moves to the normalization of relations between the former enemies had stalled. Far from it. There were simply more effective routes, ones that evaded the common German charge of the IRC's continued politicization. Across the sciences, friendships nurtured through correspondence and personal contacts did much to promote bridge-building between individuals; in chemistry, for example, a program of events in Paris to mark the centenary of the birth of Marcellin Berthelot in October 1927 provided a setting in which a small but distinguished group of German chemists mixed freely with disciplinary peers from some sixty nations.[43] In the same year, the physics community went even further. For eight days in September, an invitation from the Fascist government of Benito Mussolini brought together an elite of sixty-one physicists from fourteen nations in the first full-scale international congress in their discipline since the Paris congress of 1900. Held mainly in Como as part of the centennial of the death of the town's most famous son, Alessandro Volta, the event had the nationalistic overtones of a celebration of Italy's long tradition in science.[44] But it was the presence of a distinguished eleven-man delegation from Germany (including the Nobel Prize winners Planck, James Franck, and Max von Laue) that rooted it in the contemporary transformation of the world-order of physics.[45] Characteristically, Lorentz's concluding address insisted not only on the richness of a program that had compellingly mapped the cutting edges of the discipline but also on the congress's demonstration of the "universal" nature of physics and hence on the need to engage all nations, large and small, in ensuring its progress.[46]

While Lorentz made no mention of any particular country, his special satisfaction at German participation escaped no one. In Brussels barely a month later, in his capacity as Chairman of the fifth Solvay Conference for Physics, on the theme of "Electrons and Photons," he took similar pleasure in the presence of Albert Einstein, Wolfgang Pauli, and Werner Heisenberg, as well as Planck and Max Born (both of whom had been with him in Como). As such personal manifestations of reconciliation gathered momentum, however, so too did the marginalization of IUPAP. With the Union as troubled as ever by disagreements over the continued absence of the former Central Powers, and the hopes of freedom from the IRC's centralizing oversight frustrated, significant initiatives became impossible. Bragg and Abraham retained their offices as President and Secretary General, and the Executive Committee remained in place. But activity was reduced to the bare essentials of the management of the Union's finances (by a committee established in 1923) and the maintenance of little more than routine communication with the IRC. Even organizing a General Assembly was more than the Union could cope with, and the next one did not occur until 1931. In the circumstances, with Germany a non-member of the

[43] Robert Fox, "Science, Celebrity, Diplomacy: the Marcellin Berthelot Centenary, 1927," *Revue d'histoire des sciences* 69, (2016), 77–115 and "Savants and Diplomats: The Politics of Commemoration at the Berthelot Centenary, 1927," *Centaurus* 61, (2019), 424–42.

[44] *Atti del Congresso internazionale dei fisici: 11–20 settembre 1927–V. Como-Pavia-Roma*, 2 vols (Bologna: Nicola Zanichelli, 1928). See also Roberto Maiocchi, *Scienza e fascismo* (Rome: Carocci, 2004) and Alto Gamba and Pierangelo Scherai, *Fascismo e scienza: Le celebrazioni voltiane e il Congresso internazionale dei fisici del 1927* (Bologna: Il Mulino, 2005).

[45] *Atti del Congreso internazionale*, vol. 1, x.

[46] "Discorso del Prof H. A. Lorentz," ibid., vol. 2, 621–30.

IRC and hence excluded from membership of any of the unions, IUPAP's dreams of mounting a congress open to all nations quickly faded.[47]

By the time the IRC met for its fourth General Assembly in July 1928, the sense of crisis had deepened, and IUPAP was inevitably affected by the stalemate. Now, however, the long-awaited review of the IRC's statutes, always planned for 1931, was on the horizon. When it happened, at what was at once the fifth and last General Assembly of the IRC and the first of the new International Council of Scientific Unions (ICSU), in Brussels on July 11, 1931, the effect was immediate. The change left ICSU with no more than a coordinating role and so gave the unions the freedom they had been seeking since their frustrated attempts at reform in the mid-1920s. IUPAP also gathered in Brussels when its long-awaited third General Assembly sprang into life. At the assembly, there was routine business to conduct: a report on the Union's strikingly heathy accounts was formally approved, and the statutes were amended to take account of the passage from the IRC to ICSU.[48] But the time had also come for a change of President. Bragg, not present in Brussels and already loaded with honors and responsibilities elsewhere, withdrew from the position, and the assembly immediately cabled Millikan, a Vice-President since 1922, with an invitation to succeed him.[49] Millikan cabled his acceptance by return and was elected.

While Germany could not send formally appointed delegates, the presence of Walther Gerlach and Emil Rupp at the IUPAP assembly and the brief talks they were invited to give signaled the new openness that reigned within the IRC and its unions.[50] Their presence also flagged evolving attitudes on the German side. Abraham later recalled how the ground for the invitations had been laid, shortly before the General Assembly, in discussions he had had in Berlin with a group of representatives of the two German physical societies, chaired by Planck.[51] Contacts at that level and the talks that resulted fed into a new optimism within the Union, and the sense of renewal soon found expression in the assembly's decision to found two commissions.[52] One of them, on bibliography and publications, barely functioned. But the commission on nomenclature, soon and for long afterwards referred to as the SUN commission ("symbols, units, and nomenclature"), became an enduring focus for IUPAP activity.

[47] The condition that only nations belonging to the IRC could join a union was strictly enforced from its institution in 1922 until the replacement of the IRC with ICSU in 1931; see the Appendix at the end of this volume.

[48] Report of the third General Assembly (1931), 1–7, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

[49] Ibid., 3.

[50] Ibid., 12. The talks were two of six given before the General Assembly. The others were by Cotton (see note 54), Adriaan Fokker (Netherlands), Théophile de Donder (Belgium), and Czesław Bialobrzeski (Poland), all from countries that were full members of the union, 8 and 10–12.

[51] On the meeting, which took place in Berlin on at the end of June 1931, see Abraham to Niels Bohr, December 4, 1934, series E1, "Larkin Kerwin's correspondence," vol. 5, folder 38 "Correspondence, re: archives." Copies of correspondence from the thirties found in the Niels Bohr Archives, for instance between Bohr and Abraham," IUPAP Quebec Secretariat (hereafter IUPAP Quebec), Center for the History of science, Royal Swedish Academy of Sciences. See also Abraham to Cotton, June 17, 1931, Archives de la Bibliothèque des sciences expérimentales de l'École normale supérieure de Paris (hereafter BSE (ENS-Paris), Cotton Papers), AC 5.4.2, item 54.

[52] Report of the third General Assembly (1931), 4–5, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

The 1930s: New Challenges, New Crises

Under the Chairmanship of Glazebrook and with Charles Fabry, W. H. Keesom, and A. E. Kennelly as its other founder members, the SUN Commission went on to achieve relatively easy agreement on the conventions for photometry, calorimetry, and the symbols to be used in thermodynamics. The same, though, was not true of electrical and magnetic units. Here, divergences between the practices of different communities of users had engendered a confusion aggravated at a meeting of the International Electrotechnical Commission (IEC) in Copenhagen, Stockholm, and Oslo in 1930. The IEC's adoption of the gauss as the unit of magnetic induction (B) and the oersted for the unit of magnetic field (H) had provoked particular controversy.[53] As Aimé Cotton observed in a presentation of the issues before the 1931 General Assembly, the names adopted at the previous year's IEC meeting only added confusion by breaking with those agreed by engineers at the international electrical congress of 1900 in Paris.[54] Amid multiple uncertainties, the need for consultation was evident, not least and most immediately between physicists (for whom the gauss was the unit of both magnetic field and induction) and electrical engineers (most of whom supported the IEC in favoring distinct units and hence distinct names for B and H).[55] Investigation of the differences, which touched on the fundamental question of the existence of the parallel systems of electrostatic and electromagnetic units, led the SUN Commission to extensive consultation with a variety of bodies, including the IEC, and a presence at the international electrical congress in Paris in 1932. In the end, however, the forty-page report that Glazebrook submitted to the IUPAP General Assembly in 1934 left the existing conventions unaltered and the choice between the different systems unresolved. Endorsing the IEC's adoption of gauss for magnetic induction and oersted for magnetic field, it recommended "that the present convention be continued until there is a definite preponderance of opinion in favor of a change."[56]

Also central to the wave of the initiatives that breathed new life into IUPAP after 1931 was the resurrection of the Union's project for an international congress. As Vice-President, shortly before his formal election as President, Millikan had proposed two possible venues for such a congress: Paris in 1932, to coincide with the *Congrès international d'électricité*, or Chicago in 1933 as one of the many congresses that were planned as adjuncts to that year's International Century of Progress Exposition (the "century" being the hundred years since the foundation of the city in 1833).[57] When,

[53] Among widely circulated reports on the decisions finalized in Oslo, see *Journal of the American Institution of Electrical Engineers*, 49 (October 1930): 833–5.

[54] Cotton, "*Sur les noms des unités magnétiques*," IUPAP, Report of the third General Assembly (1931), 8–10, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg. On the 1900 congress, see Édouard Hospitalier ed., *Congrès international d'électricité (Paris: 18–25 août 1900). Rapports et procès-verbaux* (Paris: Gauthier-Villars, 1901).

[55] Hospitalier, *Congrès international d'électricité*, esp. 382–5, where the committee on units recommended the adoption of "gauss" for the unit of magnetic field and "maxwell" for the unit of magnetic flux.

[56] *International Conference on Physics, London 1934: International Union of Pure and Applied Physics. Reports on Symbols, Units & Nomenclature approved by the General Assembly of the Union at its Meeting in London on 5th October 1934* (London: Physical Society, 1935), esp. 7–8 (Conclusions).

[57] Abraham to Cotton, June 11, 1931, BSE (ENS-Paris), Cotton Papers, AC 5.4.2, item 48.

soon afterwards, the IUPAP Council met in Brussels during the ICSU's inaugural General Assembly, Chicago was chosen unanimously, both for the congress and for the fourth IUPAP General Assembly, now planned for June 1933.[58] This allowed for a leisurely schedule, and initial preparations went smoothly enough. But by February 1933, the plan was in jeopardy. Budgetary constraints following the crash of 1929 were biting hard on the American economy, to the point that Millikan admitted to Abraham that the meeting in Chicago would have to be scaled back and that it would inevitably have "diminished significance."[59] It had even proved impossible to secure funds to meet the expenses of Abraham, an essential presence as IUPAP's General Secretary, and Glazebrook, as President of the all-important SUN Commission.

Through the early weeks of 1933, Millikan's despondency contrasted with Abraham's undiminished determination that the congress and IUPAP General Assembly should go ahead. On February 11, 1933, Abraham outlined detailed plans for the reports to be presented at the assembly and for public lectures that would be mounted as part of the IUPAP's program but also be open to the many American physicists and other scientists who would be present at the exhibition.[60] And as late as March 27, he was still corresponding with Cotton in Paris about the make-up of the French delegation to the assembly and the possibility that the Union might find the $700 needed to allow Glazebrook to go to Chicago.[61] But by then Glazebrook himself was losing heart, not least because the SUN Commission had still not produced its report. His advice to Millikan was that the General Assembly should be cancelled, and on April 7, Millikan bowed to the inevitable in a cable to Abraham announcing his decision, as President, to abandon all plans for Chicago. Instead of a General Assembly, there would just be a meeting of IUPAP's "American section," which any foreign physicists visiting the exhibition would be welcome to attend. In the event, Niels Bohr and Enrico Fermi were among almost thirty eminent foreign scientists who found their way to Chicago in June, participating in ten days of celebration of science as guests of the exhibition's organizers and the American Association for the Advancement of Science.[62] But any thought of a congress, still less of a General Assembly, was out of the question. Even Abraham had to accept the decision, as he did in a letter of April 11 to Cotton, with its handwritten admission that, in the circumstances, cancellation was the best solution (see Figure 1.2).[63]

The abandonment of the Chicago congress and General Assembly dealt a major blow to the organizers' vision of IUPAP's role in the establishment of a truly international arena for physics. We know nothing of the hasty rethinking that must have

[58] Notes of a meeting held on July 10–11, 1931, Millikan Papers; cited in the chapter by Navarro in this volume note 19.

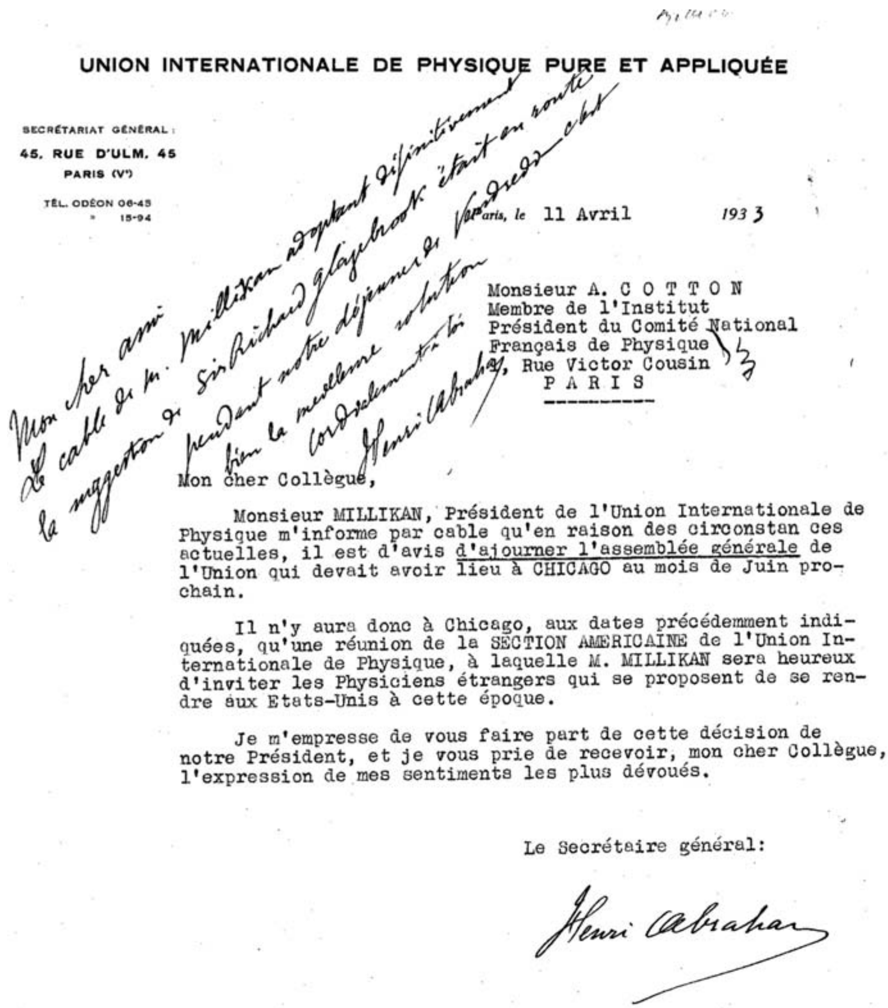
[59] Millikan to Abraham, February 1933, Millikan Papers; cited in the chapter by Navarro in this volume, note 21.

[60] Copy of circular letter, dated February 11, 1933, that Abraham seems to have prepared for sending to representatives of physics communities in countries that were not members of IUPAP; Cotton Archives, AC 23.4.1.

[61] Abraham to Cotton, March 27, 1933, BSE (ENS-Paris), Cotton Papers, AC 23.4.1.

[62] "The Chicago Meeting," *Science* 77, no. 2009 (June 30, 1933), 622.

[63] Abraham to Cotton, April 11, 1933, BSE (ENS-Paris), Cotton Papers, AC 23.4.1, where Abraham's added handwritten note refers to the cable from Millikan (now lost), sent on the previous Friday, i.e., on April 7.



UNION INTERNATIONALE DE PHYSIQUE PURE ET APPLIQUÉE

SECRÉTARIAT GÉNÉRAL :
45, RUE D'ULM, 45
PARIS (V)

TÉL. ODÉON 06-45
» 15-94

Paris, le 11 Avril 1933

Monsieur A. COTTON
Membre de l'Institut
Président du Comité National
Français de Physique
1, Rue Victor Cousin
PARIS

Mon cher ami
Le cable de M. Millikan adoptant définitivement
la suggestion de Sir Richard Glazebrook était en route
pendant notre déjeuner de Vendredi. C'est
bien la meilleure solution
Cordialement à toi
Henri Abraham

Mon cher Collègue,

Monsieur MILLIKAN, Président de l'Union Internationale de Physique m'informe par cable qu'en raison des circonstan ces actuelles, il est d'avis d'ajourner l'assemblée générale de l'Union qui devait avoir lieu à CHICAGO au mois de Juin prochain.

Il n'y aura donc à Chicago, aux dates précédemment indiquées, qu'une réunion de la SECTION AMERICAINE de l'Union Internationale de Physique, à laquelle M. MILLIKAN sera heureux d'inviter les Physiciens étrangers qui se proposent de se rendre aux Etats-Unis à cette époque.

Je m'empresse de vous faire part de cette décision de notre Président, et je vous prie de recevoir, mon cher Collègue, l'expression de mes sentiments les plus dévoués.

Le Secrétaire général:

Henri Abraham

Figure 1.2 Letter from Henri Abraham to Aimé Cotton, April 11, 1933, reporting the view of Robert Millikan, as President, that the General Assembly of IUPAP, planned for June 1933 in Chicago, should be postponed. Abraham's hand-written annotation reads "My dear friend, Mr Millikan's cable definitively adopting the suggestion by Sir Richard Glazebrook was on its way during our lunch on Friday. It is plainly the best solution. Cordially yours, Henri Abraham." Millikan evidently sent his telegram, now lost, on Friday April 7

Source: The letter, in BSE (ENS-Paris), Cotton papers, AC 23.4.1, is reproduced by courtesy of the Bibliothèque des sciences expérimentales, École normale supérieure, Paris. Copyright Cotton family.

followed. But the solution that had emerged by February 1934 (and in all probability well before that date) was for IUPAP to mount an alternative congress in association with a conference on nuclear physics that the Physical Society (PS) was planning to hold in that October in London. At this stage, the society was the senior partner, and its expectations for the conference ran high. As the report of the PS Council for the year ending February 28, put it, "The conference will mark an epoch, as it will be the first of its kind to be held in England."[64] As for collaboration with IUPAP, the plan seems to have been for parallel events taking place in the same week, though with close links between them, "especially on the social side" (see Figure 1.3).

By the time the conference began, IUPAP had secured a more central role in the proceedings than had seemed likely earlier in the year. For this, Millikan (who shared the presidency of the conference's organizing committee with the President of the PS, Robert Strutt, 4th Baron Rayleigh) and Glazebrook (as Chairman of the committee) must take credit (see Figure 1.4). They also did much to ensure the conspicuously international profile of the more than thirty papers that were eventually published in English and French editions of the conference proceedings.[65] Along with a strong

His Majesty's Government in the United Kingdom of Great Britain and Northern Ireland

International Conference on Physics

His Majesty's Government
request the honour of the company of

Monsieur A. Cotton

at Dinner at the Savoy Hotel, on Wednesday, the 3rd October, 1934, at 8.15 for 8.30 p.m.
The Right Honourable W. Ormsby-Gore, M.P., First Commissioner of Works, will preside.

Evening Dress with Decorations.

An early answer is requested to the Secretary, Government Hospitality, Treasury Chambers, Whitehall, S.W.1.
Telephone: Whitehall 1481.

Figure 1.3 Aimé Cotton's invitation to dinner at the Savoy Hotel, London during the International Conference, October 1934

Source: By courtesy of the Bibliothèque des sciences expérimentales, École normale supérieure, Paris. Cotton Papers, AC 23.5.3. Copyright Cotton family.

[64] "Report of Council for the year ending Feb 28, 1934," in *Proceedings of the Physical Society*, 46 (1934), xvii.

[65] *International Conference on Physics: London 1934. A Joint Conference organized by the International Union of Pure and Applied Physics and the Physical Society. Papers & discussions in Two Volumes*, 2 vols (vol. 1: *Nuclear Physics*, vol. 2: *The Solid State of Matter*) (London: Physical Society, printed at the University Press, Cambridge, 1935). The French edition was published in three volumes (Paris: Hermann) in 1936.

British and American presence, there were distinguished participants from France (Irène and Frédéric Joliot Curie, Pierre Auger, and Louis Leprince-Ringuet), the Soviet Union (Abram Joffe and George Gamow), and Italy (Enrico Fermi). But it was the contingent from Germany that the President of the Royal Society, Sir Gowland Hopkins, had particularly in mind when he spoke feelingly, in his address of welcome to the conference, of the capacity of science to advance despite the "anti-intellectual movements in the world."[66] Papers by five German physicists still in post in universities and Technische Hochschulen maintained an air of normality.[67] But an opening paper on "Quantum Electrodynamics" by Max Born, now in Cambridge following his dismissal from his Chair at Göttingen, reminded everyone of the tragic train of events unfolding in Germany.[68] Hans Bethe and Rudolf Peierls, too, signed a short joint paper from their English address, Manchester, where both were temporarily employed before moving on to permanent positions at Cornell and Birmingham respectively.[69]

The conference, lasting five days from October 1 to 5, left IUPAP with its standing immeasurably enhanced. An attendance of over 600, including 200 from outside the UK, was a clear measure of success. And the quality of the papers, all delivered by invitation and most of them given in London at the Royal Society and the Royal Institution though with a day in Cambridge on October 4, was high. Introductory surveys by Rutherford and Bragg set the tone for state-of-the-art presentations on cutting-edge areas of research under the broad headings of nuclear physics, cosmic radiation, and the solid state of matter.[70] As part of the congress, on the afternoon of October 5, IUPAP held its fourth General Assembly in London. Minutes far sketchier than those for the Union's earlier assemblies give no sense of what must have been the profound concerns of all delegates for their disciplinary colleagues in Germany.[71] Nevertheless, in a hand-written note addressed to Abraham from the Garden House Hotel in Cambridge, Millikan contrived an air of cautious optimism, not only about the future of IUPAP (now "well on its way, with flying sails") but also in his hope that "our German troubles too will soon be past."[72]

In reality, the troubles were far from over, and in the weeks following the conference and General Assembly they continued to make their mark on the Union. Niels Bohr's response to the invitation for him to succeed Millikan, now at the end of his three-year term as President, served only to confirm the anxieties that were circulating. His initial reaction was one of pleasure at what he saw as a purely personal honor, and Millikan clearly read the gratitude Bohr expressed in a brief telegram as

[66] Hopkins, "Address of Welcome," in *International Conference on Physics, 1934*, vol. 1, 1–3 (3).

[67] The five were Gerhard Hoffmann (University of Halle-Wittenberg), Erich Hückel (Technische Hochschule Stuttgart), Friedrich Hund (University of Leipzig), Paul Peter Ewald (University of Stuttgart), and Ewald's assistant at Stuttgart, Mauritius Renninger. A sixth speaker from a German institution (University of Halle-Wittenberg) was the Austrian Adolf Smekal.

[68] *International Conference on Physics, 1934*, vol. 1, 19–27.

[69] Ibid., vol. 1, 93–4.

[70] Ibid., vol. 1, 4–16 and vol. 2, 1–6, for the surveys by Rutherford and Bragg.

[71] Report of the fourth General Assembly (1934), 3–4, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

[72] Millikan to Abraham, undated but clearly written after the General Assembly, possibly on Sunday October 7; series E1, vol. 5, folder 38, IUPAP Quebec.

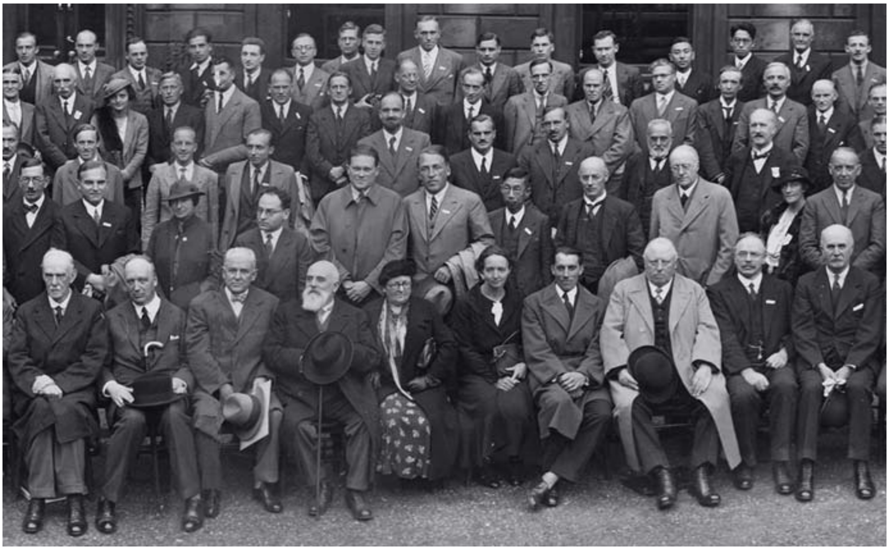


Figure 1.4 Part of a group photograph taken outside the Royal Society in the courtyard of Burlington House, London**,** during the International Conference, October 1934. Seated in the front row are (left to right) Sir Richard Glazebrook, Robert Strutt, 4th Baron Rayleigh, Robert Millikan, Henri Abraham, Madame Abraham, Irène Joliot-Curie, Frédéric Joliot, Willem Hendrik Keesom, Martin Knudsen, and Sir William Bragg

Source: Wikimedia Commons. Estate of Friedrich Hund, property of Gerhard Hund, prepared for Wikipedia in January 2019, available at https://upload.wikimedia.org/wikipedia/commons/3/38/The_Royal_Society_1934_London-t.jpg. License: https://creativecommons.org/licenses/by-sa/4.0/deed.en.

a sign of his acceptance.[73] Abraham likewise interpreted Bohr's response as signaling acceptance; on November 19, he wrote to Bohr as "*Monsieur le Président et cher Collègue*," raising financial and other aspects of the Union's business, including the need to raise subscriptions ("*Notre situation financière est en effet assez peu brillante*") and the possibility of holding the next General Assembly in Copenhagen in 1937.[74] At this point, however, Bohr's apparently sudden realization that the presidency would involve his having an executive role in a union in which the former Central Powers were still unrepresented led him to clarify his position. Replying to Abraham's letter on November 30, he expressed his regret at now having to decline; a discussion of the implications with Knudsen had convinced him that this was the only way in which he could maintain his principle of rigorously separating politics from science.[75] A further letter from Abraham explaining that membership of the Union was open to all nations without exception and so hoping that Bohr might reconsider his decision

[73] In the letter cited in note 72, Millikan quotes from the telegram he has received from Bohr "Please extend hearty thanks to Congress for great honor."

[74] Abraham to Bohr, November 19, 1934, series E1, vol. 5, folder 38, IUPAP Quebec.

[75] Bohr to Abraham, November 30, 1934, series E1, vol. 5, folder 38, IUPAP Quebec.

was to no avail.[76] Bohr's vision of a body that would bear no trace of exclusion was precisely Abraham's, but he saw himself as best placed to achieve it by retaining the independence that came with his remaining outside IUPAP.

The circumstances that led Bohr to decline the presidency went on to take an ever more ominous turn. Planning became increasingly difficult, and within IUPAP hopes of building on the high point of the 1934 conference and General Assembly soon gave way to strategies for survival. In the absence of a President, it was left for members of the Executive Committee, chaired by Millikan, to fill the gap, with Abraham maintaining essential correspondence.[77] By 1937, hopes of calling that year's General Assembly and following the normal procedure for the election of a new President were dwindling. Abraham, though, was undaunted. A meeting, early in the year, with Bohr and Langevin led, with Millikan's approval, to his inviting Fermi to accept the presidency.[78] At one point, Abraham thought the approach might succeed. Fermi, however, refused, for what Abraham described (to Bohr) as "*des raisons de modestie extrême*."[79] Ever resourceful, though, and driven by the mounting sense of crisis, Abraham fell back on his rich international network of contacts. In a meeting in London, probably in early September, he broached the question of the presidency with the Swedish X-ray spectroscopist and Nobel Prizewinner Manne Siegbahn.[80] Finding Siegbahn willing to serve, he put the idea to Bohr and followed with an exchange of letters with the EC members and other senior figures in the Union—including Millikan, Bragg, Knudsen, Keesom, Lars Vegard, and Fermi—all of whom were enthusiastically supportive.[81] Despite the irregularity of the procedure, Siegbahn, a participant in all three past general assemblies, slipped easily into the position.

Amid deepening anxieties about the fate of many German colleagues, Siegbahn and Abraham worked tirelessly to maintain such regular functions as were possible. In March 1938, in a letter to Siegbahn, Abraham urged haste in preparing for a General Assembly, which he hoped would take place in late September.[82] Essential to Abraham's plan was the expectation that Bohr might persuade the Danish Academy of Science to issue invitations to physicists from countries that did not belong to the Union. In this, his overriding hope was that Germany would be represented at the assembly, if not as a full adhering member then at least through German colleagues attending as individuals. In Berlin, Peter Debye, still at the Kaiser Wilhelm Institute for Physics (before his departure for the USA in January 1940), and Jean Roig, a former student of Abraham's, currently on a CNRS-funded scholarship at the Institute,

[76] Abraham to Bohr, December 4, 1934, and Bohr to Abraham, December 12, 1934, reaffirming his position. Also Abraham to Bohr, December 18, 1934, in which Abraham reluctantly accepts Bohr's decision, series E1, vol. 5, folder 38, IUPAP Quebec.

[77] For the membership of the new Executive Committee, appointed at the 1934 General Assembly, see Table 1.1.

[78] Abraham to Bohr, September 22, 1937, where Abraham refers to a meeting with Bohr and Langevin at the beginning of the year and a subsequent meeting with Millikan, series E1, vol. 5, folder 38, IUPAP Quebec.

[79] Ibid. See also Fermi to Abraham, October 4, 1937, series E1, vol. 5, folder 38, IUPAP Quebec.

[80] Abraham describes the meeting in his letter to Bohr, cited in note 78.

[81] Abraham received warm letters of support for Siegbahn from Bragg, Fermi, Knudsen, Keesom, Millikan, and Vegard, all written between October 1 and 7, series E1, vol. 5, folder 38, IUPAP Quebec.

[82] Abraham to Siegbahn, March 26, 1938, series E1, vol. 5, folder 38, IUPAP Quebec.

were working behind the scenes to the same end.[83] Siegbahn duly put the suggestion about an invitation from Copenhagen to Bohr.[84] But Bohr's reply was discouraging; invoking the reasons that had already led him to decline the presidency of the Union, he argued (as Knudsen had done some months earlier) that the assembly should take place in the country of the President, hence in Siegbahn's Sweden, either in Stockholm or Uppsala.[85] If Sweden became the venue, Bohr added, it would then be for the Swedish Academy to issue such invitations as it thought fit to countries that were not members of IUPAP, much as the Royal Society had done in London in 1934.

The tone of Bohr's reply to Siegbahn suggests that he was by no means convinced that, in the current political circumstances, planning for a General Assembly in September 1938 was realistic or even appropriate. And his doubts persisted. Writing to Abraham in August, Siegbahn reported on a recent inconclusive meeting with Bohr in which the focus had been on a possible assembly, now put back to September 1939.[86] Despite the persistent uncertainty, Abraham was undeterred. As late as May 10, 1939, seemingly oblivious to the gathering clouds of war, he wrote to Bohr outlining a plan for an international conference to be held in Paris in October 1940.[87] Clearly modelled on the one in London in 1934, the conference was to be a joint venture of IUPAP with the *Société française de physique* and the *Société française des électriciens*. The formation of a large planning committee (entirely French) and a list of possible speakers and topics (focused mainly on electronics and the liquid state of matter) bore witness to the seriousness of the project and Abraham's determination that the Union should survive, however menacing the circumstances.[88] Through the summer of 1939, however, even Abraham had to yield to the inevitable, and plans for the conference and the Union's repeatedly postponed General Assembly were soon overtaken by events.

War and Survival

By the time the war began, in September 1939, IUPAP's capacity for independent activity had been dramatically curtailed. Such scientific activities as could be pursued were necessarily undertaken in the form of collaborations, always with the Union as a lesser partner. An agreement signed between ICSU and the International Commission on Intellectual Cooperation (ICIC) in July 1937 had lent encouragement and the promise of modest material support, and IUPAP had done its best to respond. In the two years before the war, specialized conferences on the latest theories of physics

[83] According to information sent by Roig to Abraham; see Abraham's letter to Siegbahn, cited in note 82.

[84] Siegbahn to Bohr, March 28, 1938, in Swedish; English summary by Stefan Rozental in letter to Larkin Kerwin, October 19, 1977, series E1, vol. 5, folder 38, IUPAP Quebec.

[85] Bohr to Siegbahn, March 29, 1938, in Danish. English summary by Stefan Rozental in letter cited in note 84. Writing to Abraham on October 7, 1937, Knudsen suggested that if Stockholm or Uppsala were thought too distant for foreign delegates, Copenhagen might also be considered, with Peder Oluf Pedersen, rather than Siegbahn, as President, series E1, vol. 5, folder 38, IUPAP Quebec

[86] Siegbahn to Abraham, August 18, 1938, series E1, vol. 5, folder 38, IUPAP Quebec.

[87] Abraham to Bohr, May 10, 1939, series E1, vol. 5, folder 38, IUPAP Quebec.

[88] See "Comité d'organisation du congrès international de physique de 1940," carbon copy of a four-page typewritten outline of the plan; BSE (ENS-Paris), Cotton Papers, AC 23.9.

(in Warsaw, with the Polish section of the ICIC), the determination of the molecular and atomic weights of gases (Neuchâtel, with IUPAC), the measurement of ionizing radiation (Groningen, with the International Union of Biological Sciences), and magnetism (in Strasbourg, with the recently formed *Centre national de la recherche scientifique* and the university's institute of physics, headed by Pierre Weiss) all bore the stamp of at least some IUPAP involvement as well as Abraham's determination that the door should remain open to German physicists still in a position to take part.[89]

Valiant though these efforts were, the fact remains that by the late 1930s, IUPAP was embarked on what an earlier brief history of the Union described as "*la décade difficile*" between 1937 and 1947.[90] The description "difficult" was a benign understatement. Events in Germany, followed by the blight of war and the six years of inactivity (and suspended subscriptions) that it entailed, were bad enough. But the arrest of Abraham in June 1943 and his murder in Auschwitz six months later left IUPAP in shock and bereft of a support on which it had counted since its foundation. Abraham, in Siegbahn's words, had been the "*le centre permanent de l'Union*," and the grief at his loss was profound.[91] When peace came, the Union had to face nothing less than a relaunch of its mission.

In this task, Siegbahn's term as President, which had continued throughout the war, provided at best a frail thread of continuity. But, in the crucial eighteen months of transition between the end of the war in 1945 and the Union's 5th General Assembly in Paris, at the Faculty of science, on January 3–4, 1947, he came into his own with the mixture of determination and organizational skills that the resurrection of IUPAP required. An inspired move was his invitation for Paul Peter Ewald, teaching at Queen's University Belfast since his emigration from Germany in 1937, to take over Abraham's tasks as Secretary General. Ewald had already demonstrated his commitment to international ventures in the leading role he had played since 1944 in laying the foundations of the new International Union of Crystallography, finally admitted to the ICSU family in 1948.[92] He and Siegbahn formed an effective team, and their

[89] The titles of the papers delivered at these four conferences, all dating from 1938–39, are listed in the Report of the fifth General Assembly (1947), 24–5, series B2aa, vol. 1 "1923–1960," IUPAP Gothenburg. Among the papers, see especially those given by the conspicuously international body of contributors to the Strasbourg conference, including Richard Becker and Walther Gerlach from Germany, barely three months before the war: *Le magnétisme: Réunion organisée en collaboration avec l'Institut de physique de l'Université de Strasbourg. Strasbourg, 21–25 mai 1939*, 3 vols (Paris: Institut International de Coopération Intellectuelle, 1940), including an address of welcome on behalf of IUPAP by Abraham, vol. 1, xvi–xviii.

[90] *UIPPA/IUPAP: 50 ans. 1922–1972. Album-souvenir conçu et réalisé à Québec par le secrétariat de l'UIPPA* (1972), 14, series E1, "Larkin Kerwin's and Pierre Fleury's correspondence," vol. 5, folder 37 "IUPAP Larkin Kerwin's correspondence 1977," IUPAP Quebec. The history draws heavily on Pierre Fleury, "The International Union of Pure and Applied Physics, from 1923 to 1972," in *Physics 50 Years Later as Presented to the XIV General Assembly of the International Union of Pure and Applied Physics*, ed. Sanborn C. Brown (Washington, DC: National Academy of Sciences, 1973), 3–10.

[91] Siegbahn conveyed both his and the collective grief in addressing the Union's fifth General Assembly on January 3, 1947; see the Report of the fifth General Assembly (1947), 11–12, series B2aa, vol.1 "1923–1960," IUPAP Gothenburg. The sentiment was compounded by the deportation and murder, also in Auschwitz, of Eugène Bloch, Assistant Secretary General to Abraham and his successor in the physics laboratory at the *École normale supérieure*.

[92] Report of the fifth General Assembly (1947), 13, series B2aa, vol. 1 "1923–1960," IUPAP Gothenburg.

collaboration did much to ensure the success of the General Assembly in 1947. What emerged thereafter were the beginnings of a reconstituted IUPAP that took account of the escalating proliferation of specialties in the world of physics. A greater emphasis on the work of commissions, both IUPAP's own and new Joint Commissions that were now established with other unions, flagged the change. And with the new departure came new faces among the Union's senior officers.

The choice of the Dutch theoretical physicist and pupil of Bohr, Hans Kramers, to succeed Siegbahn as President was a key appointment that marked the passage to a younger generation. But even more consequential for the Union in the long term was the election, as Secretary General, of Pierre Fleury, the organizer of the Paris meeting, who had written his doctoral thesis under Abraham at the *École normale supérieure* in the 1920s.[93] Along with his position as head of the distinguished and internationally oriented *Institut d'optique* in Paris, Fleury was to serve for sixteen years and play a central role in bringing IUPAP to the state of prosperity it had achieved by the time of his retirement after the eleventh General Assembly in Warsaw in 1963. At that assembly, the Union, now with thirty-five nations as adhering members, received reports from fifteen specialized commissions and six joint commissions and could look back on a three-year period in which it had supported forty-one international conferences.[94] In speaking warmly of Fleury's long and distinguished service, the President, Homi Bhabha, recognized not only a personal contribution but also the magnitude of the transformation of IUPAP as a whole since 1947. The Union had emerged from the war with its morale and influence grievously undermined. Fleury left it as the major force in world physics that its founders had worked so hard for it to become.

Acknowledgments

The authors would like to express thanks to Madame Caroline Cotton for allowing them to reproduce items (Figures 1.2 and 1.3) from the Cotton family papers. In libraries and archives everywhere, they have benefited from help and expertise, notably from the staff of the libraries of the École normale supérieure, Paris, in particular the *Bibliothèque des sciences expérimentales* (BSE), which kindly made its collection of Aimé Cotton Papers available, and the Othmer Library of Chemical History, Science History Institute, Philadelphia.

[93] Report of the fifth General Assembly (1947), 20, § 11, and 22, § 15, series B2aa, vol. 1 "1923–1960," IUPAP Gothenburg.

[94] Report of the General Assembly (1963), series B2aa, vol. 1 "1960–1966," IUPAP Gothenburg.

2

The "Happy Thirties?"

Millikan's Troubled Presidency of IUPAP

Jaume Navarro

Tuesday, September 14, 1946. Amsterdam. At a conference on the Zeeman effect, a number of physicists from around the world took part in an informal evening gathering to discuss the future of the International Union of Physics. Major changes in international institutions were expected to materialize early the following year, after World War II had put an end to many interwar collaboration bodies. "It seemed that in several Unions the international cooperation was very good, …, but in the Physical Union it has always been very weak," said the British astronomer, professor Frederik J. N. Stratton (1881–1960), acting as General Secretary of the Council for Scientific Unions.[1] The conversation was a déjà vu from twenty-seven years earlier, after the Great War, when astronomy was praised for a long tradition of useful international collaboration, enabling them to create a working international union, while the physicists were slow in so doing and, as seen in the earlier chapter, unable to give it any major content in its first decade of existence. Also, in 1933, after a watered-down physics conference in Chicago, which had initially been planned as a major event to consolidate the International Union of Pure and Applied Physics (IUPAP), there was a general feeling that "the Union might disintegrate if it did not hold a meeting which would demonstrate that it had both vitality and a real work to perform."[2]

Indeed, in the 1920s, under the Presidency of William H. Bragg (1862–1942), the International Union of Physics was left in hibernation waiting for the time when Germany would be able to enroll as a member.[3] In 1931, with the transformation of the International Research Council (IRC) into the International Council of Scientific Unions (ICSU), it seemed that the time was ripe for an active and truly international union of physics. The energy, ideas, and experience in science policy of the new President, the American physicist Robert A. Millikan (1868–1953), promised to be the final trigger for IUPAP to become a functioning body of physicists. But the thirties, which Hans A. Bethe (1906–2005) called in retrospect "the happy thirties" due to the

[1] A. Estabilier to J. Needham, October 1, 1946, folder D/XI/14, 5, Archives of the International Institute of Intellectual Cooperation (IICI), available at https://digital.archives.unesco.org/en/collection/iici-documents/.

[2] R. A. Millikan to H. Abraham, August 4, 1933, roll 12, 666, Papers of Robert Andrew Millikan, microfilm edn (hereafter RAM), Caltech Archives and Special Collection Repository, California Institute of Technology.

[3] See chapter by Fauque and Fox in this volume.

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immense activity and transformations in both theoretical and experimental physics,[4] turned out to be not as happy for the Union as some hoped at the beginning of the decade.

The previously mentioned meeting in 1946 also regretted that "the archives [of the Union] were lost during the war," and that is why it is so difficult to trace the inner activity of IUPAP in the interwar years. Yet, "everyone present insisted on the necessity of bringing the union to a new life and investigating the causes of its failure in the past," among which two seemed obvious to them: the "absence of a definite scientific program" and the appointment of "great names" in the board rather than "people that have enough time and organizing qualities to be able to do all the work that should be done."[5] The first, as shall be seen, was very much the case. The latter, however, seems unfair to, at least, two people who did spend much time and effort trying to promote the Union: Millikan and, especially, Henri A. Abraham (1868–1943) who was the General Secretary from its inception and until his assassination in Auschwitz.

In this chapter, and taking as our main sources the Millikan archives and the correspondence of Abraham scattered in other repositories, including the archives of IUPAP, we shall try to reconstruct the plans, successes, and failures of the Union in the 1930s. These include Millikan's attempt to use his presidency as one more element in his pursuit to promote the place of American science in the international stage with a major (failed) conference in Chicago, the work of the two commissions created in 1931, the hopes and disappointments with the German question, and the convoluted succession in the presidency of IUPAP after 1934.

Robert A. Millikan, President of IUPAP (1931–1934/7)

Science in general, and physics in particular, saw a radical transformation in the USA in the first half of the twentieth century, especially triggered by the institutional transformations within the country and by the possibilities that the two world wars opened for the nation. Decades ago, in his oft-quoted *The Physicists. The History of a Scientific Community in Modern America*, Daniel J. Kevles (1971) gave a full portrait of such changes and the ways governmental agencies, private trusts, old and new academic institutions, as well as a number of eminent names interacted and contributed to such a transformation.[6] Millikan was one of those people who, with the qualities of the creative physicist, the entrepreneur, the manager, and the networker, helped to place American physics at the forefront of international science. Thus, it was not unsound that, in 1931, he was elected President of the re-founded IUPAP.

Having spent over two decades at the University of Chicago after obtaining his PhD in Columbia in 1895, Millikan became a very close collaborator of the astronomer George E. Hale (1868–1938) during the Great War and thereafter. In early 1917,

[4] Silvan S. Schweber, *Nuclear Forces. The Making of the Physicist Hans Bethe* (Cambridge, MA: Harvard University Press, 2012), ch. 8.

[5] A. Estabilier to J. Needham, October 1, 1946, folder D/XI/14, 7, (IICI).

[6] Daniel J. Kevles, *The Physicists. The History of a Scientific Community in Modern America* (Cambridge, MA: Harvard University Press, 1971).

as it was clear that the USA was about to join the war in Europe, both Hale and Millikan took leave from their respective university jobs and spent all their time in war-oriented research through the newly created National Research Council (NRC). This was one of the institutional achievements of Hale, who intended to promote the rather dormant National Academy of Sciences (NAS) and develop its role as advisor to the government in scientific and technological matters. The NRC was a success during the war years, and once peace came Hale, Millikan, and a few others moved quickly to ensure the NRC would also become a key element in the promotion of science useful for the nation. One of many statements by Millikan at the end of the war may help us understand his mindset and his arguments in the promotion of practical science for the good of the nation:

> Administrative positions in the industries are to-day being filled as never before from the ranks of the technically trained men. The War has taught the prospective officer that he can not hope for promotion unless he has scientific training. The War has taught the manufacturer that he can not hope to keep in the lead of his industry save through the brains of a research group, which alone can keep him in the forefront of progress. As a result of all this there is indeed a new opportunity in every phase and branch of science.[7]

Hale also convinced Millikan to move West and accept the Directorship of another of his creations: the new California Institute of Technology with its Norman Bridge Laboratory of Physics, a private research institution that would soon become a principal actor in the American research establishment thanks to, among others, the funds of the Carnegie and the Rockefeller foundations. The two men now controlled the NAS, the NRC, and Caltech making the psychologist and long-lasting editor of *Science*, James M. Cattell, say that "[w]hether the Research Council belongs to the National Academy, or the National Academy belongs to the Research Council, or both are satellites of Pasadena is a problem of three bodies that is difficult of solution. The Carnegie Corporation, the Rockefeller Foundation and the National Research Council are another problem of three bodies."[8]

The decade of the 1920s saw the expansion of Caltech and the growth of Millikan's fame, especially after he was awarded the 1923 Nobel Prize. He became one of, if not the most, visible faces of physics in the country, especially through his many public appearances and his popular books, articles, and interviews. In 1927, *Time* magazine described him as a "man of twinkling-grey eyes and sparkling wit [who] knows how to make scientific complexities charming as well as awesome."[9] In the words of one of his biographers, "he was, with the exception of Albert Einstein, the most famous scientist of his day in America. He was—a celebrity."[10]

Among his many jobs in the 1920s, Millikan became involved in foreign relations to promote American science abroad. In 1922, he was appointed Foreign Secretary of

[7] R. A. Millikan, "The New Opportunity in Science," *Science* 50 (1919): 285–97, 297.

[8] Quoted in Robert H. Kargon, *The Rise of Robert Millikan. Portrait of a Life in American Science* (Ithaca and London: Cornell University Press, 1982), 105.

[9] Quoted in Kargon, *The Rise of Robert Millikan*, 148.

[10] Kargon, *The Rise of Robert Millikan*, 148.

the NRC, as well as American member of the Committee on Intellectual Cooperation of the League of Nations. It was through these appointments that Millikan became, from the very beginning, part of the Union of Physics, being appointed as one of eight Vice-Presidents in 1922. He was also, as explained in the previous chapter of this book, responsible for emphasizing the "pure and applied" aspects of physics in the Union.[11]

In 1931, with the transformation of the IRC into ICSU, IUPAP seemed to be on track for real activities. The lack of formal activities by the Union in the previous decade is manifest in the report on the accounts that Abraham gave at the 1931 General Assembly (GA). The Secretariat had been collecting the annual dues from the national member states, yet spent only a small fraction of the money simply on basic administrative expenses, amounting to a ten percent of the payments (actually, the expenses during those eight years were almost equal to the interest credited by the bank). With this, by 1931, the balance of IUPAP was 96.899,75 francs.[12]

The first decision of the third GA, on July 10, 1931, was to nominate Millikan as the next President. The appointment was made in absentia, although communication by cable that very same day between Brussels and Pasadena formalized the new presidency. Millikan was not in Europe at that time, but he would travel to Europe in October that year to attend the Volta conference in Como. On the way back to America, a letter to Max von Laue gives us a glimpse of Millikan's views on and hopes for IUPAP and his Presidency:

> ... this union, of which Bragg has been the president, has been purposely quiescent until it could be made completely *international* in its membership; and finally, that when assurances came last summer, after conversations between Abraham (Paris) and Planck, Schrödinger and yourself, that the time had come when it could be made fully international it set about the organization of some active committees.[13]

This letter helps us to understand the mood in 1931. Abraham, Millikan, and a number of physicists were certain that Germany would soon join the Union after which it should start having formal activities. As a matter of fact, the GA decided to create two working commissions: one for Symbols, Units, and Nomenclature (SUN), under the presidency of Richard T. Glazebrook (1854–1935), and another one on Bibliography and Publications, coordinated by Blas Cabrera (1878–1945), Aimé Cotton (1869–1951), and Paul Langevin (1872–1946). The relationship between the commissions and the German membership is clear since, as Millikan also writes, these are "ready to function actively as soon as the German representation in their membership can be provided for, and they both have important work to do which should not be delayed." The work of such commissions will be discussed later on.

[11] See chapter by Fauque and Fox in this volume for details.

[12] *Union internationale de physique pure et appliquée. Troisième assemblée générale. Bruxelles—10 et 11 juillet 1931. Procès-verbal.* Series B2aa "General Reports," vol. 1, folder "1923–1960," IUPAP, Gothenburg Secretariat, (hereafter IUPAP Gothenburg), Center for the History of Science, Royal Swedish Academy of Science.

[13] R. A. Millikan to M. von Laue, November 25, 1931, roll 12, 550, RAM. Emphasis in the original.

With this letter, Millikan was joining Abraham in his efforts to materialize the incorporation of Germany into IUPAP. But, as will be seen in the next section, things were not that easy. Millikan also worked to get the Italians back in the new IUPAP, after conversations in Como. As a matter of fact, and certain that the Germans would almost immediately join the Union ("assurances have been obtained that the Germans will participate ... in all future activities of the International Union of Pure and Applied Physics," he said), he wrote to Guglielmo Marconi (1874–1937) asking him "whether we may count on full Italian participation" in the forthcoming activities organized and coordinated by IUPAP, especially in regards the SUN Commission. Italy had joined the Union in 1925 but only paid its dues until 1927. In 1932 it re-joined the International Council of Unions and IUPAP.[14]

Millikan's election to the presidency of IUPAP was also one more element in his efforts to internationalize American physics. The 1931 GA not only appointed him but agreed to hold the next meeting in Chicago in 1933. This was the grand plan Millikan had for his tenure: to bring a large number of European physicists to the USA in a meeting that would situate the country at the center of international physics; like the summit of the successful St Louis conference of 1904.[15] Indeed, Chicago had long been planning a major fair to celebrate the centenary of the foundation of the city. Like all events of this kind, the fair was expected to be an event to attract business, trade, and academic conferences. It was the perfect venue for a major international event for physics.

As a matter of fact, as early as June 9, 1930, as Foreign Secretary of the National Academy, Millikan received a letter from the organizing committee of the 1933 Chicago World Fair, asking the academy for advice and inviting them to coordinate the major scientific events during the celebrations. "The directors of this Fair," so the letter said, "consider it at once a national and a scientific undertaking," arguing that "in keeping with the importance of the event, with the scientific character of the exhibition and with the dignity of the occasion" the National Academy should be the one selecting and sending the invitations.[16] Two things here are important for our story. First, the letter mentions up to eighteen international scientific and professional unions but does not include IUPAP, a clear sign that, as already recognized, the Union of Physics was latent or dormant. The second is the limited offer to provide funds to invite foreign scientists:

> If the Directors of the Fair were to guarantee ocean transportation for a certain very limited number of men in each international organization, what sum would you estimate as necessary for this purpose? In other words, we should greatly appreciate your judgement as to what organizations ought to be invited and how many men ought to be subsidized in the manner which I have indicated.[17]

[14] Italy had been a member of IUPAP since 1925 but stopped paying the dues in 1927. When they "re-joined" in 1932, they paid all the annual memberships due since 1927. See Roberto Lalli, "Cento anni di IUPAP," *Il Nuovo Saggiatore* 39 (2023): 45–56.

[15] See Richard Staley, *Einstein's Generation: The Origins of the Relativity Revolution* (Chicago: Chicago University Press, 2008).

[16] H. Crew to R. A. Millikan, June 9, 1930, roll 6, 732, RAM.

[17] H. Crew to R. A. Millikan, June 9, 1930, roll 6, 733, RAM.

It is clear that Millikan took the offer to heart and included it in his plans for the coming years. Since he was one of the Vice-Presidents of the latent IUPAP, in February 1931 he received Abraham's invitation to take part in the July meeting in Brussels that would re-found this and other unions. In May, he replied apologizing for not being able to attend (his plans to attend the Como conference were certainly more pressing), but he mentioned for the first time the possibility of organizing a big event on physics in Chicago:

> I would like to suggest that inasmuch as the Chicago Exposition in the summer of 1933 will unquestionably bring to it a very large number of the world's physicists, it might be a very excellent time for holding a meeting of the International Union. The management of the Exposition has asked ... to recommend to it a group of eighty scientists outside of the United States who may be invited to meet with it there in the third week in June, 1933, and read papers, and I think that it was planned to pay at least the traveling expenses of all these invited guests. This would seem to make this time and place, therefore, a very logical one for the meeting of the International Union.[18]

This offer was a trigger to elect Millikan as President of IUPAP for the next three years, since the choice of the venue for 1933 preceded the election of the new President. Although Millikan himself was not in Brussels in July 1931, and neither was the current President, Bragg, Frank Schlesinger (1871–1943) and Arthur E. Kennely (1861–1939), the two American delegates at the meeting, sent notes on how the discussions unfolded. The first question to be addressed was the place for the following meeting. Paris, London, and Chicago were the three options, and the latter was unanimously voted for. "The Chairman then suggested," so the report follows, "that it would thus be very appropriate if Dr. Millikan were elected President of the Union for the ensuing term, covering the date of the 1933 Chicago meeting. On motion, Dr. Millikan was so elected, unanimously."[19] The Century of Progress International Exposition, since such was the name of the Chicago Fair, was meant to become the first major event of IUPAP ten years after its formal approval.

Indeed, Millikan soon pushed for the scientific quality and institutional significance of the Chicago meeting. As already seen, in his urging of Marconi to secure the participation of an Italian delegation, in his conversations with Glazebrook in London in the Fall of 1931, and in a few letters thereafter, he pushed the SUN Commission to make haste on a first memorandum on the state of "the fundamental definitions of Electric and Magnetic Units," so as to have international discussions underway during 1932 and make the Chicago meeting the place for an international agreement.[20]

[18] R. A. Millikan to H. Abraham, May 8, 1931, Roll 6, 769, RAM.
[19] Notes of a Meeting of IUPAP, July 10–11, 1931, roll 6, 765–6, RAM.
[20] R. Glazebrook to M. von Laue and to G. Marconi, December 1, 1931, roll 12, 569–72, RAM. See also R. A. Millikan to G. Bonnet, May 9, 1932, roll 12, 637, RAM.

But Millikan's grand plan was soon to face the economic reality of the country and of the world. The crash of 1929 was only then beginning to kick in and to reduce budgets, cancel plans, and force politicians and administrators to make difficult choices. The Century of Progress International Exposition was one such event that had to be scaled down, and the invitation to foreign scientists reduced to the bare minimum. At the beginning of 1933, it was already clear that IUPAP would not meet in Chicago: "I was hoping that efforts which I had been making in other directions for the paying of the expenses of either one or both of yourself and Dr. Glazebrook to Chicago might be successful," wrote Millikan to Abraham, adding that "in view of the present situation it has been impossible to make this provision." And in a defeatist tone he concludes that "the meeting will necessarily have a diminished significance."[21]

He also tried to have IUPAP pay for, at least, Abraham and Glazebrook, but the latter informed that the decision had been to postpone the intended meeting, not least because the SUN Committee had not yet managed to produce a serious report, let alone achieved a significant international agreement on the matter of units and symbols.[22] In the end, Millikan's grand plan was reduced to a one-day meeting of the "American section of the International Union of Pure and Applied Physics with Foreign Guests," on June 24, 1933. The papers by the "foreign guests," namely Glazebrook and Abraham were read in absentia by local physicists (Millikan and Kennelly, respectively).[23]

In early August, Millikan reported in a rather over-optimistic letter to Abraham that the scaled-down meeting had been a success and that, while some expressed "fear that the Union might disintegrate if it did not soon hold a meeting which would demonstrate that it had both vitality and a real work to perform," Millikan saw "a large amount of useful activity in the field of symbols, units and nomenclature." Yet, he accepted that "the most important function of the Union will be the organizing and holding of international congresses."[24] As shall be seen later, IUPAP finally had its next GA in October 1934 at a large physics meeting in London and Cambridge organized mainly by the (British) Institute of Physics.

The downsizing of scientific events in the Chicago Exhibition was, of course, not the only casualty of the Great Depression. At the time Millikan was giving up his hopes for a historic physics meeting in Chicago, the NAS received news from the Secretary of State that the Congress was not going to allocate the usual amount of money to pay for the membership to the several international unions of ICSU. "With reference to the share of the United States as an adhering member of the International Research Council [sic] and associated Unions for the calendar year 1932," so the note went, "you are informed that in consequence of the failure of the 72nd Congress to make provision for these quotas it will be necessary to withdraw from the Unions."

[21] R. A. Millikan to H. Abraham, February 16, 1933, Roll 12, 657, RAM.

[22] R. Glazebrook to R. A. Millikan, April 14, 1933, Roll 12, 659, RAM.

[23] Minutes of the meeting of the American section of the International Union of Pure and Applied Physics with Foreign Guests, in roll 12, 662, RAM.

[24] R. A. Millikan to H. Abraham, August 4, 1933, roll 12, 666, RAM.

And it added that all diplomatic steps for the withdrawal would be made by "the appropriate diplomatic officers of the United States."[25]

Millikan soon drafted a response complaining that "adherence of the United States to these Unions was made ... through its National Academy of Sciences ... so that withdrawal, if desired, is to be effected through the action of the National Research Council," not by the Government. The provisional solution was clear: that the NAS would "make strong efforts to find other sources than appropriation by Congress for the payment, for this year, of the dues in these organizations, in the hope that subsequent congresses will see fit to continue the long-established policy of meeting these dues in the future."[26]

To stress the point, he also prepared a report to be sent to the Secretary of State highlighting the importance of the unions and of ICSU as a way to secure a prime place for the nation in the international world of science. Indeed, Millikan would stress that "the presidents of a considerable number of the international scientific organizations are at present from the United States," which showed the increasingly central role of American scientists like himself on the world stage.[27] The report also gave four examples of "important international activities," one of which was the IUPAP Chicago meeting and the activities of the SUN Commission, which he aggrandized saying that "the discussion of the problem in symbols, units and nomenclature [was] a problem of fundamental importance to all the related sciences," not only to physics.[28]

The amount of money was not huge. The total sum of the membership fees was under $5000, 3000 of which were devoted to the Geodetic and Geophysical Union (IUPAP was the cheapest, with only $63 in 1932).[29] Since the creation of ICSU, the government had annually provided for the money, yet without a clear mandate. Now that things were tight, and in the absence of a legal directive other than precedent, the Congress rejected this allocation. It was time to start lobbying so as to solve the problem "not alone for this year, but for the future," as Sol Bloom (1870–1949), a congressman for West Side Manhattan, assured the President of Columbia University, Nicholas Murray Butler (1862–1947): "I feel confident that we will be successful, and now that I know *you* are interested, the thought occurs to me that we *must* be successful."[30]

This situation remained in place for the dues of 1932 and 1933, but lobbying worked. A hearing in Congress on March 6, 1934, with the presence of "twenty-five scientific men who spoke or contributed statements in favor of the bill" introduced by Bloom was unanimously recommended for adoption.[31] After that, the Senate also

[25] W. Carr to P. Borckett, March 16, 1933, roll 6, 794, RAM.
[26] R. A. Millikan to W. Carr, April 5, 1933, roll 6, 800, RAM.
[27] "Report of the Foreign Secretary of the National Academy of Sciences," July 12, 1933, roll 6, 796, RAM. George E. Hale was President of ICSU, Frank Schlessinger of the International Astronomical Union (IAU), Millikan of IUPAP, Arthur E. Kennelly of ISRU (International Scientific Radio Union), Isaiah Bowman of the International Geographical Union.
[28] "Report of the Foreign Secretary of the National Academy of Sciences," roll 6, 798, RAM. The wording of the report shows that it was partly written before the Chicago meeting.
[29] Albert Barrows, September 30, 1933, "NRC, Relationship with International Scientific Organizations," roll 6, 805, RAM.
[30] Bloom to Butler, October 11, 1933, roll 6, 809, RAM. Emphasis in the original.
[31] NRC, Division of Foreign Relations, Annual Report 1933–1934, roll 6, 825, RAM.

passed the bill, and the President signed it on June 16. Yet, that was not the end of the story because this item was not included in the "deficiency bill," thus preventing the NRC from receiving the money from the government for the 1934 dues either,[32] having to wait until the following year to normalize the situation.

The German Question ca 1931

Immediately before and after the 1931 GA, Abraham had been in touch with members of the German physics community. Indeed, as the person who was behind the wheel in drafting the new statutes, he even traveled to Berlin to discuss the wording with Planck, Schrödinger, and others, so as to ensure that, immediately after their approval, German physicists would join the Union. His hope was that Germany would send an official delegation to Brussels and become a founding member of the new IUPAP. But things were not moving that fast on the German side. Planck, but especially Schrödinger, seemed to be very actively promoting the process, and the *Deutschen Physikalischen Gesellschaft* (DPG) had already set up a specific committee to discuss the matter. On June 13, under the presidency of Planck and the Austrian physicist Egon Schweidler (1873–1948), the committee however decided that no official delegation could be sent to Brussels and that the matter should be studied further, once the new statutes had been approved. The GA of the DPG, due to take place in September, should be the one to decide on the matter. Eventually, Walther Gerlach (1889–1979) and Emil Rupp (1898–1979) were "cordially greeted" as observers at the GA of IUPAP.[33]

As Schrödinger reported immediately, there were a number of misgivings on the German side. First, no official delegation could be sent to Brussels since the IRC was still active and the exclusion of Germany was, from their point of view, still in place. Abraham tried to play this down arguing that while the letter of the old statutes said so, the spirit was that "in reality the meeting in Brussels will be a truly constitutive assembly so as to establish the Union on a new basis and all delegations will have the same powers."[34] Moreover, Abraham was also certain that the meeting would be agreeable and that the new statutes would be approved without much discussion: "this is not just a personal impression," he said, since he had sent the existing draft to all the delegates and "nobody had raised any objections."[35] Yet, this objection probably shows that not everybody in Germany had forgiven their exclusion a decade earlier.

In any case, this was not the most difficult point to solve. International unions had been built under the assumption that members would be nations through their national academies or similar representative bodies. But Germany was far from having such a centralized structure and there was more than one institution representing physicists, the most important of which seemed to be the DPG and the *Gesellschaft für*

[32] Office Memorandum 97 (Barrows), June 23, 1934, roll 12, 855–6, RAM. The bill was HR 6781. The fiscal year ended at the end of June, so no more provisions could be made for the budget.

[33] *Union internationale de physique pure et appliquée. Troisième assemblée générale. Bruxelles—10 et 11 juillet 1931. Procès-verbal*, 3, series B2aa "General Reports," vol. 1, folder "1923–1960," IUPAP Gothenburg.

[34] H. Abraham to E. Schrödinger, June 7, 1931, roll 6, 539, RAM.

[35] H. Abraham to E. Schrödinger, June 7, 1931, roll 6, 539, RAM.

Technische Physik (DGTP).[36] Because of that, both Planck and Schrödinger had asked how likely it was to have more than one society representing one nation. Moreover, the DPG also "contains sub-societies in Germany, in Austria and in Czechoslovakia," which raised the problem of who would represent the Austrian physicists (the DPG or a "small Austrian society")? Or, worse, who would represent the German speaking Czech physicists (the DPG or the Czech Society, since the latter was already a member of the Union)?

Schrödinger was correct when, in early June, he urged Abraham to do all he could to encourage the German society to join as soon as possible ("*je souhaite l'accomplissement … très vivement et très empressément!*") for fear of "imponderable dangers" that would derail the whole project.[37] As he feared, in September 1931 the annual GA of the DPG decided to create yet another commission, with three members from the DPG and three from the DGTP to study the matter.[38] In the same meeting, Max von Laue became President of the DPG.

This is, thus, the context of Millikan's letter to von Laue previously quoted. In it, Millikan acknowledged the creation of the new six-person panel, and inquired "whether you do not think it possible that this committee can meet and act in the very near future."[39] At stake was the commencement of the activities of the new IUPAP, especially the preparation of the Chicago meeting and the work of the SUN Committee. At the same time, and in the hope of speeding up the process, Glazebrook also urged von Laue by explaining that the new commission he was heading had started working immediately on a number of issues (see the next section). "Had Germany been a member," he said, "the memorandum when settled, would have been sent to the Association of German Physicists adhering to the Union, with a formal request for their help." And he went on saying that "In work of this kind it is clearly important to obtain the views of such a body and the object of this letter is to ask how this may be done. The matter is urgent." Glazebrook's suggestion was as follows.

> Clearly the most satisfactory way of securing this would be that the Committee of which you are Chairman should come to an early decision and recommend adherence to the Union of Physics. Is this a possible course? Failing this have you any possible alternative which would give me as Chairman of the S.U.N. Committee your valued help from the commencement of our deliberations?[40]

This "diplomatic enquiry," as Glazebrook called it, did not work.[41] The committee had already met in October and "had decided that the time for affiliating had not yet come." As for some German participation in the SUN consultations, von Laue suggested to contact Julius Wallot (1876–1960), the representative of the German

[36] In 1930, the DGTP had 1370 members, slightly more than the 1320 of the DPG.
[37] E. Schrödinger to H. Abraham, June 5, 1931, roll 12, 538, RAM.
[38] M. Planck to H. Abraham, October 8, 1931, roll 12, 532, RAM.
[39] R. A. Millikan to M. von Laue, November 25, 1931, roll 12, 550, RAM.
[40] R. Glazebrook to M. von Laue, December 1, 1931, roll 12, 570, RAM.
[41] R. Glazebrook to R. A. Millikan, December 1, 1931, roll 12, 567, RAM.

Committee for Units and Formulas. Schrödinger's fears of delays sine die were materializing.

A derivative of this deferment, as many still saw it, was the situation of IUPAP within the new ICSU. The agreement with Schrödinger and Planck was to clearly word the new statutes in a way that IUPAP would not necessarily be a part of the former IRC or the new ICSU; else, the Germans would find it difficult to join. In early January 1932, the General Secretary of ICSU, Henry Lyons, asked about it and Abraham replied that "the situation of the International Union of Physics regarding the International Council needs to remain in suspense until after the adhesion of our German colleagues in the International Union of Physics."[42] The consequence of this was that IUPAP would not have a delegate in ICSU and, of course, they would not pay dues.

Henry Lyons and possibly also George Hale, the President of ICSU, did not share Millikan and Abraham's interpretation of the statutes. Since IUPAP had never left the IRC, so the argument went, it immediately became a part of ICSU. As a compromise, and also in view that other members of the Executive Council of IUPAP such as Martin Knudsen (1871–1949) and Willem H. Keesom (1876–1956) agreed with Lyons,[43] Millikan accepted sending the two statutory delegates to the first Executive Council of IUPAP to be held in London in May 1932 and wait for a formal decision at the next GA of IUPAP (still expected to take place in Chicago). The two appointed representatives were Glazebrook and Cotton, but due to last-minute urgent matters neither could attend, and Abraham sat in for them at the meeting in London.[44]

Ironically, as mentioned in the previous section, it was at that meeting that Italy re-joined ICSU and, later, also IUPAP, thus contributing to the interpretation of the statutes given by the International Council.

Two Commissions at Work

As already mentioned, the 1931 GA agreed the creation of two commissions within IUPAP, both with a clear internationalist and inter-unionist vocation: the SUN Committee and a Commission for Bibliography and Publications. Neither comes as a surprise, since both topics had already been present in the discussions leading to the creation of the IRC in 1918.[45] Let us start with the latter. Coordinated by Blas Cabrera (1878–1945), Aimé Cotton (1869–1951), and Paul Langevin (1872–1946), its mission was to promote that "each scientific memory ... be accompanied by a summary," and to "organize a mechanism so that those summaries can be quickly communicated to the bibliographical journals of the different countries."[46] This project transcended

[42] H. Abraham to H. Lyons, January 7, 1931, roll 12, 583, RAM.
[43] M. Siegbahn to H. Abraham, in H. Abraham to R. A. Millikan, April 27, 1932, roll 12, 635, in RAM.
[44] H. Abraham to R. A. Millikan, June 29, 1932, roll 12, 654, RAM.
[45] See the paper by Fauqué and Fox, this volume.
[46] *Union internationale de physique pure et appliquée. Troisième assemblée générale. Bruxelles—10 et 11 juillet 1931. Procès-verbal*, 5, series B2aa "General Reports," vol. 1, folder "1923–1960," IUPAP Gothenburg.

the world of physics and, as Cabrera reported to IUPAP, a meeting of the International Institute of Intellectual Cooperation (IIIC) held in Paris in March 1932 linked the unification of scientific terminology to the need for a centralized bibliographical repository: a resolution of the IIIC promoted that "steps be taken to constitute ... an international centre of documentation with a view to facilitating the unification of terminology used in physics, chemistry, biology and the other natural sciences."[47] Indeed, the 1947 IUPAP GA described this group of three physicists as simply the representatives of the Union in the Commission for the Coordination of Terminologies created in 1932 by the IIIC. There is no evidence of any further reference to the IUPAP Bibliography Commission.

The SUN commission did do some work, partly due to the influence of Glazebrook, who had been the first Director of the National Physics Laboratory (NPL) in the UK in the first two decades of the 20th century and who, though now formally retired, still held much political power and influence. As a matter of fact, the SUN Committee seems to have emerged from a discussion at the Brussels July 1931 GA of IUPAP where the British delegation (i.e., Glazebrook himself and Ezer Griffiths, also an NPL man)[48] should define the unit of heat. As a result of this proposal at the GA, "a 'sous commission' was appointed to deal with Symbols, Units and Nomenclature in Physics and to report to the Union."[49] And already in the first meeting of this "sous commission," probably taking place during the days of the GA, two resolutions were put forward: (1) "that the unit of heat when measured in units of energy be the Joule defined as equivalent to 10^7 ergs," and (2) "that the gramme-calorie is the amount of heat required to raise the temperature of one gramme of water from 14,5° to 15,5° of the International Scale of Temperature."[50]

It comes as no surprise that Glazebrook pushed for the creation of this commission. In previous years, he had been involved in discussions at NPL on the need to internationally coordinate standards since "at present there is much waste of time involved in comparing figures deduced from standards, which are unnecessarily varied."[51] Symbolic proof that there was an intent of doing serious and coordinated work is that Glazebrook and Griffiths, the latter introducing himself as its Secretary, started sending correspondence with letterheaded paper with the name of the SUN Committee printed on it and used the NPL as its formal address.

One of the first things the commission was involved in was in connection with the units in thermodynamics. W. H. Keesom, one of four members of the SUN Committee and Director of the Leiden laboratory, formally communicated to Glazebrook the status quo of long discussions on thermodynamic units among low-temperature physicists. In 1928, those present at the fifth International Congress of Refrigeration in Rome had decided to form a special committee to "formulate propositions as to

[47] Cabrera, Report on the meeting of the Committee on the Coordination of Scientific Terminology, Paris, March 18 and 19, 1932, roll 12, 619–20, RAM.

[48] These were the only two representatives of Britain at the GA of 1931. *Union internationale de physique pure et appliquée. Troisième assemblée générale. Bruxelles—10 et 11 juillet 1931. Procès-verbal*, series B2aa "General Reports," vol. 1, folder "1923–1960," f. [7] (IUPAP Gothenburg).

[49] R. Glazebrook, letter August 5, 1931, Department of Scientific and Industrial Research (DSIR) 10/20, The National Archives UK, Kew, London (hereafter NAUK stands for National Archives of the UK).

[50] R. Glazebrook, letter August 5, 1931, DSIR 10/20, NAUK.

[51] C. Egerton to R Glazebrook, Memorandum re Physical Constants, June 1931, DSIR 10/20, NAUK.

a system of nomenclature and symbols for the different functions used in thermodynamics as well as a definition of a unit of entropy."[52] The commission had already proposed the word "enthalpy" for the function U + pV, and to denote internal energy by the symbol U, and S for entropy. Keesom suggested that the SUN Committee of IUPAP should discuss the proposal and contribute to the discussions led by the International Institute of Refrigeration, as well as trying to include IUPAC in the conversation. So, in a way, the first task the SUN Committee assumed was, in a way, to join in an already backed agreement on some thermodynamic units. This was approved in Buenos Aires in 1932.[53]

A more problematic issue was that of electric units. In September 1931, the Harvard-based A. E. Kennelly, who was Associate Director of the International Electrotechnical Commission (IEC) and Chairman of its section B for Electric and Magnetic Magnitudes and Units, and had acted as one of two American delegates in the 1931 IUPAP GA, met with Glazebrook and Griffiths in London during a meeting of the IEC. Debates on the right units for magnetic induction (B) and magnetic fields (H) among electrical engineers had been underway for a few years,[54] and Kennelly suggested the new SUN commission should get involved; partly to advise them, but also to make sure physicists did not add to the jumble, since "this confusion is also reflected in certain text-books of physics."[55]

To meet this challenge, in early 1932, Glazebrook, who was also chairman of the Electrical Standards and Units Committee at the NPL,[56] sent a memorandum to all national unions of physics with a number of questions dealing with systems of electrical units and asking national committees to reply as soon as possible: "It is hoped on receipt of this information to prepare a memorandum summarizing the views of Physicists in the Countries adhering to the Union in a form suitable for discussion by the General Assembly."[57] The goal was to prepare a report ready to be discussed and approved by the intended 1933 Chicago meeting and GA.

It is clear that Millikan wanted to make sure the other members of the American section of IUPAP, A. H. Compton, F. D. Foote, W. L. Severinhaus, W. F. D. Swann, and H. W. Webb, were aware of the importance of taking part in the discussion so as to get as many physicists as possible involved. "The subject," he said, "is of such importance that this committee should only act as a transmitter of the best judgements that can be found in the country as to desirable changes."[58] That is why F. K. Richtmyer, Chairman of the Division of Physical Sciences of the NRC and W. F. G. Swann, President of the American Physical Society were included in the discussions on the American side. But the Chicago meeting never happened and no consensus on the matter was reached.

[52] W. H. Keesom to R. Glazebrook, September 7, 1931, roll 12, 528, RAM.
[53] *Union internationale de physique pure et appliquée. Quatrième assemblée générale. Londres, 5 octobre 1934. Procès-verbal* (Paris: Hermann, 1936), in series B2aa "General Reports," vol. 1, folder "1923–1960," f. [15], IUPAP Gothenburg.
[54] See Fauqué and Fox in this volume for further details.
[55] A. E. Kennelly to R. A. Millikan, February 18, 1932, roll 12, 597, RAM.
[56] J. E. Petavel to R. Glazebrook, January 18, 1933, DSIR 10/20, NAUK.
[57] E. H. Griffiths to R. A. Millikan, January 27, 1932, roll 12, 589, RAM.
[58] R. A. Millikan to W. F. D. Swann, March 2, 1932, roll 12, 604, RAM.

The issue was not settled in 1933, nor at the 1934 London meeting and GA. In 1935, Kennelly would again contact Glazebrook, as chairman of the SUN Committee, and Abraham, as Secretary of IUPAP, asking for advice on another issue. The plenary meeting of the IEC had unanimously voted a resolution to adopt the Giorgi system of four absolute practical units. Three of them were universally settled (metre, kilogram, and second), but the fourth one was in dispute (ohm, volt, ampere, coulomb, farad, henry, or weber were the candidates). "It was decided," Kennelly reported, "that the choice should not be made before consulting the international Union of pure and applied Physics S.U.N. committee and the Comité International de Poids et Mesures Comité consultative d'Electricité."[59] Glazebrook's response is symptomatic of the functioning of the SUN Committee: before trying to get the views of the other members, an opinion should be asked locally, of English electricians and of the Electrical Units and Standards Committee of the NPL. With that, as he had done in 1932, he would prepare a memorandum to circulate among the other national members of IUPAP.[60] Sadly, Glazebrook, who was already eighty by this time, would die later that year and with him the SUN Committee would lose its driving force.

Although not directly the work of the commission, Millikan and Abraham received two requests for funds in the early years of the 1930s. One seems to have been agreed during Bragg's presidency: support for the work leading to the publication of the second edition of the crystallographic tables. Interestingly, the only major grant IUPAP gave in the interwar period (37,000 francs, over one-third of the total budget of the Union between 1922 and 1934) went to the German physicist specialized in crystallography, Paul P. Ewald (1888–1985). The story goes as follows. After a conference on crystal structure organized in London by the Faraday Society in 1929, Bragg promoted deeper international collaboration in sharing and standardizing information among crystallographers. The commitment was to support the efforts of Ewald as co-editor of the journal *Zeitschrift fur Kristallographie* in producing a table of crystallographic structures. The first outcome was published in 1931 as *Strukturbericht Volume I (1913–1928)* by Ewald and Carl Hermann and, finally, in 1935, the two-volume *Internationale Tabellen zur Bestimmung von Kristallstrukturen*. "Ewald's activities as one of the editors of the *Zeitschrift*, as co-editor of the *Strukturbericht*, and as one of the prime movers behind the *Internationale Tabellen* contributed greatly to the growth of an autonomous international crystallographic community,"[61] to the extent that, after World War II, and having been forced to emigrate from Germany in 1937, he was promoted and was the first President of the International Union of Crystallography.

The second petition came from Charles Marie, the long-lasting editor of the *Tables annuelles de constantes et données numériques de chimie, de physique, de biologie et de technologie*.[62] In the 1930s, Marie would ask for advice on whether the spectroscopic constants, a field of "exceptional development" should be included in the Annual

[59] A. E. Kennelly to H. Abraham, June 27, 1935, DSIR 10/20, NAUK.

[60] R. Glazebrook to E. H. Griffiths, July 3, 1935, DSIR 10/20, NAUK.

[61] Harmke Kamminga, "Paul P. Ewald and the Building of the Crystallographic Community," in *P.P. Ewald and his Dynamical Theory of X-Ray Diffraction*, ed. D. W. J Cruickshank, H. J. Juretscheke, and N. Kato (Oxford: Oxford University Press, 1992), 42.

[62] See chapter by Fauque and Fox in this volume.

Tables and, if so, would IUPAP give a grant for these to be published?[63] Conversations continued and there was praise for Marie's work with the tables among the members of IUPAP;[64] but no formal agreement seems to have been reached until the 1934 meeting, where 5,000 francs were promised for this project.[65] Charles Marie was grateful to Millikan for his efforts in getting support from Richtmyer and the NRC, as well as for IUPAP's decision. The latter was particularly welcome due to "the resistance we have found among pure physicists, many of whom do not seem to value the usefulness" of the tables.[66] Millikan, who had promoted the inclusion of "applied" in the name of the Union of Physics, was almost certainly flattered by this praise.

Niels Bohr's Failed Presidency

In the same way Millikan had been elected President of the Union in absentia in 1931, so was Niels Bohr appointed President during the GA of 1934 in London. After the fiasco of the plans for the Chicago Conference, IUPAP met during a major conference for physics that took place at London and Cambridge in October 1934.[67] The succession of events of this story is yet another sign of the lack of coordination and the troubled path the Union underwent in the interwar period. As the outgoing President, Millikan had a conversation with Bohr on the phone telling him about his election. Millikan's letter to Abraham reads as follows:

> "I called Bohr on Saturday telling him we had "had a most distinguished congress the climax of which was the election of Bohr as president." Today I have a reply reading: "Please extend hearty thanks to congress for great honor" Bohr.
>
> "So, thanks to yourself and Sir Richard Glazebrook the Union is now 'well on its way, with flying sails.' Congratulations! ! I hope our German troubles too will soon be past. Copenhagen will be an ideal place in which to bring them in."[68]

This letter seems to show that, although Bohr had not attended the London meeting, Glazebrook and Abraham had pulled the strings to have him elected as President as the best way to boost the Union. The news of the election was transmitted by Millikan, not on the phone, as Millikan seems to imply, but on a telegram with the text: "Fitting climax to distinguished congress enthusiastic election of Bohr as president." To this, Bohr replied with the telegram previously mentioned, giving the impression that he had accepted. But this letter also shows that Millikan, Abraham, Glazebrook, and others thought that Bohr's presidency would help solve the "German troubles."

63 C. Marie to R. A. Millikan, November 20, 1931, roll 12, 549–50, RAM.

64 C. Marie to R. A. Millikan, January 27, 1932, roll 12, 589–90, RAM; F. K. Richtmyer to R. A. Millikan, April 1, 1932, roll 12, 624, RAM.

65 *Union internationale de physique pure et appliquée. Quatrième assemblée générale. Londres, 5 octobre 1934. Procès-verbal* (Paris: Hermann, 1936), 3–4. In series B2aa "General Reports," vol. 1, folder "1923–1960," f. [8] (IUPAP Gothenburg).

66 C. Marie to R. A. Millikan, January 22, 1935, roll 6, 127, RAM.

67 See chapter by Fauque and Fox in this volume.

68 R. A. Millikan to H. Abraham, October 1934, series E2 "Correspondence with Council Members," vol. 1 "1934–1999," folder M, IUPAP Gothenburg.

And this was the great misunderstanding between the outgoing Executive Committee and the newly elected President.

History seemed to be repeating itself. As seen at the beginning of this chapter, after the GA that, in a way, re-founded IUPAP along the lines of the transformation of the IRC into ICSU, there was a great expectation that German physicists would soon join IUPAP. But things never materialized, in spite of the untiring efforts of Abraham and Millikan.

Bohr's election and apparent acceptance in 1934 seems to have happened under the misunderstanding that it was merely a kind of honorary recognition, not the appointment of President of the Executive Council. This information, which he "first learnt after the return of Knudsen to Copenhagen ... has brought me personally in a most difficult situation, since from the very creation of the international research council I have officially taken the position not to cooperate in the work of the council and its unions, before the perfect international character of these organizations was attained."[69] Indeed, though the Danish Academy was part of IUPAP and other unions, Bohr had "never been a member of the committee of the Danish academy which represents the physical union in our country, of which Kudnsen is chairman, and thus it happens that I was so ignorant as regards the functions of the union."[70] Bohr also thought that he had to be consistent with the stance he had taken from 1919 and remain away from the Union, since "the present moment would be very inopportune for such steps. Indeed, the difficulties which we all then felt have been ever increasing on account of the deplorable political development in the countries which are not yet represented in the research council."[71] In other words, Bohr did not distinguish if threats to "total" internationalism (in Europe) came from the excessive sense of revenge by the victors of the Great War or from the new nationalist regime in Germany.

Unaware of this misunderstanding, as Abraham was preparing the official report of the fourth GA, he wrote to Bohr formally asking for his acceptance to be the next President, in the understanding that he had already committed. As a matter of fact, this letter not only congratulates him on his appointment but immediately goes into business with things related to the publication of abstracts from the London conference, the possible increase in the fees that member countries were paying, and the organization of the next congress and GA in Copenhagen in three years' time.[72] To Abraham's surprise, Bohr's response in the negative came at the same time as Millikan received the news directly from Bohr.

The resignation of Bohr from the presidency left the Union at a standstill. And nothing was done about the matter until 1937, when Bohr visited the West Coast of the United States and met with Millikan. As the latter reported to Abraham, Bohr kept thinking that he "should not act at this moment as the President of the International Union wholly due to what he considers to be the demands of 'diplomacy,'" and

[69] N. Bohr to R. A. Millikan, October/November 1934, ID: 01/01/007, The Niels Bohr Archive, Niels Bohr Institute, Blegdamsvej 17, 2100 København, Dinamarca.

[70] Ibíd.

[71] Ibíd.

[72] Abraham to Bohr, November 19, 1934, series E2 "Correspondence with Council Members," vol. 1 "1934–1999," folder R, IUPAP Gothenburg.

he agreed with the move to ask Enrico Fermi to accept the official presidency and organize the next conference and GA in 1938 in Copenhagen.[73] The idea seemed to have come from a conversation in early 1937 between Bohr, Langevin, and Abraham. But that did not go through either: Fermi rejected the offer with reasons "of extreme modesty."[74]

The next in line was the Swedish physicist Manne Siegbahn (1886–1978), with whom Abraham met at some point in London. This time, the proposition was successful, although this meant that the intended 1938 conference should take place in Sweden rather than Denmark. The preserved correspondence between Abraham, Millikan, and Bohr on this matter shows how the former, as Secretary of the Union, somehow regarded Bohr as the formal President, since he was not only informed about all the steps he was taking but was also asking for his approval.[75] But this opened another can of warms: Knudsen had agreed to hold the 1938 meeting in Copenhagen on the understanding that Fermi (or Bohr) would be the President. But now that the choice seemed to be Siegbahn, it "looked only natural" to hold the meeting in the country of the new President, namely Sweden (Uppsala and Stockholm as the two obvious options). In case the Executive Council wanted to hold the meeting in Copenhagen, so Knudsen suggested, the presidency should be offered to Professor Peder Oluf Pedersen (1874–1941), whose "physical works are well known and are of great importance, and who is used to and very able to preside over these kind of international meetings."[76]

To Abraham's despair, by the spring of 1938 no decision had been taken on whether to hold a meeting that fall, either in Copenhagen or in Sweden. Neither materialized, and in 1939 he was again urging Bohr to support the organization of a meeting like the one in London in 1934, because since then IUPAP had not had a GA. His suggested place and date were Paris some time in 1940, for which he had obtained the support of the French Society of Physics and the French Society of Electrical Engineers.[77] Indeed, the meeting never happened, and by the end of the decade, the only known activities in which IUPAP participated were three conferences organized by the *Institut International de Coopération Intellectuelle* in 1938 (Warsaw and Neuchatel) and 1939 (Strasbourg).

Coda

In his letter to Siegbahn discussing preparations for the possible conference in Copenhagen in 1938, Abraham was still hopeful that the Germans might join the Union, "in spite of everything," and that the meeting should be prepared considering

[73] R. A. Millikan to H. Abraham, March 23, 1937, roll 12, 743, RAM.

[74] H. Abraham to N. Bohr, September 22, 1937, series E1, vol. 5, folder 38 "IUPAP Larkin Kervin. Correspondence Re: Archives," IUPAP, Quebec Secretariat (hereafter IUPAP Quebec), Center for the History of Science, Royal Swedish Academy of Sciences.

[75] Ibid.

[76] M. Knudsen to H. Abraham, October 5, 1937, series E1, vol. 5, folder 38 "IUPAP Larkin Kervin. Correspondence Re: Archives," IUPAP Quebec.

[77] H. Abraham to N. Bohr, May 10, 1939, series E1, vol. 5, folder 38 "IUPAP Larkin Kervin. Correspondence Re: Archives," IUPAP Quebec.

the possibility of German participation.[78] As previously seen, that meeting never happened, let alone the incorporation of Germany to IUPAP. The fiasco with Bohr's Presidency and the death of Glazebrook in 1935 left Abraham almost alone as the most engaged physicist in keeping the agonizing Union alive. Abraham never saw the following GA.

[78] H. Abraham to M. Siegbahn, March 26, 1938, series E1, vol. 5, folder 38 "IUPAP Larkin Kervin. Correspondence Re: Archives," IUPAP Quebec.

PART II
RESHAPING IUPAP AFTER WORLD WAR II

3

From Diplomacy to Physics and Back Again

The Changing Roles of IUPAP in the Second Half of the 20th Century

Roberto Lalli

Following an interwar period marked by scientific inactivity and political failures,[1] the International Union of Pure and Applied Physics (IUPAP) underwent a major renovation after World War II. In 1947, IUPAP resumed its activities with new political foundations, completely redesigning the scope and functions of the organization. The emergence of a new world order, and the changing role of physics within it, presented the architects of IUPAP's revival with a set of constraints and goals in the pursuit of making the institution more relevant in the international arena. Simultaneously, the establishment of the United Nations (UN) as the leading organization for maintaining the emerging world order provided a framework, both in terms of organizational structures and objectives, with which international scientific institutions had to engage.[2]

IUPAP's transformation paralleled those of its sister unions and their umbrella organization, the International Council of Scientific Unions (ICSU), as they were all influenced by the evolving global context.[3] However, as a union focused on a specific discipline that had rapidly become crucial for national security and international relations, physicists involved in IUPAP's revival faced unique challenges and issues distinct from other unions. The elevated status of physics following World War II, partly due to its contributions to the Allied military effort,[4] resulted in a significant increase in the number of physicists employed in governmental organizations, for national policies viewed a large pool of physicists as necessary scientific manpower

[1] See the chapters by Fauque and Fox, and Navarro in this volume.

[2] Clare Wells, *The UN, UNESCO and the Politics of Knowledge* (London: Palgrave Macmillan UK, 1987).

[3] For historical accounts of other ICSU unions, see Adriaan Blaauw, *History of the IAU: The Birth and First Half-Century of the International Astronomical Union* (Dordrecht; Boston: Kluwer Academic Publishers, 1994); Roger Fennell, *History of IUPAC, 1919–1987* (Oxford; Boston: Blackwell Science Ltd, 1994); Olli Lehto, *Mathematics without Borders: A History of the International Mathematical Union* (New York: Springer, 1998); Johannes Andersen, David Baneke, and Claus Madsen, *The International Astronomical Union: Uniting the Community for 100 Years* (Cham: Springer International Publishing, 2019); Danielle Fauque, "1919–1939: The First Life of the Union," *Chemistry International* 41 (2019): 2–6; Norbert Schappacher, *Framing Global Mathematics: The International Mathematical Union between Theorems and Politics* (Cham: Springer International Publishing, 2022); Thierry Montmerle and Danielle Fauque, eds., *Astronomers as Diplomats: When the IAU Builds Bridges Between Nations* (Cham: Springer International Publishing, 2022).

[4] Richard Rhodes, *The Making of the Atomic Bomb* (New York: Simon & Schuster, 1986).

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during political or military crises.[5] Physicists became essential members of national advisory bodies and diplomatic endeavors.[6] Some of them even emerged as public figures in the nuclear arms control debate.[7]

In this paper, I will examine how global political forces and individual agendas intersected in the daily activities of IUPAP's officers. It aims to elucidate on the nature of IUPAP as an international scientific institution, and on how its constitutional goals evolved in different political contexts. Since the establishment of the UN, a legal distinction has been made between intergovernmental (IGOs) and non-governmental organizations (NGOs), whereas prior to 1945, this distinction was less clear for international law.[8] Consequently, it is in the post-World War II period that IUPAP, along with ICSU and all its unions, became legally defined as NGOs.[9] As discussed in the "Introduction" to the volume, scholars studying scientific internationalism have suggested looking into the dichotomy between NGOs and IGOs by developing two-type taxonomies distinguishing, e.g., between spontaneous and bureaucratic organizations,[10] or between autoletic and heteroletic organizations.[11]

While these categories can be useful, IUPAP does not entirely fit into taxonomies. It is legally classified as an NGO and should, in principle, operate as spontaneous or autoletic. But the previous chapters in this volume have demonstrated that this was not entirely the case during the interwar period. This paper further confirms it by showing that IUPAP's post-World War II activities were marked by several transitions from one mode of operation to another. I will discuss these transitions by proposing a four-phase periodization including the interwar period discussed in previous chapters:

1. Foundation to the end of World War II (1922–46).
2. Refoundation and growth as a predominantly Western organization (1947–56).
3. Transformation into a bridge between the East and the West during the Cold War (1957–89).
4. Reconfiguration as a global organization aligned with the UN sustainable growth agenda in the post-Cold War era (1990 to the present).

[5] David Kaiser, "Cold War Requisitions, Scientific Manpower, and the Production of American Physicists after World War II," *Historical Studies in the Physical and Biological Sciences* 33, no. 1 (2002): 131–59.

[6] For the US case, see Daniel J. Kevles, *The Physicists: The History of a Scientific Community in Modern America* (Cambridge, Mass: Harvard University Press, 1987).

[7] S. Waqar and H. Zaidi, "Scientists as Political Experts: Atomic Scientists and Their Claims for Expertise on International Relations, 1945–1947," *Centaurus* 63, no. 1 (2021): 17–31.

[8] Kerstin Martens, *NGOs and the United Nations: Institutionalization, Professionalization and Adaptation* (Basingstoke: Palgrave Macmillan, 2005).

[9] For the role in world affairs of NGOs, see Akira Iriye, *Global Community: The Role of International Organizations in the Making of the Contemporary World* (Berkeley: University of California Press, 2002).

[10] Elisabeth Crawford, Terry Shinn, and Sverker Sörlin, "The Nationalization and Denationalization of the Sciences: An Introductory Essay," in *Denationalizing Science*, ed. Elisabeth Crawford, Terry Shinn, and Sverker Sörlin (Netherlands: Springer, 1993), 1–42.

[11] Aant Elzinga, "Modes of Internationalism," in *In Internationalism and Science*, ed. Aant Elzinga and Catharina Landstrom (London: Taylor Graham, 1996), 3–20.

By focusing on the basic features of these phases and the dynamics of the transition from one phase to another it emerges that one primary aim of IUPAP was related to exercises that we call today "science diplomacy."[12] I thus suggest that IUPAP should rather be viewed as a hybrid science diplomacy organization where the balance between different modes of operation was actively negotiated. I argue that understanding IUPAP as a hybrid science diplomacy organization may provide a more useful historiographical perspective, for a thorough historical examination is necessary to determine how the balance between the two modes unfolded. Furthermore, the paper shows that, despite IUPAP's inclusion in a larger organizational system of international science, various historical processes related to general political issues were autonomously managed within the organization. In spite of their diversities, individual agendas did play a fundamental role in the decision-making processes in this way building an institution whose historical development was significantly different from that of similar institutions.

The Refoundation of IUPAP in 1947

IUPAP underwent a complete restructuring during the first post-World War II assembly held in Paris in January 1947. This refoundation process was characterized by two key factors which blended scientific and diplomatic ambitions, urging to restart international scientific collaboration while sidestepping the geopolitical divisions of the Cold War. Firstly, individual physicists who had a leading role in the organization advocated for a new approach to international collaborative work. Their goal was to facilitate the establishment of an international community of physicists despite geopolitical barriers. These physicists were aware of IUPAP's previous failures and of the changing societal and public roles of physics in the aftermath of World War II. Consequently, they envisioned an organization operating differently from its interwar predecessor to address the post-war challenges and support international cooperation in physics.

The thirty delegates present at the fifth IUPAP General Assembly in January 1947 did not assume the organization's survival as a given. Charles Galton Darwin, for instance, one of the main representatives of the UK delegation, even proposed to dissolve IUPAP, arguing that the Union "had never done anything worthwhile."[13] The temporary Secretary General, Paul P. Ewald—a German physicist and crystallographer who had opposed the Nazi regime and emigrated to the UK in 1937—opposed

[12] For current discussion on science diplomacy, see, e.g., Tim Flink and Ulrich Schreiterer, "Science Diplomacy at the Intersection of S&T Policies and Foreign Affairs: Toward a Typology of National Approaches," *Science and Public Policy* 37, no. 9 (2010): 665–77; Daryl Copeland, "Science Diplomacy," in *The SAGE Handbook of Diplomacy*, ed. Costas M. Constantinou, Pauline Kerr, and Paul Sharp (SAGE, 2016), 628–41; Pierre-Bruno Ruffini, *Science and Diplomacy: A New Dimension of International Relations* (New York, NY: Springer Berlin Heidelberg, 2017); Charlotte Rungius and Tim Flink, "Romancing Science for Global Solutions: On Narratives and Interpretative Schemas of Science Diplomacy," *Humanities and Social Sciences Communications* 7, no. 1 (2020): 1–10.

[13] P. Ewald to L. Kerwin, January 19, 1972, series E2 "Correspondence with Council Members," vol. 1 "A–R," folder E, IUPAP, Gothenburg Secretariat (hereafter IUPAP Gothenburg), Center for the History of Science, Royal Swedish Academy of Sciences.

Darwin's proposal. While acknowledging that they were trying to "resurrect [a] body, which ha[d] never shown much sign of life" he advocated for a new role for IUPAP in world affairs.[14] This role implied an explicit definition of the political relations within IUPAP, which Ewald argued should be based on three principles. The first was that IUPAP should remain a strictly scientific institution, free from governmental influence in any form. The second underlined that IUPAP should be truly international avoiding the exclusion policies implemented after World War I. Ewald contended that IUPAP officers should rather invite the former enemy countries in World War II to cooperate as soon as the political conditions allowed. Finally, Ewald stressed that IUPAP should promote a positive public image of the physicists in contrast to the one that saw the physicists as "cogs in the military machine," an image that was becoming widespread because of the role physicists had been playing in the development of nuclear weapons.[15] Ewald's forceful proposal can be seen as part of a broader movement among scientists to revamp institutionalized forms of international scientific cooperation across various disciplines. As a matter of fact, Ewald himself had been instrumental in the establishment of a new union, the International Union of Crystallography, in 1946,[16] and attempts to build institutionalized networks in other specific fields like optics were underway.[17]

In addition to these bottom-up efforts, the overall institutional framework of international scientific cooperation was also changing. The creation of the United Nations Educational, Scientific and Cultural Organization (UNESCO) prompted a reorganization of the activities of ICSU and its unions.[18] In December 1946 ICSU and UNESCO signed an agreement of close cooperation to promote the natural sciences. This agreement provided substantial funding for ICSU and its unions to expand their activities and set a framework aligning the unions' agendas with that of UNESCO.[19] In part, this was clearly stated in the agreement between ICSU and UNESCO according to which ICSU should accept the principles that had inspired the foundation of UNESCO, but it was *not* a strict legal requirement, for ICSU and its unions maintained full independence (Figure 3.1).[20]

Since the foundation of UNESCO many started to think that international scientific ventures should be related to UNESCO and then, to its main goals understood

[14] Paul P. Ewald to B. Gross, January 16, 1947, vol. 3 "Fleury correspondence 1947–1963," folder 21 "Commission on Cosmic Rays," IUPAP, Quebec Secretariat (hereafter IUPAP Quebec), Center for the History of science, Royal Swedish Academy of Sciences.

[15] *IUPAP, Minutes of the Fifth General Assembly, September 1947*, 17, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg, translation from the booklet *IUPAP 1922–1992*, available at https://archive2.iupap.org/wp-content/uploads/2013/04/history.pdf.

[16] Kamminga, H. "The International Union of Crystallography: Its Formation and Early Development," *Acta Crystallographica Section A Foundations of Crystallography* 45, no. 9 (1989): 581–601.

[17] John N. Howard, "The Early Meetings of the International Commission for Optics," *Optics & Photonics News*, June 16–17, 2003.

[18] Wells, *The UN, UNESCO and the Politics of Knowledge*; James Patrick Sewell, *UNESCO and World Politics: Engaging in International Relations* (Princeton, NJ: Princeton University Press, 1975); Aant Elzinga, "UNESCO and the Politics of International Cooperation in the Realm of Science," in *Internationalism and Science*, ed. Aant Elzinga and Catharina Landstrom (London: Taylor Graham, 1996), 89–131.

[19] Frank Greenaway, *Science International: A History of the International Council of Scientific Unions* (Cambridge: Cambridge University Press, 1996).

[20] *IUPAP, Minutes of the Fifth General Assembly, September 1947*, 2, series B2aa "General Reports," vol. 1 "1923–1966," IUPAP Gothenburg.

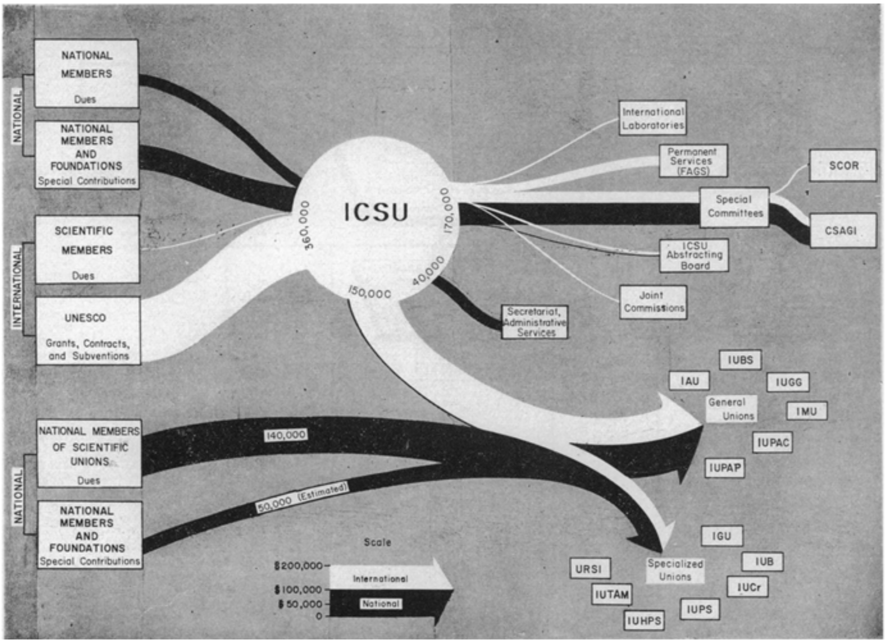

Figure 3.1 Flow chart showing the approximate flow of funds of ICSU and its member unions in 1957

Source: Reproduced from Atwood, Wallace W. "International Council of Scientific Unions," *Science* 128, no. 3338 (1958): 1558–61, on 1560, with the permission of the American Association for the Advancement of Science.

as "promot[ing] the general welfare through a better understanding in all matters of importance among nations."[21] This interpretation was dictated by the same concerns expressed by Ewald, that IUPAP should not only work towards the advancement of physics but also have a societal impact and influence the public perception of the field. The formal agreement between ICSU and UNESCO further reinforced the idea that ICSU and its unions should align their scientific activities with UNESCO's agenda.

The combination of bottom-up efforts and the changing institutional landscape resulted in significant transformations of IUPAP's scientific activities. Unlike some other unions, such as the International Astronomical Union (IAU), in the interwar period IUPAP had created only general commissions on Finances, Publications and on Symbols, Units and Nomenclature (SUN) with no commission dedicated to promoting specific areas of research. The refoundation phase saw the immediate creation of commissions specialized to physics sub-fields. In addition to them, IUPAP officers also established new kinds of commissions—the soon to be called affiliated commissions. Affiliated commissions were, in principle, commissions devoted to broader research fields, but since the definition of "broader fields" was and remained vague,

[21] Ed Uehling to P. Ewald, November 18, 1946, box 9, folder 1, Paul P. Ewald Papers 1906–1990, Division of Rare and Manuscript Collections, Cornell University Library.

the main difference was the status of these commissions. Rather than being created within IUPAP, these were existing organizations that were incorporated into IUPAP and remained partly autonomous. The first, and for twenty-five years the only one, affiliated commission was the International Commission for Optics (ICO).[22]

The creation of commissions became the focal point of IUPAP's revitalized scientific activities, indicating its shift from an organization focused on establishing international standards to one dedicated to promoting international exchange and cooperation in various sub-fields of physics. This trend is exemplified by the first post-World War II specialized commission. Initially focused on standardization in thermodynamics, it quickly expanded its scope becoming the *Commission on Thermodynamics and Statistical Mechanics* in 1948.[23] This commission, along with the second specialized commission on cosmic rays, served as examples of the range of actions that specialized commissions could undertake, particularly in organizing and sponsoring international meetings. On the one hand, this redefinition of IUPAP's activities was in line with the overall framework of the UNESCO-ICSU agreement, which encouraged project-oriented endeavors, and therefore led IUPAP officers and commissions to focus on specific activities. But it also aligned with the efforts of individual physicists to revitalize the Union by including discussions on scientific activities, as well as the general trend of institutionalizing growing international scientific networks, as in the case of affiliated commissions.[24]

However, the activities under the UNESCO-ICSU agreement introduced some confusion regarding the prioritization and funding of different activities. Initially, there was a broad interpretation of improving the circulation of scientists and adopting a project-oriented approach. IUPAP officers utilized UNESCO funds to provide research travel grants and explored the possibility of supporting specific research projects. These actions produced criticism too. Former IUPAP President Robert Millikan argued that the limited funds available to IUPAP would make such policies unsustainable in the long run and risked undermining its broad scope. Millikan also believed that IUPAP was now "a body which exists primarily for promoting international peace and good will," in line with UNESCO's agenda of "build[ing] the foundations for lasting peace through stimulating as much as possible acquaintance, friendliness, and understanding between the nations."[25] We don't have any document shedding light on IUPAP officers' reactions to Millikan's views, but the initial activities in support of travel grants and projects rapidly faded away, hence suggesting that they informed IUPAP's initiatives. From the late 1940s, the Union shifted its focus to primarily promoting and sponsoring conferences on specific fields or themes, which continue to shape the core scientific activities of its topical commissions to this day.

[22] Howard, "The Early Meetings of the International Commission for Optics."

[23] *IUPAP, Minutes of the Sixth General Assembly, July 1948*, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

[24] The inclusion of affiliated commissions was a matter of contention within IUPAP, which preferred to support financially growing scientific networks without extending the number of affiliated commissions. This is why the second affiliated commission, the International Society on General Relativity and Gravitation, was only established in 1974. See Roberto Lalli, *Building the General Relativity and Gravitation Community During the Cold War* (Cham: Springer International Publishing, 2017).

[25] Robert Millikan to Pierre Fleury, May 19, 1948, series E2 "Correspondence with Council Members," vol. 1, folder M, IUPAP Gothenburg.

A Western-Driven Organization in the Early Cold War, 1947–1956

Between the fifth and sixth General Assemblies in 1947–48, the few physicists who were involved in IUPAP redesigned the organization's function and activities, relatively free from governmental pressures, in a situation where the majority of the Union's members were political allies of the Western camp. After the re-foundation phase, French physicist Pierre Fleury, an expert in optics and a former student of Henri Abraham, became the Union's Secretary General. Fleury had played a crucial role in the organization of the 1947 General Assembly in Paris and had been instrumental in the establishment of ICO.[26] Fleury and the other officers started immediately working to modify the perception of IUPAP as an inactive and useless organization. The first post-World War II decade of IUPAP focused on defining criteria for creating new specialized commissions and engaging renowned international physicists to support their activities. Simultaneously, Fleury and the other IUPAP officials sought to re-activate and enhance the work of the two general commissions created in the interwar period, such as the SUN Commission and the Commission on Publications, aiming to ensure that their decisions were acceptable to all physics national communities in IUPAP member countries.

During this phase, a significant portion of IUPAP's activities involved joint commissions recently established by ICSU to address urgent scientific issues. In 1951, IUPAP's involvement in joint commissions included topics like radioactivity, physico-chemical data, the ionosphere, spectroscopy, and scientific abstracts.[27] While the subjects of these joint commissions overlapped with the themes of the newly formed IUPAP topical commissions, joint commissions were designed as short-lived organizations for the rapid resolution of pressing problems, particularly related to standardization. In contrast, IUPAP's own commissions aimed for long-term cooperation in organizing the international development of specific research areas.

Over this first post-World War II decade, this new function was implemented and expanded through an organization primarily composed of national members from the Western bloc. This situation was common to many international organizations at that time due to the Soviet Union's isolationism under Stalin's rule and the absence of the newly formed People's Republic of China (PRC) after the civil war victory of the Chinese Communist Party in 1949. Apart from a few countries, other continents than North America and Europe were also greatly under-represented.

The political, ideological, and practical consequences of these absences have been extensively discussed in the case of UNESCO and were similar in other international scientific organizations associated with it, including IUPAP.[28] Until the mid-1950s, US interests dominated these organizations promoting the concept of free science in

[26] A. Maréchal, "Pierre Fleury 1894–1976," *Nouvelle Revue d'Optique* 7, no. 6 (1976): 403.

[27] For the functioning of inter-union commissions see the chapter by Fauque and Van Tiggelen in this volume.

[28] Sewell, *UNESCO and World Politics*; Wells, *The UN, UNESCO and the Politics of Knowledge*; Elzinga, "UNESCO and the Politics of International Cooperation in the Realm of Science."

contrast to the view of science planning dominant in totalitarian regimes.[29] Consequently, the principle of open membership envisioned by Ewald in 1947 could not be fully realized during the first ten years after IUPAP's re-establishment. In 1951, only seventeen out of the twenty-six countries listed as IUPAP national committees had representatives at the seventh General Assembly in Copenhagen, with the majority being representatives from the United States, the United Kingdom, and their political allies in the Cold War context.[30]

This situation led to a partial resolution of the major political issue that had hindered IUPAP's operations in previous decades: the official cooperation with German physicists. The foreign policies of the Federal Republic of Germany (FRG) aimed at integrating with the Western bloc aligned with West German leading scientists' aspiration for the full participation in Western-driven international scientific ventures. In 1952, the IUPAP Executive Committee accepted the FRG's membership request, which was then ratified by the IUPAP General Assembly in 1954, even before the FRG acquired full sovereignty in 1955 (Figures 3.2 and 3.3).

This initial phase played a crucial role in shaping the regulatory role of IUPAP in the scientific arena. However, the dominance of Western bloc members had implications, as evident in the 1951 recommendation by the IUPAP Commission on Publications for abstracts to be published in both French and English, as well as the emphasis on having an information and translation service for papers in Russian.[31]

This phase in IUPAP's post-war history consolidated its role as a sponsor and promoter of international conferences in specific research areas, which became the main activity of the newly created specialized commissions. This reconfiguration of participation by national committees allowed physics communities to organize events with long-lasting positive consequences for the development of physics in their countries and the re-establishment of international contacts after the isolation experienced during World War II. This is exemplified by the efforts of Japanese physicists in organizing the International Conference of Theoretical Physics in 1953[32] and the Italian Physical Society's effort to take a leading role in organizing IUPAP-sponsored international meetings during the late 1940s and 1950s.[33] Because of their country's positioning during World War II, Japanese and Italian physicists sought more than others to regain a leading position in the international scientific arena, as promoters of international scientific cooperation ventures.

In addition to standardization and conference organization, some IUPAP specialized commissions still tried to pursue a more project-oriented approach. The Cosmic Rays Commission was established in 1947 in order to "study where and

[29] For a discussion on the use of the ideology of scientific freedom in the US psychological warfare during the Cold War see Audra J. Wolfe, *Freedom's Laboratory: The Cold War Struggle for the Soul of Science* (Baltimore: Johns Hopkins University Press, 2018).

[30] *IUPAP, Report of the Seventh General Assembly, July 1951*, series B2aa, vol. 1, IUPAP Gothenburg.

[31] *IUPAP, Report of the Seventh General Assembly, July 1951*, 9–10, series B2aa, vol. 1, IUPAP Gothenburg. For the historical context of use of languages in the sciences, see Michael D. Gordin, *Scientific Babel: How Science Was Done before and after Global English* (Chicago; London: The University of Chicago Press, 2015).

[32] See the chapter by Kenji Ito in this volume.

[33] Roberto Lalli, "Cento anni di IUPAP," *Il Nuovo Saggiatore* 39 (2023): 45–56.

Figure 3.2 Eight IUPAP General Assembly in London in 1954. Mott is at the center of the first line, to his left Karl K. Darrow and IUPAP Secretary General Pierre Fleury. To his right one sees Werner Heisenberg who officially represented the German commission when it was officially admitted in IUPAP

Source: Courtesy AIP Emilio Segrè Visual Archives, Marshak Collection.

Figure 3.3 IUPAP national members in 1954

Source: Members listed in *IUPAP, Report of the Eight General Assembly, July 1954*, 19–20, 1954, series B2aa, vol. 1, IUPAP Gothenburg. Created by the author with https://historicalmapchart.net/.

how international planning of work would be most useful."[34] This commission had the ambitious goal to discuss the coordination of research, with special reference to the coordination of observations at different altitudes, which was put forward by its First Secretary Pierre Auger, a key figure in the future establishment of the European Organization for Nuclear Research (CERN).[35] This activity included a mapping of the observatories in IUPAP member states,[36] but later involved the support to Indian physicist Homi J. Bhabha's proposal for the creation of a UNESCO high-altitude laboratory in the Himalaya range (which ultimately did not materialize).[37] The project-oriented approach of the Cosmic Rays Commission differed from other commissions due to the unique nature of cosmic-ray research and its significance in the planning of the International Geophysical Year—one of the most important international cooperation projects initiated by ICSU in the 1950s that involved a complete reconfiguration of participation in international endeavors.[38]

Following Stalin's death and the conclusion of the Korean War in 1953, there were significant changes in Soviet internal and foreign policies. These led to increased Soviet participation in international organizations such as UNESCO, ICSU, and its affiliated unions which contributed to make them less "Western," especially as the involvement of the Soviet Union consequently prompted greater participation from other Eastern European scientific institutions.[39] IUPAP was no exception to this trend.

IUPAP as a Venue for East-West Negotiations in the Cold War Scenario, 1957–1989

In November 1956, the IUPAP Executive Committee accepted the membership request of the Soviet Union, a decision ratified by the ninth IUPAP General Assembly held in Rome in 1957. The involvement of the Soviet Union immediately resulted in the participation of most countries from the Soviet Bloc and other communist nations in the activities of IUPAP (Figures 3.4 and 3.5). Starting from 1957, this change in membership marked the beginning of a new phase for IUPAP characterized by a reconfiguration of the Union's science diplomacy role. Whether explicitly recognized by IUPAP officers or not, governments became more involved in its organizational affairs. The participation of scientists of Eastern European countries in international ventures were centrally controlled by politicized state apparatuses. From the Western camp, the participation of Eastern Bloc countries meant that such international

[34] P. Fleury to Pierre Auger, January 22, 1947, vol. 3, folder 21 "Commission on Cosmic Rays," IUPAP Quebec.

[35] A. Hermann et al., *History of CERN, I: Launching the European Organization for Nuclear Research* (Amsterdam; New York: North Holland, 1987).

[36] P. Auger, Project and questionnaire, undated, vol. 3, folder 21 "Commission on Cosmic Rays," IUPAP Quebec.

[37] P. Petitjean et al., eds., *Sixty Years of Science at UNESCO 1945–2005* (Paris: Unesco, 2006), 56.

[38] Roger D. Launius, James R. Fleming, and David H. DeVorkin, eds., *Globalizing Polar Science: Reconsidering the International Polar and Geophysical Years* (New York: Palgrave, 2010).

[39] Konstantin Ivanov, "Science After Stalin: Forging a New Image of Soviet Science," *Science in Context* 15, no. 2 (2002): 317–38.

Figure 3.4 IUPAP General Assembly at Basel in 1966. In the first row, far left, is Fleury and third from his left is Soviet physicist Dmitry I. Blokhintsev, who became President in that General Assembly, followed by Louis Néel, Paul Huber, Clifford Butler, Gordon Sutherland, J. Lecomte, and M. Kotani

Source: Larkin Kerwin, "The International Union of Pure and Applied Physics," *Physics Today* 22, no. 5 (1969): 53–5, on 55, with the permission of the American Institute of Physics.

scientific organizations were re-interpreted as a venue for negotiation and exchange of information crossing the East-West divide. One immediate change that shaped the institution was that a balance between the numerical representation of the two superpowers, and of the two Cold War blocs, became an imperative.[40]

High-ranking IUPAP officers were fully aware of the impact that enlarged membership within the political context of the Cold War would have on the organization. As argued by Cozzoli in this volume, Edoardo Amaldi was elected as the new President in 1957 precisely because IUPAP officers saw him as the ideal figure to lead IUPAP through this delicate transformation of membership and role.[41]

During Amaldi's three-year presidency, he faced significant political challenges while overseeing the growth of IUPAP's scientific activities. The major political controversies he encountered at the beginning of this new phase were related to membership requests from national institutions situated in territories whose political independence was hotly contested. Between 1958 and 1959 the IUPAP Executive Committee received membership requests from the PRC, from the ROC in Taiwan,

[40] See, e.g., the chapter by Hof in this volume.
[41] See the chapter by Cozzoli in this volume.

and from the German Democratic Republic (GDR). At the time, both the PRC and the ROC claimed to represent all of China, while the status of the GDR was challenged by the FRG. Since 1955, the FRG implemented the Hallstein Doctrine, which threatened to sever diplomatic relations with any nation recognizing the GDR. In cases of territorial conflicts, IUPAP membership, which was based on the concept of national membership, could provide semi-official international recognition to these territories. Hence, participation in IUPAP and similar international bodies carried symbolic diplomatic value for the respective governments.

The diplomatic dimension of these issues became soon evident to the officers involved. When it became known that the IUPAP Executive Committee was considering Taiwan's Chinese Physical Society membership request, the Chinese Physical Society of Beijing threatened to withdraw. The US State Department was particularly committed to advocating the inclusion of Taiwan as a national member of IUPAP (as was the case in other unions).[42] Similarly, the West German national committee opposed the request for membership of the GDR's Physics Society, arguing that Eastern German physicists could be included in a unique German national committee, aligning therefore with their country's foreign policy of the Hallstein Doctrine.

Detailed analyses of these negotiations are presented in other chapters of this volume,[43] but it is important to recall here how they influenced the officers' understanding of IUPAP's changing role. While IUPAP officers sought suggestions from ICSU and other unions, they ultimately had to make their own decisions autonomously. So, in 1959, one year after accepting the membership of the Chinese Physical Society of the PRC, the IUPAP Executive Committee discussed the membership request from the Chinese Physical Society of the ROC during a meeting in Moscow. The majority of the committee voted in favor of accepting the application, although this decision was not uncontroversial.[44] To accept the Taiwanese Physical Society, IUPAP officers had to explicitly redefine the interpretation of "national membership" in the IUPAP statutes. The majority agreed to interpret literally the statutes' definition, which referred to "territories that are scientifically independent."[45] However, they added that this interpretation did not carry any political implications regarding the recognition of the independent status of these territories. This autonomous decision was in line with the Principle of Political Non-Discrimination issued by ICSU in 1958,[46] but it didn't go uncontested. In fact, this perspective sharply contrasted with Joseph Needham's understanding of the definition of national membership

[42] For a compelling analysis of this process in the IAU, see Ronald E. Doel, Dieter Hoffmann, and Nikolai Krementsov, "National States and International Science: A Comparative History of International Science Congresses in Hitler's Germany, Stalin's Russia, and Cold War United States," *Osiris* 20, no. 1 (2005): 49–76; Thierry Montmerle, "When China Left the IAU: A Reappraisal," in *Astronomers as Diplomats: When the IAU Builds Bridges Between Nations*, ed. Thierry Montmerle and Danielle Fauque (Cham: Springer International Publishing, 2022), 169–98.

[43] See chapters by Hu, Liu, and Yin, Olšáková, and Cozzoli in this volume.

[44] Réunion de Comité Exécutif, Moscau, 1959, Compte-rendu succint, box 106, folder 1, subfolder 6 "Corrispondenza Fleury 1959–1960," fondo Edoardo Amaldi, subfondo Archivio Dipartimento di Fisica (hereafter AEA), Physics Deparment Archives of Sapienza University of Rome.

[45] E. Amaldi to N. Mott, November 24, 1959, box 106, folder 1, subfolder 4 "Corrispondenza Presidente 1957–1960," AEA.

[46] ICSU, Resolution on Political Non-Discrimination, Washington DC, October 1958, Appendix D in ICSU, *Universality of Science. Handbook of ICSU's Standing Committee on Free Circulation of Scientists*

Figure 3.5 Map of IUPAP national members in 1960

Source: Members listed in *IUPAP, Report of the 10th General Assembly, September 1960*, 4–5, series B2aa, vol. 1, IUPAP Gothenburg. Created by the author with https://historicalmapchart.net/.

in his subsequent letter arguing against Taiwanese membership in ICSU-related international organizations.[47]

A few months later, when confronted with controversies arising from the membership request of the East German physical society, the decision regarding Taiwanese membership served as a precedent that led the IUPAP Executive Committee to accept the membership of the GDR committee, despite protests from the West German national committee. Amaldi summarized the rationale behind this decision, stating that the Executive Committee could not adopt different approaches in two cases that held similar political implications from opposite sides of the Iron Curtain.[48] The IUPAP Executive Committee stood by its decisions even accepting that the PRC delegates withdrew membership on the ground that it could not participate in any organization that recognized the ROC, even if implicitly. For the first time, the minutes of the General Assembly held in Ottawa in 1960 explicitly documented the representatives' votes on membership requests, revealing political divisions among members (Figure 3.5).[49]

It was immediately evident that the loss of the PRC physics community constituted a significant setback for IUPAP's global ambitions, given China's scientific potential. Amaldi attempted to convince the President of the Chinese Physical Society in Beijing not to withdraw by emphasizing that the IUPAP Executive Committee had

(Stockholm: ICSU, 1990), 14. Copy in series E8 "Correspondence concerning visa problems," vol. 1, "1975–1996," IUPAP Gothenburg.

[47] Joseph Needham to Rudolph Peters, May 20, 1960, box 106, folder 1, subfolder 4 "Corrispondenza Presidente 1957–1960," AEA.

[48] E. Amaldi to Ferdinand Trendelemburg, March 17, 1960, box 106, folder 1, subfolder 4 "Corrispondenza Presidente 1957–1960," AEA.

[49] *IUPAP, Report of the 10th General Assembly, September 1960*, 22, series B2aa, vol. 1, IUPAP Gothenburg. The delegations of the USSR, Poland and Czechoslovakia voted against the admission of Taiwan, while the delegation of East Germany, Spain and Japan abstained. See also E. Amaldi to N. Mott, September 22, 1960, box 106, folder 1, subfolder 4 "Corrispondenza Presidente 1957–1960," AEA.

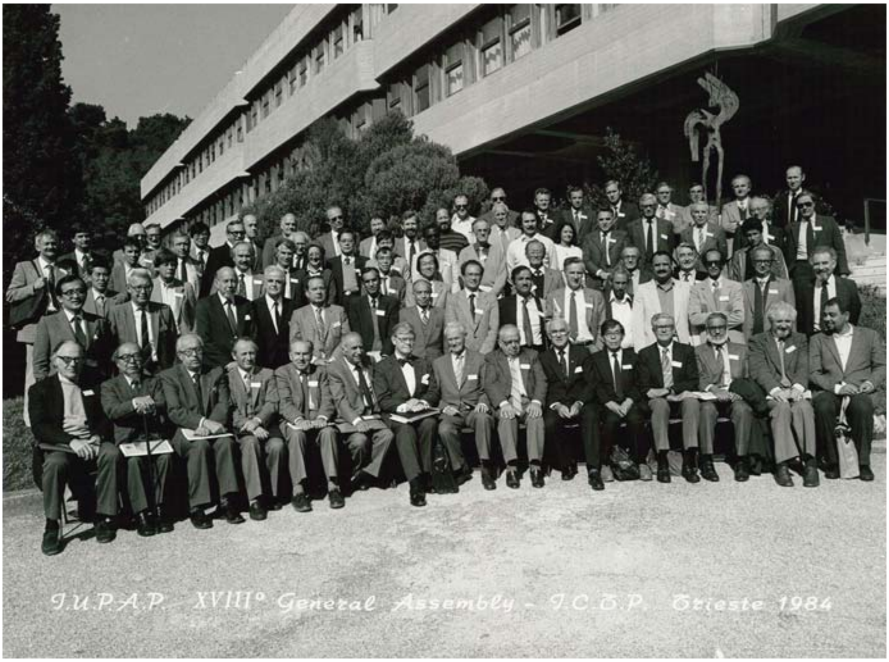

Figure 3.6 18th IUPAP General Assembly held at the International Center for Theoretical Physics, Trieste in 1984. It was the first General Assembly in which physicists from both PRC and Taiwan attended as official representatives
Source: ICTP Photo Archive/Ludovico Scrobogna.

maintained a neutral stance by accepting both East German and Taiwanese members. However, this strategy proved unsuccessful. Physicists in mainland China only joined IUPAP twenty-five years later, over a decade after the easing of political tensions between the United States and the PRC had begun, and only after IUPAP officially amended its statutes during the 1981 General Assembly, changing the definition of membership from national to liaison committees (Figure 3.6).[50] This change resulted from lengthy negotiations between IUPAP officers and representatives of the PRC, and was a necessary condition for the PRC membership. These negotiations spanning several decades exemplify the internal struggles within IUPAP to establish principles and rules that could provide a balance amidst the political and ideological divisions of the Cold War.

These cases underscore the subtle yet explicit diplomatic functions that IUPAP assumed during this period, as the organization endeavored to define its role as a non-governmental organization in which, however, the actual negotiations made clear references to governments' needs, strategies and goals. On one hand, governments considered highly important the participation of their national scientific organizations in such international NGOs and, in some cases, were actively involved to pursue

[50] *IUPAP General Report 1982*, series B2aa, vol. 2, IUPAP Gothenburg.

politically relevant goals, even though only scientists were officially involved in the negotiations. On the other hand, a group of Western-based IUPAP officers genuinely sought to establish principles independently, demonstrating that they were not merely acting under pressures from the United States and its Western allies' governments, which politically supported Taiwan. Years later, the admission of East Germany's scientific organizations to IUPAP, ICSU, and other unions was hailed as a seminal moment in which officers in these organizations acted against the will of their own governments, with IUPAP being the first union to accept a scientific organization representing the GDR.[51]

Another important aspect that signifies the changing role of IUPAP after 1957 is evident in the negotiations surrounding the selection of Edoardo Amaldi's successor. Initially, Amaldi was expected to serve two terms, totaling six years. However, recognizing the necessity for a more rapid turnover, given the evolving membership and the new responsibilities undertaken by IUPAP, he decided to step down at the end of his first term.[52] Consequently, he campaigned to establish a norm where a single term of service would be the standard. Simultaneously, the long-serving Secretary General, Fleury, also offered his resignation. While many officers acknowledged Fleury's significant contributions during IUPAP's renovation phase,[53] others held differing opinions. Dissatisfaction among members of the US national committee arose due to their concerns regarding Fleury's handling of the role. The latter were eager to witness a rejuvenation in the position of Secretary General after Fleury had occupied it for over fifteen years.[54]

The prospect of losing both Amaldi and Fleury brought forth the question of ensuring continuity in the process of renewal. At the 1959 meeting in Moscow, the IUPAP Executive Committee members agreed to amend the statutes and introduce a new officer position: the First Vice-President. This role was designed to serve as the President in the subsequent term, providing three years to acquire the necessary knowledge and experience. Determining the next set of officers initiated a lengthy exchange of letters among IUPAP officers, revealing diverse views on the organization and the relationship between the selection of officers and the composition of IUPAP membership. Additionally, this process shed light on the fact that the decision-making nucleus was actually a small subsection of the Executive Committee. The IUPAP Vice-President, Robert B. Brode, who was also a member of the US national committee, along with Amaldi and Mott, deliberated on the matter for months before presenting a solution to the other officers. However, even among the three of them, no consensus on a shared proposal could be reached.[55]

[51] Statement by Harrison Brown, 8th Meeting of the General Committee of ICSU, September 9, 1977, 3, vol. 1, folder 9/1 "Kerwin's Correspondence 1971–1977, ICSU—Libre circulation des scientifiques," IUPAP Quebec.

[52] E. Amaldi to N. Mott, July 28, 1959, box 106, folder 1, subfolder 6 "Corrispondenza Fleury 1959–60," AEA.

[53] Hans H. Staub to P. Fleury, February 17, 1960, box 106, folder 1, subfolder 6 "Corrispondenza Fleury 1959–60," AEA.

[54] Robert B. Brode to J. H. Van Vleck, July 18, 1957, box 1, folder 15 "Correspondence 1949, 1957," Robert B. Brode Papers, Bancroft Library, University of California Berkeley.

[55] N. Mott to E. Amaldi, August 1, 1959, box 106, folder 1, subfolder 4 "Corrispondenza Presidente 1957–1960," AEA.

The discussion revolved around geographical and geopolitical balance, categorized into the West and the East, although the interpretations of these terms varied among individuals. Amaldi included India and Japan among the Eastern countries based on geographical, cultural, and historical considerations. He envisioned a long-term alternation between East and West in the IUPAP presidency. Consequently, he believed that his successor should be a representative of the East, favoring the Indian nuclear physicist Homi J. Bhabha. In contrast, the First Vice-President should be a prominent figure from the West, specifically an US physicist, followed by a Soviet First Vice-President in the subsequent election.[56] While adhering to the concept of alternation, others employed a more politically oriented interpretation of the East-West balance. Amaldi sought to understand the position of the US national committee regarding the suggested names and the underlying rationale of the proposed scheme.[57] Although Brode generally accepted the scheme, he advocated for the immediate election of a Soviet President as a representative of the East, contrary to Amaldi and Mott, who preferred Bhabha. Upon receiving contrasting opinions from the Executive Committee at large, Amaldi proposed Bhabha as the successor.[58] To ensure continuity, Fleury accepted to remain as Secretary General for three more years, while a new figure, the Associate Secretary General, would have the same three-year period as the First Vice-President to familiarize themselves with the duties of the Secretary General.

From a structural standpoint, this debate led to establish the position of the First Vice-President to guarantee continuity in the functioning of IUPAP. The new position was officially incorporated into the statutes at the tenth General Assembly in Ottawa, although the succession from the First Vice-President to President was not made automatic.[59] At the 1960 General Assembly, Bhabha became the seventh President of IUPAP. However, Amaldi's overall plan for alternation with a US Vice-President did not materialize. Instead, a representative from France, solid-state physicist Louis Néel, was elected as the First Vice-President. The discussion and outcome of the debate on the appointment of future officers highlight how IUPAP was maturing as an organization, with a strong self-perception of its various roles, thanks to its increased and more diverse membership.

The Eastward enlargement of IUPAP membership in the post-1957 period brought about significant reconfigurations in the organization's activities, primarily influenced by Cold War concerns. Three key themes emerged during this period, the first two being highly interconnected. The first theme was the focus on physics education, which coincided with a reform of the physics curriculum in the 1960s.[60] Although IUPAP had previously been involved in educational activities, the establishment of a Commission on Education in 1960 marked an official commitment. It also chimed with the aims and goals of UNESCO, which aimed to support the development of scientific education. Since the signing of the agreement with ICSU there were

[56] E. Amaldi to N. Mott, September 9, 1959, box 106, folder 1, subfolder 4, AEA.
[57] E. Amaldi to R. Brode, November 23, 1959, box 106, folder 1, subfolder 4, AEA.
[58] E. Amaldi to H. Bhabha, May 23, 1960; H. Bhabha to E. Amaldi, July 6–8 1960, box 106, folder 1, subfolder 4, AEA.
[59] E. Amaldi to N. Mott, September 22, 1960, box 106, folder 1, subfolder 4, AEA.
[60] See chapter by Simon in this volume.

expectations that ICSU unions would do just that, in line with UNESCO's agenda, but it only became a priority after the Eastward enlargement of the membership.[61]

A second theme emerged prominently in this phase: the support for physics in developing countries. UNESCO promoted activities in this direction, which gained momentum after the Soviet Union joined the UN organization. In 1957, the IUPAP General Assembly "invite[d] the President and the Secretary General to contact U.N.E.S.C.O. about the possibility of helping *under-developed countries* in matters concerning the development of physics."[62] This focus on developing countries shifted IUPAP's priorities. Assuming that such countries were more interested in applied physics for industrial applications rather than basic research, IUPAP started addressing issues related to applied physics, which had not received significant attention previously.[63] Furthermore, IUPAP directed its focus on physics education to explore effective ways of articulating physics education in developing countries.[64]

The third theme that emerged during this period was closely tied to Cold War imperatives and initially centered around the status of East Germany. After the East German Physical Society had become an IUPAP national member in 1960, the issue of obtaining visas for physicists from all member states to attend IUPAP-sponsored international conferences became a challenge. East German physicists faced enormous difficulties in attending conferences in NATO countries.[65] This visa problem led to a debate at the 1963 General Assembly in Warsaw, where a resolution was passed emphasizing that "the free travel possibilities of all scientists forms an indispensable basis for successful international co-operation."[66]

In connections with the discussion in other unions and in ICSU that were experiencing similar problems, in 1963 this issue was reconceptualized as the principle of the "free circulation of scientists," which became a major focus of ICSU. As argued by Turchetti in this volume, the East German problem in attending conferences in NATO countries sparked a controversy between IUPAP and NATO, which was pivotal in the creation of the ICSU Standing Committee on the Free Circulation of Scientists (SCFCS) aiming to prevent the exclusion of scientists based on political discrimination from international congresses sponsored by the ICSU family.

IUPAP officers made this issue a primary matter of concern. This redefined the organization's role, with the visa problems becoming independent of the original East German issue and informing a variety of other cases of discrimination globally. Political conflicts between IUPAP member states disrupted the activities of committees, and hampered participation to conferences for scientists of a number of nationalities.

[61] Petitjean et al., *Sixty Years of Science at UNESCO 1945–2005*, 77–80.

[62] *IUPAP, Minutes of the Fifth General Assembly, September 1947*, 27, series B2aa "General Reports," vol. 1 "1923–1966," IUPAP Gothenburg.

[63] See chapter by Martin in this volume. See also Presidential Address by Professor Robert F. Bacher at the 14th General Assembly, Washington, September 1972, IUPAP General Report 1973, 94–103, series B2aa, vol. 2, IUPAP Gothenburg.

[64] See, e.g., folder 4,31 "International commission on Physics Education, 1965–83" Larkin Kerwin fonds (P202), subseries P202/B4 IUPAP, *Division de la gestion des documents administratifs et des archives*, Université Laval, Quebec, Canada (hereafter IUPAP Kerwin).

[65] See the chapters by Olšáková and Turchetti in this volume.

[66] Report 11th General Assembly, Warsaw 1963, 20, series B2aa, vol. 1, IUPAP Gothenburg.

From 1967 an increasing number of cases depended on the disruption of diplomatic relations between the USSR and Israel after the Six-Day War.[67]

The issue of the free circulation of scientists underscored IUPAP's increasing role in science diplomacy. This was exemplified by Canadian physicist, Larkin Kerwin, IUPAP Associate Secretary General from 1963. In *Physics Today,* Kerwin summarized the main purposes of IUPAP this way: "The Union's purpose is to foster international physics meetings, more rapid dissemination of information and the establishment of international standards, units and nomenclature. Its *unofficial* goal is to make a contribution to general international understanding."[68] The unofficial, political goal underlined by Kerwin is not discussed in detail in the article, but the increasing self-perception of officers that IUPAP was also an agent in diplomatic relations was intimately related to the issue of the free circulation of scientists, in which Kerwin himself was particularly involved.[69] The free circulation of scientists also evolved as a concept, including the issues of obtaining exit visas from the scientists' own nation up to the limitations imposed to scientists who wanted to migrate.[70]

Starting from the late 1960s, the topic of the free circulation of scientists became so central that in 1972 Canadian physicist Robert. E. Bell defined it "the most important aim of IUPAP."[71] Bell proposed a range of actions to negotiate with hosting countries and ensure that "bona fide" scientists were not excluded from IUPAP-sponsored international meetings based on nationality. While countries had the right to reject individual visa applications, Bell suggested that hosting countries should allow substitutes of the same nationality. Failure to achieve this would show that the exclusion was based solely on political discrimination, and this should lead IUPAP to withdraw sponsorship of conferences in such cases. The pursuit of the free circulation of scientists became increasingly relevant, shaping the organization of conferences and the relations between IUPAP committees and hosting countries. In 1981, IUPAP even withdrew sponsorship of a conference, highlighting the significance of this matter.[72]

When the IUPAP statutes underwent major changes in 1981, the very first article defining the aims of the Union was also modified. The aims of IUPAP were now summoned in six chapters rather than the four of the previous version. The new two goals were: "to foster free circulation of scientists" and "to encourage research and *education*."[73] With this modification stressing the central role of the pursuit of the free circulation of science and education, IUPAP members officialized the shifted range of activities that had been characterizing the science diplomacy function of the Union during the Cold War.

[67] See, e.g., Lalli, *Building the General Relativity and Gravitation Community During the Cold War.*

[68] Larkin Kerwin, "The International Union of Pure and Applied Physics," *Physics Today* 22, no. 5 (1969): 53–5, emphasis mine.

[69] See, e.g., series E8 "Correspondence Concerning Visa Problems," vol. 1, IUPAP Gothenburg.

[70] *Universality of Science: Handbook of ICSU's Standing Committee on the Free Circulations of Scientists*, 1990, series E8, vol. 1, folder 28 "ICSU Statements," IUPAP Gothenburg.

[71] R. E. Bell, "Memorandum," September 23, 1972, *IUPAP, Report of the 14th General Assembly, Washington DC 1972*, 92, series B2aa, vol. 2, IUPAP Gothenburg.

[72] It was the conference on defects in insulating materials held in Riga, Estonia, USSR, in May 1981, where Israeli physicists could not take part. See, series E8 "Correspondence concerning visa problems," vol. 1, folder 14 "1981 Riga USSR," IUPAP Gothenburg.

[73] *IUPAP, General Report, 1982*, 8, series B2aa, vol. 2, IUPAP Gothenburg, emphasis mine.

The strict adherence to the principle of the free circulation of scientists sometimes conflicted with other principles implemented by international scientific organizations. A major contention arose in 1987/8 when Japanese authorities followed the UN ban on South Africa due to apartheid. In compliance with the UN policy, Japanese authorities asked South African scientists seeking visas for an IUPAP-sponsored conference to sign a declaration disavowing racial prejudice and membership in discriminatory organizations.[74] This request was considered a repudiation clause by ICSU, contradicting the principle of the free circulation of scientists, which should apply regardless of political views. Japanese physicists argued instead that ICSU's position was untenable in this case, highlighting the conflict of principles that required specific actions rather than rigid adherence to the free circulation principle.[75]

In Search of a New Identity in the Post-Cold War Period

The significant role played by the pursuit of the free circulation of scientists indicates that IUPAP gained popularity among physicists primarily because it allowed for, or at least facilitated, exchanges among scientists, overcoming geopolitical barriers. Most of these barriers were associated with the Cold War. IUPAP officers had consciously transformed IUPAP into an organization that enabled scientific exchanges that would have been otherwise difficult if not impossible. During the Cold War, IUPAP was far from being a truly global organization, as its membership included only a few countries from the Global South, with insufficient representation from Africa, Asia, and Latin America. Nonetheless, the active participation of Eastern European countries established its status as a privileged platform for scientific exchange among physicists.

After 1989, this was no longer the case. The privileged position of physics began also to fade away, for it lost the place it had as the most relevant natural science for military developments during the Cold War and the nuclear arms race. With the conclusion of the Cold War rivalry, state support for physics research significantly diminished, leading to a decline in the primacy of physics as *the* science fundamental to national security.[76] Furthermore, in addition to physicists' reduced influence on state affairs after the Cold War, IUPAP also lost one of its major objectives that had defined its actions during that era. IUPAP's role in facilitating international exchanges and cooperation between scientists working on opposite sides of the Iron Curtain was no longer deemed necessary. The changing context led physicists to question the necessity of IUPAP, similar to what happened in the post-World War II period. At the 22nd General Assembly in Uppsala in 1996, the IUPAP President, the Japanese

[74] Michiji Konuma to Jan S. Nilsson, April 11, 1988, series E8 "Correspondence Concerning Visa Problems," vol. 1, folder 24 "Japan 1987/88 Problems," IUPAP Gothenburg.

[75] Jiri Kondo to Jan S. Nilsson, April 15, 1988, series E8 "Correspondence Concerning Visa Problems," vol. 1, folder 24 "Japan 1987/88 Problems," IUPAP Gothenburg.

[76] Michael Riordan, "The Demise of the Superconducting Super Collider," *Physics in Perspective* 2, no. 4 (2000): 411–25.

physicist Yoshio Yamaguchi, acknowledged that IUPAP had gained popularity during the Cold War primarily because it allowed for East-West encounters.[77] Consequently, it became imperative for IUPAP officers to reinvent the organization, with some critics highlighting its inadequate response to the challenges of the post-Cold War era, particularly its inactivity in supporting scientists from the former Eastern Bloc.[78]

The reconfiguration of IUPAP activities by its officers was driven by major social and scientific concerns. Efforts were made to expand membership in the Global South and address the issue of sustainable development, consequently shifting the focus towards applications rather than basic research. Another significant issue that was specifically addressed was the gender imbalance in physics, which led to the creation of a special Working Group on Women in Physics in 2002. The participation of women in physics had traditionally been little visible, and this was amplified in IUPAP General Assemblies, where female scientists were scarce if not absent (see Figures 3.2, 3.3, and 3.4). IUPAP officers decided to address this issue by promoting greater enrollment of women in physics departments and encouraging their participation in the organization's activities, committees, Executive Councils, and General Assemblies.

Lastly, IUPAP directly confronted the decline of physics, which its officers attributed to a reduction in funding. At the General Assembly in Berlin in 2002, President Burton Richter advocated for a reductionist perspective, mirroring the linear model of innovation. In Richter's view, IUPAP should promote the argument that advances in sciences deemed more useful by the public and lawmakers, with biotechnology being highlighted as the most relevant example, were dependent on "long-term research in the physical sciences."[79] These viewpoints encapsulated the most significant changes in the role of IUPAP at the turn of the millennium, ultimately leading to a substantial increase in the membership of countries from the Global South in 2008 (Figure 3.7).

The post-Cold War era presented mounting challenges to an organization that had shaped itself in response to Cold War imperatives, where physicists had attained influential positions in state decision-making processes, thereby assuming greater political responsibilities. To address the declining social and political standing of physics, IUPAP officers expanded the social scope of the institution and used the linear model to emphasize the foundational role of physics in technological progress in public and political arenas. Alongside a heightened focus on gender balance and an increase in membership from the Global South, the primary message IUPAP officers sought to convey was the primacy of physics research in technological and economic development.

[77] Yoshio Yamaguchi, "IUPAP—Present and Future," in *IUPAP, General Report 1997*, 37, series B2aa, vol. 3, IUPAP Gothenburg.

[78] Frank Pobell, "Comments on the Future Role and Future Structure of IUPAP," in *IUPAP, General Report 1994*, 50, series B2aa, vol. 3, IUPAP Gothenburg.

[79] Burton Richter "President's Address to the IUPAP General Assembly," Berlin 2002, available at https://archive2.iupap.org/general-assembly/24th-general-assembly/minutes/appendix-b/, for the concept of linear model of innovation, see, e.g., Benoît Godin, "The Linear Model of Innovation: The Historical Construction of an Analytical Framework," *Science, Technology, & Human Values* 31, no. 6 (2006): 639–67.

Figure 3.7 Map of IUPAP national members in 2008

Source: Members listed in *IUPAP, Minutes of the 26th General Assembly, Japan, October 2008*, 2, available at https://archive2.iupap.org/wp-content/uploads/2013/12/file_50089.pdf [last accessed on September 8, 2023]. Created by the author with https://historicalmapchart.net/.

Conclusion

This chapter has provided an overview of the evolving roles of IUPAP from the aftermath of World War II to the present day. The analysis was based on the view that IUPAP's history can be divided in the four major phases listed in the "Introduction" of this chapter. This periodization has allowed to highlight significant shifts in the goals, actions, and priorities of IUPAP between each phase. In most cases IUPAP officials recognized the need for substantial transformations in the organization's regulatory role to support an international community of physicists, which was in principle global, but in practice heavily limited by political conditions in the different periods. This is particularly true for the reconfigurations of activities and public images occurring after the end of World War II and the Cold War. The passage between the second and third phase, from a Western-led organization to a venue for East-West negotiations, was perhaps more implicit. Still, IUPAP officers had a clear perception that deep changes in the role and structure of the organization were needed to face the eastward enlargement of membership.

These phases aligned to broader transformations in global political orders, driving the need for renovation and adaptation within the organization. IUPAP's transformations were primarily influenced by the political context rather than by major reconfigurations of physics knowledge. Even the establishment of topical scientific commissions was often motivated by internal negotiations within IUPAP and national committees, with their work also shaped by political concerns and constraints.

However, it is important to note that IUPAP did have a crucial scientific role. The organization played a central part in setting internationally agreed standards,[80]

[80] See the chapter by Doran in this volume.

resolving scientific disputes,[81] and supporting the development of sub-disciplines or research areas.[82] Nevertheless, the conditions and priorities set by IUPAP officials were primarily determined by the political context, emphasizing the diplomatic aspect alongside scientific endeavors. This was expressed publicly by IUPAP officials, emphasizing the organization's need to remain free from governmental interference or acknowledging its "unofficial" goal of improving political relations within the UNESCO framework, fully in line with the present-day understanding of science diplomacy.[83]

The chapter prompts a reflection on how to categorize IUPAP as an international scientific institution. The first period, between the two World Wars, was dominated by political aspects, illustrating the limitations of an idealistic view of international scientific cooperation. The second period witnessed an attempt to reestablish IUPAP based on different principles and a focus on promoting physics internationally, albeit within a limited section of the world due to the organization's predominantly Western nature.

With the entrance of the Soviet Union, the aspiration for IUPAP to remain free from governmental pressures became unrealistic. Negotiations between IUPAP officials, commissions, and governments became more prevalent, with some officials being closely tied to their respective nation's agendas and foreign policies. While IUPAP was undeniably an NGO after 1946, it is harder to argue that it was entirely "spontaneous" or "autoletic" starting from 1957.[84] The nature of IUPAP's operations demonstrates that relations among scientists, national institutions, and state governments were more intricate than suggested by its non-governmental organization label. Governmental influence was evident in the centralized structure of Soviet Bloc participation and in US scientists engaging in discussions with the Department of State on politically significant matters. This third phase witnessed a renewed focus on diplomacy as a key priority for the organization, as seen through the increasing emphasis on the pursuit of the free circulation of scientists. Characterizing the post-Cold War period is more challenging, given the ongoing processes that are still unfolding. However, it is clear that there has been an effort to refocus the organization on physics itself, acknowledging that physics had lost its primacy among the natural sciences, which had prevailed during the Cold War.

In conclusion, understanding IUPAP's modes of operation over its entire existence proves difficult when relying on fixed taxonomies of scientific institutions. Instead, the case discussed here shows that it is more useful to consider IUPAP as a hybrid science-diplomacy organization, whose mode of operation depended

[81] Ann E. Robinson, "Attempting Neutrality: Disciplinary and National Politics in a Cold War Scientific Controversy," *Centaurus* 63, no. 1 (2021): 84–102.

[82] One major example is the change of status of general relativity from a mathematical exercise to a building block of theoretical physics, as shown by the history of the second affiliated commission of IUPAP, the International Society on General Relativity and Gravitation. Lalli, *Building the General Relativity and Gravitation Community During the Cold War*.

[83] Ruffini, *Science and Diplomacy*.

[84] Crawford, Shinn, and Sörlin, "The Nationalization and Denationalization of the Sciences;" Elzinga, "Modes of Internationalism."

on broader historical processes and underwent continuous renegotiation, especially during periods of foundational transformations.

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4
Drawing the Line between Pure and Applied Physics

Joseph D. Martin

The name "International Union of Pure and Applied Physics" (IUPAP) might appear cumbersome to the modern eye. Wouldn't an International Union of Physics be inclusive enough? Why saddle the name with a wordy and redundant distinction like "Pure and Applied"? This essay probes that question and shows that we can learn much about the circumstances in which IUPAP emerged, the issues it was constituted to address, and its evolving mission by considering how the organization navigated the fraught, but nevertheless potent distinction between pure and applied physics.

This aspect of IUPAP's identity calls out for historical contextualization in no small part because the pure/applied distinction is itself a strictly historical one. Although physicists still refer to "applied physics"—*Physical Review Applied*, established in 2014, is one of the newer additions to the American Physical Society's family of journals—"pure physics" is no longer the preferred nomenclature. Since the mid-20th century, physicists have gravitated toward less morally freighted terms like "basic" or "fundamental" to cover the provinces of physics that "pure" would once have named.[1] Understanding why the "PA" appeared in IUPAP, and with what consequences, requires probing the historical background that explains how those categories would have been understood when IUPAP was founded in 1922.

The Prehistory of Pure Science

References to "pure science" in English began to appear more frequently in the mid-19th century, but they did not at that time approximate the meaning that would predominate in the early 20th century. The notion of pure science that shaped the establishment of the institutions of physics such as IUPAP instead had its roots in the late-19th century and reflected Victorian debates about the role of science in society. Tracing that shift shows the contours of the intellectual, social, and political contexts in which IUPAP emerged.

William Whewell, the 19th-century polymath, was always careful with his words. He coined quite a few of the terms scientists still use, including "anode," "cathode,"

[1] This analysis will focus largely on the Anglo-American world, but IUPAP is not a monolingual organization, and so it is worth noting a similar drop-off in the use of the French "*physique pure*" in favour of "*physique fondamentale*" during the second half of the 20th century.

Joseph D. Martin, *Drawing the Line between Pure and Applied Physics*. In: *Globalizing Physics*. Edited by: Roberto Lalli and Jaume Navarro, Oxford University Press. © Oxford University Press (2024). DOI: 10.1093/oso/9780198878681.003.0005

"ion," and, indeed, the word "scientist" itself.[2] When it fell from Whewell's pen, "pure science" referred to areas of inquiry that could be advanced a priori, without reference to the fickle empirical realm. And so, he referred to the science of motion as pure because it "does not depend upon observed facts, but upon the Idea of motion."[3] Here, the *pure* were opposed not to the *applied*, but to the *inductive* sciences. Pure, or deductive sciences could be apprehended from first principles; inductive sciences could progress only via empirical access to the external world. The distinction was key to Whewell's classification of the sciences.[4]

In the late 19th century, the significance of "pure" when attached to science shifted meaning and began to take on a clear moral valence. A passion for pure science was a distinguishing feature of the X Club, a group of Victorian thinkers who advocated the pursuit of "science, pure and free," by which they meant that it was both superior to mere technical work and unfettered by the strictures of religious dogma.[5] Their more prominent members, including John Tyndall and Thomas Henry Huxley, used their platform to advocate for the pursuit of science for its own sake, by practitioners who were pure insofar as the advance of science itself was their only animating motive.

This view coalesced in the 1870s and 1880s. In 1870, inaugurating University College London's new Faculty of Science, the chemist and fellow-traveler of the X Club Alexander Williamson delivered "[a] Plea for Pure Science," calling on the government to support scientific investigations conceived without a practical aim.[6] When Tyndall undertook a lecture tour of the United States in late 1872 and early 1873, the leitmotif of his lectures was the necessity of cultivating pure science if the United States aspired to advance its national fortunes and win the regard of the international scientific community.[7] Tyndall echoed Alexis de Tocqueville's observation that the American character included a preoccupation with the practical and profitable over the abstract and arcane. He contrasted pure not with empirical, inductive science, but rather with science pursued for the sake of profit or glory—purity, for Tyndall, resided not in the nature of the phenomena, but in the heart of the investigator.

By the 1880s, Huxley too became a vocal public advocate for the moral and practical superiority of pure science. Physicists such as William Thomson and Peter Guthrie Tait, ideological opponents of the X Club, had cultivated a close connection between physics and industry and made great hay in the era of burgeoning steam and telegraph infrastructure. Huxley perceived danger in linking the pursuit of science to the pursuit

[2] On Whewell, see: Laura Snyder, *Reforming Philosophy: Victorian Debates on Science and Society* (Chicago: University of Chicago Press, 2006); Richard Yeo, *Defining Science: William Whewell, Natural Knowledge, and Public Debate in Early Victorian Britain* (Cambridge: Cambridge University Press, 1993).

[3] William Whewell, *Aphorisms Concerning Ideas, Science, and the Language of Science* (London: Harrison & Company, 1840), 8.

[4] Raphaël Sandoz, "Whewell on the Classification of the Sciences," *Studies in History and Philosophy of Science* 60 (2016): 48–54.

[5] Thomas Archer Hirst, quoted in Ruth Barton, *The X Club: Power and Authority in Victorian Science* (Chicago: University of Chicago Press, 2018), 227.

[6] Alexander W. Williamson, *A Plea for Pure Science* (London: Taylor and Francis, 1870). See also, Graeme Gooday, "Vague and Artificial: The Historically Elusive Distinction between Pure and Applied Science," *Isis* 103, no. 3 (2012): 546–4.

[7] Michael D. Barton, Joseph D. Martin, and Gregory Radick, eds., *The Correspondence of John Tyndall*, vol. 13, *June 1872–September 1873* (Pittsburgh: University of Pittsburgh Press, 2024).

of profit and sought in particular to deny that applied science had any independent existence—it was *merely* the application of pure science.[8]

In 1883, across the Atlantic, the physicist Henry Rowland, an experimentalist who had earned an international reputation for his precision diffraction gratings, made his own plea for pure science to the American Association for the Advancement of Science. Like Tyndall, and de Tocqueville before him, Rowland observed the hard-headed pragmatism that ran through American culture and warned that "those who wish to pursue pure science in our own country must be prepared to face public opinion in a manner which requires much moral courage."[9] In 1899, at the first meeting of the American Physical Society, which he represented as its inaugural President, Rowland reiterated his message: "He who makes two blades of grass grow where one grew before is the benefactor of mankind; but he who obscurely worked to find the laws of such growth is the intellectual superior as well as the greater benefactor of the two."[10] Rowland's vision of pure science exerted a long-lasting influence on the character of the American Physical Society, the principal institution of American physics.[11]

Both Huxley and Rowland might have been expected to develop more nuanced positions on the basis of their own knowledge and practice. Whatever his disdain for the theologically minded North British physicists like Thomson and Tait, Huxley witnessed thermodynamics and electromagnetism blossom in the wake of the successes of steam engines and telegraphy.[12] Moreover, as a bullish Darwinian, he was aware that artificial breeding techniques inspired Charles Darwin, and not the other way around. Rowland, for his part, came from the American tinkerer tradition, cutting his teeth on electrical components and railway engineering before turning to physics. As an experimentalist, he held that the theory–experiment distinction did not map onto the pure–applied distinction—experimental investigations could be pure as well—but he would have been aware of the extent to which successful experiment relied on the resources of industry. Huxley's and Rowland's views make most sense, then, when viewed as aspirational rather than descriptive.

These joint efforts thus constituted an organized campaign to create a new category of pure science, positioned prior to applied science and engineering, both in the sense that it was intellectually worthier, but also in the sense that abstract knowledge must, by either necessity or by robust contingency, come chronologically before its practical application. Between Whewell in the early 1900s and the X Club and Rowland later in the century, the key intervening factor was the rapid growth of engineering and industry as sources of profit, and thus of influence and authority, especially in industrializing Britain. The new category of pure science was itself engineered to secure the social standing of the scientist. As science became a profession, the nobility of

[8] Gooday, "Vague and Artificial."

[9] Henry A. Rowland, "A Plea for Pure Science," *Science* 2, no. 29 (1883): 242–50, on 242. See also Paul Lucier, "The Origins of Pure and Applied Science in Gilded Age America," *Isis* 103, no. 3 (2012): 527–36.

[10] Henry A. Rowland, "The Highest Aim of the Physicist," *Science* 10, no. 258 (1899): 825–33, on 826.

[11] See Joseph D. Martin, *Solid State Insurrection: How the Science of Substance Made American Physics Matter* (Pittsburgh: University of Pittsburgh Press, 2018), esp. ch. 1.

[12] This latter proposition is not borne out by the historical record. See, e.g., Bruce J. Hunt, *Pursuing Power and Light: Technology and Physics from James Watt to Albert Einstein* (Baltimore: Johns Hopkins University Press, 2010).

the undertaking determined the status of that profession, and casting pure science as morally superior to engineering and applied science was a way to ensure that its comparatively unprofitable undertakings would still be able to command cultural capital.

The natural opposite of "pure" is not "applied," but "impure." That fact could not have been lost on the turn-of-the-century advocates of pure science, nor on their contemporaries with applied interests. As the 20th century dawned, the relationship between pure and applied sciences was, by design, oppositional and antagonistic.

The Rise of Applied Science

"Applied science," like "pure science," became a more common term in the 1870s and 1880s. To apprehend its meaning, it is important to note that through much of the 19th century, "science" was a generic term that could be applied to just about any area of specialist knowledge or skill. Understood in this way, "applied science" did not mean "science, which is then applied," but something much more like "the specialised practical arts." On this understanding, applied science was science in its own right, not something apart from it.

When Huxley and his contemporaries emphasized the contrast between pure and applied science, and insisted that the former preceded the latter, they were subtly but consequentially shifting the meaning of "applied science," attempting to transform it into "the uses of science." This represents a considerably narrower understanding of "science," which, by the 1880s, no longer referred to *any* systematized knowledge or knowhow, but rather became restricted to the natural sciences (with a sometimes-grudging acknowledgment of the human sciences as well).

Rowland in the United States, like Huxley in Britain, had thrown down a gauntlet. American engineers responded by embracing the term "applied science," but interpreting it differently. Applied science was distinct from the mechanical arts by virtue of holding greater professional standing, deserving of a place in university curricula and of its own professional societies. But it was also not a science itself, and so should remain independent from the growing, professionalizing scientific disciplines, where it was in any event held in low esteem. This balancing act, as Ronald Kline describes, led American engineers into a devil's bargain, in which they gained the professional recognition increasingly afforded to scientists by adopting Rowland's assumption about the linear relationship between science and technology.[13]

World War I represented a crucial juncture in the relationship between pure and applied science. Disruption of trade with Europe heightened the need in the United States for the cultivation of domestic industrial know-how, and the need to apply science to develop it. Likewise in Britain, France, and Germany, scientists were mobilized for their technical expertise in a way they had not

[13] Ronald Kline, "Construing 'Technology' as 'Applied Science': Public Rhetoric of Scientists and Engineers in the United States, 1880–1945," *Isis* 86, no. 2 (1995): 194–221.

been in previous conflicts.[14] Whereas previously, "pure science" and "applied science" had been used rhetorically to police the boundaries between emerging professional communities, war work increased the stock of "pure and applied science" as a collective noun, emphasizing the interdependence of abstract and practical investigations.

After the war, applied scientists enjoyed much-enhanced social capital. Although physics remained a little-known profession, chemists parlayed their wartime work on poison gas into public visibility and policy influence.[15] In a remarkable inversion, defenders of pure science sought to borrow the newfound prestige of applied science. The American biologist, John M. Coulter, maintained: "[t]he public has begun to recognize the fact that pure and applied science are not mutually exclusive fields of activity, but complementary, and therefore public support for pure science has been growing, and *as a consequence of the practical achievements of pure science in connection with the war*, it bids fair to enter upon its own public estimation and support."[16]

One result, especially in the United States, was rapid growth in the number of professional scientists who identified as applied physicists. The meeting at which the American Physical Society (APS) was founded in 1899 had just 36 attendees. In 1902 it had 144 members, and only four from industry. But by the end of World War I, about a quarter of the APS's growing membership hailed from industry. These applied physicists, alienated by the APS with its strong emphasis on abstract investigations, clamored for professional representation.[17] More physicists were beginning to hang their identity on applications, and unbashfully so.

The institutional situation was somewhat better for applied physicists in Britain, who were amply represented in the Physical Society of London. British physics also had a long and proud tradition of close connections with industry. But the war was likewise a watershed moment, convincing the government that it needed to invest more heavily in applied science, even over the objections of the still-powerful Huxley acolytes that pure science was the wellspring of all that could be applied, and risked neglect.[18]

At the dawn of the interwar period, the relationship between pure and applied science was an intensely current topic in the Anglo-American world. That relationship was also in flux. The course of world events had inspired many to rethink the value hierarchy that had defined the relationship since the two terms began to be used in conjunction. At the same time, the champions of pure science had succeeded to a large extent in making the case that applied science could not simply forge ahead on its own, as was evident when IUPAP met in Chicago in 1933, alongside the Chicago World's Fair, which adopted the motto, "Science Finds, Industry Applies,

[14] Arne Schirrmacher, "Sounds and Repercussions of War: Mobilization, Invention and Conversion of First World War Science in Britain, France and Germany," *History and Technology* 32, no. 3 (2016): 269–92.

[15] Hugh R. Slotten, "Humane Chemistry or Scientific Barbarism?: American Responses to World War I Poison Gas, 1915–1930," *The Journal of American History* 77, no. 2 (1990): 476–98.

[16] John M. Coulter, "The Role of Science in Modern Civilization," *Transactions of the Illinois State Academy of Science* 11 (1918): 19–28, on 22. My emphasis.

[17] Martin, *Solid State Insurrection*, 20–7.

[18] Stathis Arapostathis and Graeme Gooday, "Electrical Technoscience and Physics in Transition, 1880–1920," *Studies in History and Philosophy of Science Part A* 44, no. 2 (2013): 202–11.

Man Conforms." The coordination of pure and applied science had been a necessity of war, and the link would have to be maintained to make science an engine of peace.

International Union, National Agendas

IUPAP itself emerged from a family of responses to World War I, coordinated by the International Research Council (IRC). Scientific exchange was conceptualized as a tool for healing the wounds of war and promoting international comity.[19] The IRC quickly formed international unions for geodesy and geophysics, astronomy, and chemistry. These institutions recognized the increasingly international nature of scientific practice, sought to strengthen the bonds between scientists in disparate nations, and aimed to implement greater standardization in the practice of science and in the language of scientific exchange.

It was the chemists who first insisted on adding "pure and applied" to the name of their union in 1919, and so IUPAP, when it formed in 1922, followed the lead of the International Union of Pure and Applied Chemistry (IUPAC).[20] Industrial chemists had long been a powerful constituency in the chemistry community and the name ensured that their interests were enshrined in the name of the union. The name of IUPAP is thus notable for two reasons: it similarly recognized the importance of applied physics, and it reinforced the parallelism with the other major branch of the physical sciences.

The first IUPAP General Assembly, which met in 1923 with representatives from thirteen countries, among whom the diversity of expertise reflected the ambition to instill unity among physicists with a variety of interests.[21] But the lack of discussion of the pure and applied components of physics at these meetings make evident the extent to which the distinction was, to a large extent, an Anglophone imposition; the French minutes of early meetings routinely lapsing into referring to the body as *l'Union Internationale de Physique*, indicating a certain superfluity of *pure et appliquée* in the Francophone world by the 1920s. Indeed, the journal *Journal de Physique Théorique et Appliquée*, founded in 1872, changed its name to *Journal de Physique et le Radium* in 1920 after a merger with *Le Radium*.

The pure/applied distinction might have been a potent one in Britain and the United States, but its potency reflected the internal professional politics of those national scientific communities rather than a global consensus around those categories. Categories like pure and applied science, that is, were primarily national in character. Bernadette Bensaude-Vincent has shown no category representing an

[19] See the chapter by Fauque and Fox in this volume.

[20] Frank Greenaway, *Science International: A History of the International Council of Scientific Unions* (Cambridge: Cambridge University Press, 1996), 50.

[21] Belgium, Denmark, Spain, the United States, France, Great Britain, Italy, Japan, Norway, the Netherlands, Sweden, Switzerland, and Czechoslovakia sent scientific representatives. Canada, Poland, and South Africa were also members, but sent no representatives. In the wake of World War I, Germany was excluded.

appropriate cognate to "applied science" ever stabilized in France.[22] In Japanese, the word "pure" was rendered differently for IUPAP than it was for the IUPAC.[23] Germany had a tradition in *reine und angewandte Mathematik*, but its physical counterpart, *reine und angewandte Physik* appeared comparatively rarely.

The union forged between pure and applied science, as represented in IUPAP's name, that is, was more important for physics within particular national contexts than it was for physics internationally. In national-level scientific communities, these categories mediated the support and esteem certain types of research received. At first glance, the inclusion of this distinction in the name of an international organization seems to indicate the upward pressure those national tensions exerted on the international stage. But little evidence suggests that IUPAP concerned itself explicitly with addressing the tensions between pure and applied physics in its early years. The divisions that consumed its attention were the national ones, and it sought modes of scientific exchange that could bridge those divides, with its purity or applicability a secondary concern.

What should we make of IUPAP's cumbersome name in light of this? The General Assembly's early discussions suggest that navigating the pure/applied distinction played little role in either framing or executing its mission.[24] The name is, however, indicative of the broader context that led to its emergence. The very existence of an international body that explicitly linked pure and applied physics put them on the same footing and reinforced the connection between them. IUPAP made a statement that applied physics *was* physics. By electing William Bragg as its first President, it bestowed international leadership upon an individual who held the regard of both acolytes of abstraction and practically minded practitioners. For applied physicists, that provided a measure of prestige that they sometimes felt they lacked within their national communities. For pure physicists, it reinforced the necessity of pursuing and supporting abstract research alongside practical research. IUPAP's name, that is, reflected an emerging consensus that the abstract and practical branches of physics were necessarily linked.

Pure and Applied Physics in Practice

If IUPAP's name signaled parity between pure and applied physics in the eyes of the international community, its practices nevertheless reflected the relative disciplinary dominance of pure physicists through the middle decades of the 20th century. It also reflected the comparative ease of sharing abstract research across national boundaries.

[22] Bernadette Bensaude-Vincent, "At the Boundary between Science and Industrial Practices: Applied Science, Arts, and Technique in France," *Science Museum Group Journal* 13 (Spring, 2020): 201309.

[23] I thank Kenji Ito for this observation.

[24] "Union Internationale de Physique Pure & Appliquée, Assemblée Générale Constitutive, Paris—Décembre 1923"; "Union Internationale de Physique Pure & Appliquée, Deuxiéme Assemblée Générale, Bruxelles—7 Julliet 1925;" "Union Internationale de Physique Pure & Appliquée, Troisiéme Assemblée Générale, Bruxelles—10 et 11 Julliet, 1931," series B2aa, vol. 1, folder A "General Reports, 1923–1960," IUPAP, Gothenburg Secretariat, (hereafter IUPAP Gothenburg), Center for the History of Science, Royal Swedish Academy of Science.

IUPAP was born into a world wounded by war, and not long into its existence another global conflict loomed, which saw charter members Japan and Italy pitted against most of the others. In that context, amid awareness that physics could be readily applied to the causes of war, IUPAP's internationalization efforts were more easily directed toward non-applied subjects. In its early decades, it concerned itself especially with questions of scientific notation and nomenclature. Metrology, for instance, occupied a sweet spot between pure and applied physics—salient enough to problems of interest to nations, such as trade and mapping, to garner widespread interest, but abstract enough to be understood as pure. IUPAP, which was led by representatives of the classical physics tradition, also engaged little with the burgeoning field of quantum mechanics, which in any event would have been difficult to pursue seriously without including German physicists.

World War II significantly reordered the international physics community. Following the intellectual migration from Europe and massive government investment, the balance of global power shifted to the United States. The US government was newly enthusiastic about federal physics funding and, in the wake of the success of the Manhattan Project, many other nations were of a similar mind. Nuclear physics, an abstruse pursuit in the 1930s, became the iconic representation of the power of the pure, once applied. IUPAP's role coordinating the pure and applied branches of physics took on new meaning in the post-war world.

Two circumstances would prompt a fuller-scale re-evaluation of the proper relationship between abstract and practical approaches to physics within IUPAP. The first of these was the expansion of the organization's membership. Just twenty nations had joined before World War II. By the end of the 1960s, that number had doubled. The new membership transformed IUPAP into a more thoroughly global organization. Sixteen of the first twenty member states were in Europe or North America, the exceptions being charter members Japan and South Africa, Australia (joined 1925), and China (joined 1934, left 1949, re-joined 1984). The addition of countries like India (1948), Argentina and Brazil (1951), Israel and Pakistan (1951), the Soviet Union (1957), and the Koreas (1969) meant that, at the dawn of the 1970s, the interests of the member states reflected not just countries with established scientific infrastructure, but those who aspired to build it as well.

As a 1978 report on physics in Pakistan put it "basic science—even the segments necessary for 'applicable' physics—is a frightful luxury for a poor country."[25] The perception within IUPAP was that nations seeking to gain coequal membership in the international scientific community after World War II often lacked both the resources and the inclination to launch major programs in fundamental physics. They recognized the abstract virtue of scientific engagement as a source of international prestige, but they more often than not sought to combine it with proximate material benefit to their domestic societies and economies. Crucially, this was not a universal characteristic of IUPAP's new members. In Brazil, for instance, the development of infrastructure for fundamental research held at least as much importance as support

[25] Untitled Report on Physics in Pakistan, 1978, series E11, vol. 2, folder 08 "Council meeting Stockholm 1978," IUPAP Gothenburg.

for applied work.[26] Nevertheless, the perception that it was true for *some* nations spurred efforts to increase activity in support of applied physics, the systematic neglect of which became a recurring topic of discussion.

In 1981, IUPAP addressed this issue through the formation of a Commission on Physics for Development.[27] Existing commissions tended to support conferences that represented the latest developments in specialized fields, and these activities catered best to physicists from nations that were industrialized, not those that were industrializing. The commission addressed the perceived "need for developing countries to be able to send their scientists to m[e]etings where matters of a more general nature were discussed."[28]

Conferences organized under the auspices of this commission focused more squarely on applied issues—energy, environment, and industry among them. The first of these, held in Trieste in 1984, took as one of its key objectives "to identify and define priority fields of physics which are most important for the technological and industrial development of third world countries."[29] The action the conference identified also focused on applied aims, including establishing "regional experimental and applied physics research centers in selected developing Countries" and "the establishment and maintenance of one or more international centers in experimental and applied physics."[30] The Commission on Physics for Development, though, remained a comparatively small element of IUPAP's activities. It played a role in making IUPAP membership a more attractive proposition for developing countries. Its direct engagement in applied questions, though, did little to overcome the impression elsewhere in the Union that applied interest remained underemphasized.

Awareness of the relative paucity of applied physics in the IUPAP program had been present for some time. In 1972, IUPAP President Robert F. Bacher's speech to the fourteenth General Assembly noted ruefully: "Our main activities have been in sponsoring research conferences on the latest work on the forefront of the various fields of pure physics. This is not of primary interest to the developing nations and there is no reason why it should be." Bacher, himself a nuclear physicist, Manhattan Project veteran, and former provost of Caltech suggested that IUPAP would have to take applied considerations into account more explicitly, for instance in its education programs, to generate interest in the developing world.[31] As IUPAP pursued an expansion strategy that would add thirteen new members before the end of the century, these concerns became increasingly relevant.

[26] Cássio Leite Vieira and Antonio Augusto Passos Videira, "Carried by History: Cesar Lattes, Nuclear Emulsions, and the Discovery of the Pi-Meson," *Physics in Perspective* 16, no. 1 (2014): 3–36.

[27] International Union of Pure and Applied Physics, minute of the Executive Committee meeting held in Paris, August 29, and September 3, 1981, series E11, vol. 3, folder 09 "Council meeting Paris 1981," IUPAP Gothenburg.

[28] Larkin Kerwin, letter to Mary Beth Stearns, March 22, 1978, series E12, vol. 1, folder 06 "General Assembly Stockholm 1978," IUPAP Gothenburg.

[29] Luciano Bertocci, memo to IUPAP International Advisory Committee, August 11, 1983, series E11, vol. 4, folder 03 "Council meeting Ottawa 1983," IUPAP Gothenburg.

[30] Daniele Sette "On the International Support to Physics in Developing Countries," series E11, vol. 6, folder 11 "Council meeting Quebec 1989," IUPAP Gothenburg.

[31] Robert F. Bacher, Presidential address at the XlVth General Assembly, Washington, September 1972, Appendix VI in *Report on the XIVth General Assembly, Washington, DC, 1972*, IUPAP-17, series B2aa, vol. 2, folder A "General Reports, 1969–1987," IUPAP Gothenburg.

The second factor that prompted new discussions of the pure–applied relationship within IUPAP was the changing fortunes of applied physics in the United States and Western Europe. Applied physicists became more assertive in the 1970s and 1980s. Within the APS, new divisions dedicated to computational physics, materials, and lasers were established. The breakup of the Bell System in 1984 was a blow to industrial physics research, but the diaspora of physicists with industrial experience into universities further softened the academic/industrial divide that had been so acute two or three decades earlier.

New institutions emerged to advocate for the needs of applied physicists. As solid-state physicists with fundamental interests restyled themselves as condensed matter physicists, the interdisciplinary field of materials research gained traction. The Materials Research Society was established in 1973, in no small part because of the efforts of the Indian-born American physicist Rustum Roy, who advocated fiercely for increased emphasis on applied, rather than basic research as the wellspring of advances in both science and technology.[32]

IUPAP could hardly ignore these developments. In 1976, it organized a conference in Dublin on the topic of physics in industry, which drew eighty-five contributions from physicists representing twenty-two countries.[33] The lively nature of the conference inspired then IUPAP President Clifford Charles Butler, an English physicist then serving as President of the Nuffield Foundation, to commit to a greater role for industrial topics in future IUPAP meetings.[34]

It took some time, however, before deeds would align more closely with words. Through the 1980s, concern about overemphasis on the pure portion of the organization's mission cropped up more frequently in internal communications. The British materials scientist Cyril Hilsum worried in October 1983 that "IUPAP is intended to support applied physics as well as pure physics, yet the overwhelming majority of our conferences are on pure physics."[35] His was not an isolated view. IUPAP President Allan Bromley acknowledged in January 1985 that "the Union over the years has tended to forget the fact that it bears responsibility for applied as well as so-called pure physics."[36]

By the mid-1980s, IUPAP began to take concrete action to alter the balance that had theretofore tilted in favor of pure physics. A resolution adopted at the October 1, 1985 Executive Committee meeting in Oslo ensured that "at least one of the Chairman and Vice-Chairman of each Commission shall be drawn from the industrial physics world."[37] This did increase industrial representation within IUPAP and

[32] Joseph D. Martin, "What's in a Name Change?: Solid State Physics, Condensed Matter Physics, and Materials Science," *Physics in Perspective* 17, no. 1 (2015): 3–32.

[33] E. O'Mongain and C. P. O'Toole, eds., *Physics in Industry* (Oxford: Pergamon, 1976).

[34] Frank E. Jamerson, "Physics in Industry," *Physics Today* 30, no. 10 (1977): 71–2.

[35] Cyril Hilsum, letter to Jan Nilsson, Associate Secretary General IUPAP, October 12, 1983, series E11, vol. 4, folder 15 "Council Meeting Oslo 1985," IUPAP Gothenburg.

[36] D. Allan Bromley, letter to John Bardeen, Conyers Herring, Hendrik Casimir, and Frederick Seitz, January 24, 1985, series E11, vol. 5, folder 15 "Council Meeting Oslo 1985," IUPAP Gothenburg.

[37] "Minutes: Oslo meeting, September 30–October 1, 1985 Norwegian Academy of Science, Oslo, Norway," Appendix F, series A1, vol. 1, folder E "Minutes from Council Meetings 1972–1999," IUPAP Gothenburg.

bring more contributors from applied spheres into meetings, but with, as one report put it, "uneven success."[38]

Throughout the 1980s and 1990s, the role of industrial physics in the Union, and strategies for increasing its involvement, was a perennial topic of discussion within the governance structure. Various working groups were formed to discuss the issue, and to think about how to navigate the cultural difference between the largely academic physicists who thought of research and collaboration on the scale of decades, and industrial researchers who, once the previously academic-style research laboratories like Bell were shuttered, increasingly planned on the scale of years, if not months.

But despite several suggestions that IUPAP required a commission—a primary subdivision of IUPAP charged with supporting conferences—dedicated to industrial physics, one was never established. The Union instead attempted to better integrate researchers with applied interests into the existing topical commissions, most notably the Commission on Semiconductors, established in 1951. The commission supported a variety of international meetings, including the prominent series of International Conferences on the Physics of Semiconductors. The series predated the commission, originating in a 1950 meeting in Reading, England, at which William Shockley presented his work on the junction transistor, and remained an important forum for exchange between academic and industrial researchers.[39]

Nevertheless, the primacy of a pure-physics perspective within IUPAP had consequences for the commissions. In 1978, the Union governance floated a proposal to merge the commissions dedicated to semiconductors, magnetism, and solid-state physics to create a new commission on condensed matter physics. Such a move would have mirrored activity in organizations like the APS, which in 1978 renamed its Division of Solid State Physics the Division of Condensed Matter Physics, in part to keep up with the new, and increasingly non-solid cutting-edge of the field, but also because of concerted efforts to emphasize the intellectual contributions of the field over the industrial.[40]

Pushback came from, among others, Mary Beth Stearns, a solid-state physicist then a principal scientist at the Ford Motor Company and a member of the Commission on Magnetism. Stearns observed that semiconductor physics, magnetism, and solid-state physics collectively produced over 28% of doctorates in physics in the United States. Since each commission had limited representation in the IUPAP governance structure, merging these commissions would systematically underrepresent those areas' interests relative to fields like particle physics (14.8% of doctorates), nuclear physics (3.8%) and space science (3.7%). "The present and proposed distribution of commissions is not representative of the physics community," Sterns concluded. "[t]he executive committee's amalgamations … would make the representation worse—not

[38] "International Union of Pure and Applied Physics Minutes, Meeting of the Executive Council, September 1996," series A1, vol. 1, folder E "Minutes from Council Meetings 1972–1999," IUPAP Gothenburg.

[39] Leo Esaki, "Highlights in Semiconductor Device Development," *Journal of Research of the National Institute of Standards and Technology* 86, no. 6 (1981): 565–70.

[40] Joseph D. Martin, "What's in a Name Change?"

better."[41] Larkin Kerwin, then Secretary General, circulated Sterns's letter to the IUPAP Executive Committee. The merger never took place, and instead the Solid-State Commission was renamed the Commission on Structure and Dynamics of Condensed Matter in 1981.[42]

Stearn's observation about the proportionality of representation on the IUPAP Executive Committee highlights another mechanism that conspired to ensure the underemphasis of applied physics. In principle, commissions were responsible for both the pure and applied dimensions of their subjects. Subjects with large applied components tended to be populous, but were most commonly represented on the Executive Committee by academic physicists, and those subjects more oriented toward basic research were both smaller, and so overrepresented relative to the size of their communities within IUPAP, and inclined to neglect potential applied dimensions of their fields altogether.

In 1985, Bromley raised the question of "whether IUPAP should take some further aggressive action to establish closer ties with physics related industries." He outlined two competing schools of thought within IUPAP:

> In one, the emphasis is on retaining the unity of science, and the recognition of the great importance of keeping the pure and applied aspects of any of our subfields in close communications. There are obvious benefits, not only within the science itself but also in terms of making the science understandable and attractive to all those taxpayers who inevitably end up supporting it. The other branch argues that the pure and applied sections of our disciplines have already pulled so far apart that it is a futile hope to even consider bridging the gaps between them. This group argues that what we should do is to establish a whole new set of Commissions charged specifically with the health and well-being of the applied sections of physics.[43]

Not for the first time, the question arose of how to fit practical research into the structure of institutions organized around topical divisions based on a taxonomy that privileged the categories of abstract research.

The IUPAP Secretary General, Jan Nilsson, circulated Bromley's query to the leadership of the commissions. Responses generally agreed that IUPAP should do more to respond to the needs of applied and industrial researchers. "I think that IUPAP should live up to its name," Hiroshi Kamimura of the Commission on Semiconductors put it.[44] Representatives of areas that enjoyed a close relationship between abstract and practical researchers, though, tended to share the sentiment articulated by Per Christian Hemmer, of the Commission on Thermodynamics that "no really meaningful distinction can be drawn between pure and applied physics," and to favor measures to increase IUPAP's attention to applied matters, but to disfavor radical restructuring

[41] Mary Beth Stearns to Larkin Kerwin, February 20, 1978, series E12, vol. 1, folder 06 "General Assembly Stockholm 1978," IUPAP Gothenburg.

[42] Executive Committee meeting minutes, August 29, and September 3, 1981 (ref. 27).

[43] Jan S. Nilsson, memo to Chairmen and Secretaries, IUPAP International Commissions, April 2, 1985, series E11, vol. 5, folder 08 "Council Meeting Oslo 1985," IUPAP Gothenburg.

[44] Hiroshi Kamimura to Jan S. Nilsson, August 16, 1985, series E11, vol. 5, folder 08 "Council Meeting Oslo 1985," IUPAP Gothenburg.

of the organization.[45] Treating applied physics separately, they felt, would enforce a division between basic and applied interests that they did not regard as reflecting their fields.[46] Representatives from the commissions dedicated to particle physics, mathematical physics, astrophysics, and cosmic rays, evidently not regarding the issue as one of interest to their membership, neglected to reply.

The consequence was to continue with the status quo, so far as the structure of commissions was concerned, but to encourage the practice adopted in 1985 of nominating members from industry, or with applied expertise, to leadership positions and to encourage IUPAP-sponsored meetings to recruit more speakers with applied interests. Structurally, the factors that favored non-applied research within the organization remained in place. Nor did contextual factors, in an era of increasing international economic competitiveness, work in favor of IUPAP's effort on this front. Such factors would continue to limit efforts to support applied topics into the 21st century. As the council noted in 2001, while lamenting the decline of industrial participation in IUPAP activities, "many industrialists were unwilling to share their newest research with others fearing the commercial competition."[47]

The three-decade saga of applied industrial physics and its relationship to IUPAP's mission reveals much about the wider international community of physicists in the late-20th century. Abstract, fundamental physics of the type pursued in large accelerators and telescopes was highly visible during this period, and proved a particularly potent medium for scientific exchange.[48] But as the Cold War cooled, and then fizzled, military pressures were replaced by economic ones. Intellectual property regimes became barriers as significant as military secrecy regimes to international exchange of knowledge. Just as IUPAP had struggled in the early 20th century to build meaningful exchange around applied research in the context of widespread militarism, it faced similar challenge in the late 20th century in the face of widespread mercantilism.

Conclusion

Historians of science and technology have of late sought to deconstruct the distinction, however it is expressed, between pure, basic, or fundamental research on one hand and applied, practical, technologically oriented research on the other. So-called pure pursuits have never been independent of the needs, desires, and values

[45] Per Christian Hemmer to Jan S. Nilsson, August 5, 1985, series E11, vol. 5, folder 08 "Council Meeting Oslo 1985," IUPAP Gothenburg.

[46] Pierre Aigrain to Jan S. Nilsson, August 29, 1985, series E11, vol. 5, folder 08 "Council Meeting Oslo 1985," IUPAP Gothenburg.

[47] Minutes, IUPAP Council and Commission Chairs Meeting, September 28–29, 2001, Mexico City, Mexico, series A1, vol. 1, folder C "Minutes of the IUPAP Council & Commission Chairs Meeting," IUPAP Gothenburg.

[48] Joseph D. Martin, "Prestige Asymmetry in American Physics: Aspirations, Applications, and the Purloined Letter Effect," *Science in Context* 30, no. 4 (2017): 475–506; Joseph D. Martin, "Word and Image in Popular Science," in *Where Words and Image Meet*, ed. Florence Grant and Ludmilla Jordanova (London: Bloomsbury, 2024).

of the pursuers and their supporters.[49] Applied research often opened avenues into fundamental insight.[50] Historians have nevertheless pointed out that, however murky the lines were in practice, the distinction itself had considerable rhetorical power, and considerable practical stakes.[51] The way in which "pure and applied" physics were navigated within IUPAP reinforces that point.

IUPAP is an object lesson in the relationship between aspiration and reality. Like the other international unions established in the wake of World War I, IUPAP sought *unity*. It sought international unity, but, as the name suggests, it also sought an elusive unity among the various branches of physics, and particularly among those who ferret out physical principles and those who put them to work.

Both forms of unity, however, proved difficult to cultivate. The world was rocked by war, both hot and cold, in the decades following IUPAP's establishment. Physicists played key roles in both. And IUPAP was little more successful than other organizations at combatting the centrifugal forces—such as divergent incentives, cultural differences, and competing priorities—that pulled academic and industrial researchers, and so often basic and applied researchers, away from each other on the institutional level, even as the practice of physics saw them become increasingly intertwined.

[49] Steven Shapin, *Never Pure: Historical Studies of Science as If It Was Produced by People with Bodies, Situated in Time, Space, Culture, and Society, and Struggling for Credibility and Authority* (Baltimore: Johns Hopkins University Press, 2010).

[50] Joan Bromberg, "Device Physics vis-à-vis Fundamental Physics in Cold War America: The Case of Quantum Optics," *Isis* 97 (2006): 237–59.

[51] Mario Daniels and John Krige, "Beyond the Reach of Regulation?: 'Basic' and 'Applied' Research in the Early Cold War United States," *Technology and Culture* 59, no. 2 (2018): 226–50.

5

Under the ICSU Umbrella

The Joint Commission on Radioactivity (1947–1955) between IUPAP and IUPAC

Danielle Fauque and Brigitte Van Tiggelen

After the end of World War II, the situation facing international scientific unions was profoundly new. Resuming personal contact between scientists, reactivating international exchanges, and becoming part of the new structures created formed the essence of the work immediately ahead.

On December 16, 1946, the International Council of the Scientific Unions (ICSU), the federative structure that had brought them together since 1931, had just signed an agreement with one of the satellite organizations of the United Nations, which succeeded the defunct League of Nations, the United Nations Educational, Scientific and Cultural Organization (UNESCO).[1]

In this mutual recognition agreement, UNESCO considered the international scientific unions as a natural and appropriate form of the "international organization of science" and ICSU as the competent body to represent them and coordinate their activity. ICSU, in turn, recognized UNESCO as the leading United Nations' body in the main field of international scientific relations and declared that it accepted "the principles inspiring the convention establishing UNESCO." Accordingly, UNESCO would send an observer to all meetings of the Executive Board of ICSU, and the latter would send an observer to the General Conference of UNESCO. In return, ICSU would receive a grant to cover part of its administrative expenses and the travel costs of union members. UNESCO also offered the use of its premises in Paris for ICSU meetings.

It is in this context that the concept of "Joint Commissions" emerged and developed. In this chapter, we focus on the Joint Commission on Radioactivity (JCR), which gathered members from two ICSU unions, delegated by the International Union of Chemistry and the International Union of Physics.[2] Before diving into the creation and whereabouts of the JCR, the first three sections will be devoted to the context before World War II as related to inter-union cooperation and the situation of the International Union of Pure and Applied Chemistry (IUPAC) and the International Union of Pure and Applied Physics (IUPAP) immediately after

[1] Chloé Maurel, *Histoire de l'UNESCO. Les trente premières années. 1945–1974* (Paris: L'Harmattan, 2010).

[2] The name "International Union of Chemistry" was given in 1930, but its initial name, IUPAC, was taken again in 1947. IUPAP did not change its name in 1931 (see statutes), but frequently took the short name International Union of Physics (IUP). Here, we choose to use the official names IUPAC and IUPAP.

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the end of the conflict. Providing this context allows for a better understanding of the specific circumstances of the JCR in 1947 since this Joint Commission was not created ex nihilo. Quite the contrary: the newly formed commission incorporated former bits and pieces from both unions, as well as the formerly autonomous Radium Standard Committee, and was heavily populated with radioactivists such as Irène and Frédéric Joliot-Curie, Friedrich A. Paneth, George de Hevesy, and James Chadwick, as the fourth section details. The fifth section focuses on the management of inter-union commissions inside ICSU, which despite statutes, reports, and high-level discussions during General Assemblies, remained rather empirical. So much so that the JCR was continued in 1954 despite strong reservations expressed on its workings, and requests to renew its membership and purview. To assess the reality of the situation, the work of the JCR is examined more closely in section six, demonstrating the heavy influence of the couple Joliot-Curie, and the dominant position of the *Laboratoire Curie* as the holder of the radium standard, in all of the commission's affairs, while section seven recounts the sudden reversal of decision on the part of ICSU, putting an end to the JCR in 1955. The decision came as a shock to the members of the JCR, especially Paneth and Frédéric Joliot-Curie, as illustrated in section eight. Beyond getting rid of the old guard, other aspects that have to be factored in are considered in section nine: new usages and developments of radioactivity surely required new standards, whereas Frédéric Joliot-Curie's personal political actions in support of communism and pacifist views were no longer supported by France in the context of the Cold War. The last and concluding section looks at the completely new Joint Commission that was set up, the Joint Commission for Applied Radioactivity (JCAR), and reflects on how, despite a totally different structure and purpose, the JCAR had to deal with the legacy of its predecessor, in the context of the emergence of new national and transnational scientific organizations.

Inter-Union Cooperation before World War II

In fact, the convention with UNESCO was preceded by a convention of similar nature signed in 1937 with the International Institute of Intellectual Cooperation (IIIC). The IIIC was the administrative body of the International Committee on Intellectual Cooperation (ICIC).[3] By taking over from the IIIC, UNESCO inherited its archives and staff, including Angel Establier,[4] who was by then UNESCO's liaison officer with ICSU and remained in office several years after the war. Delegates of both the IIIC and UNESCO were attending the ICSU meetings during the transition period of overlapping international structures that characterizes the years 1945–47. In 1947, UNESCO was eventually installed in Paris.

[3] Jean-Jacques Renoliet, *L'UNESCO oubliée. La Société des nations et la coopération intellectuelle (1919–1946)* (Paris: Publications de La Sorbonne, 1999).

[4] Angel Establier (1904–76) was trained as pharmacist and biochemist, and worked with the IIIC from 1931 to 1946, and then with UNESCO until 1954.

Trans-union joint work was not new: indeed, IUPAP and IUPAC had already worked together in the 1930s in the framework of the IIIC. In 1932, Blas Cabrera,[5] one of IUPAP's Vice-Presidents, asked the IIIC for the creation of a commission to coordinate scientific terminologies between the unions of physics, chemistry, biological sciences, and the International Electrotechnical Commission (IEC). The first meeting took place on the premises of the IIIC, at the Palais Royal in Paris, on March 18 and 19. Among other issues on the agenda was the question of the harmonization of electromagnetic and electrostatic units, which constituted a real stumbling block between physicists and electricians.[6] Another important matter concerned the universal adoption of the centimetre-gram-second (CGS) decimal system, and, specifically for the International Union of Biological Sciences (IUBS), the question of nomenclature in botany.[7] For what concerns joint work between physicists and chemists, which is the topic of this contribution, a meeting of this interdisciplinary commission met in Madrid in 1933 to discuss terminology shared by both disciplines.[8]

In 1934, at the 2nd General Assembly of ICSU in Brussels, the Secretary General, Sir Henry Lyons, read the speech of the President George Ellery Hale, who was excused. Evoking the work of the various inter-union commissions, in particular between the International Astronomical Union (IAU) and the International Union of Geodesy and Geophysics (IUGG), the report underlined that the "chief function" of ICSU was "to bring the unions in interactive cooperation and to initiate studies involving the joint efforts of many specialists," and as a successful example of this work, he cited the Commission on Solar and Terrestrial Relationships (IAU, IUGG, International Union of Radio Science (URSI)).[9] During the assembly, another inter-union committee on Instruments and Methods of Research was created between IUPAP, IUPAC, the IGU (International Geographical Union), and the IUGG, which despite distinguished members such as Robert Millikan, George E. Hale, Edwin P. Hubble, Giorgio Abetti, and Hugo R. Kruyt, would not prove to be very active.[10]

At that same meeting in Brussels, the Danish mathematician Niels Erik Nörlund stressed the difference between the International Research Council, terminated in 1931, and its successor, ICSU: "If the old Council was superimposed on the Unions, the current Council has adopted a republican regime."[11] He argued that the council would be particularly interested in the boundary areas between several unions. Actually, on top of those cited by Hale, other Joint Commissions ("*commissions mixtes*")

[5] Blas Cabrera y Felipe (1878–1945), a Spanish physicist, who specialized in magnetism, and was internationally known, was exiled in Paris in 1936, the Secretary of the BIPM until 1941, then exiled in Mexico.

[6] See chapter by Fauque and Fox in this volume.

[7] Société des Nations, IIIC, Commission de coordination, Archives de la Bibliothèque des sciences expérimentales de l'École normale supérieure de Paris (hereafter BSE (ENS Paris)), Cotton Papers, AC 23.6.

[8] Sir Henry Lyons ed., *The Second General Assembly of the ICSU, held in Brussels, July 9th to 13th,* 1934. Reports of Proceedings (London: Harrison and son Ltd, 1935), 105.

[9] Ibid., 6.

[10] Ibid., 16.

[11] Ibid., 11, our translation.

linked to several unions had been formed such as, for example, those of Longitudes, of Time (Commission de l'Heure), etc. The current tendency of nations to isolate themselves from each other, he added, increased the importance of the role of the council, an example of selfless work had to be set.[12] This is the first time that the term "*mixtes*" [joint] appears. After the signing of the convention between ICSU and the IIIC in 1937, IUPAP benefited from the administrative and financial support of the latter for its last pre-war conferences, which were held together with IUPAC, and the IUBS.[13]

Subsequent national and international events disturbed international relations between scientists and made it impossible to hold the ICSU General Assembly in Copenhagen in 1940. Nörlund's plans had to wait until the end of the war.

IUPAC after World War II

As soon as the creation of UNESCO was formalized in November 1945, a meeting of the ICSU Executive Council, also in London in December, took up, among other things, the question of coordinating commissions. They recalled those that had existed since well before the war, and those that were planned concerning the ionosphere, oceanography, physico-chemical constants, and viscosity (rheology).[14] At a meeting from July 19 to 22, 1946, the ICSU Executive Committee returned to the topic of what are from now on called Joint Commissions.[15] The commissions appointed in 1945 had been approved by the unions (item 4), and their conveners had been named (items 10 and 11), as well as for the Commission on Solar and Terrestrial Relationships (item 11). But much of the discussion focused on the reaction of the international scientific community to the bombings of Hiroshima and Nagasaki. The question of the relations between science and society was virulent and the special commission of ICSU created before the war, the Commission on Science and its Social Relations (CSSR), integrating all the unions, was asked to draw up a report on the various opinions issued with a bibliography as complete as possible of all publications on the subject. Protests arose against the secrecy that surrounded research in the nuclear field and particularly with regard to weapons. States had each quickly created organizations in charge of taking up the question, in particular for France, the *Commissariat à l'énergie atomique* (CEA), in

[12] Ibid., 11.

[13] See chapter by Fauque and Fox in this volume.

[14] ICSU: "Draft Report of the CSSR on the attitude of scientific workers with regard to the problems raised by the application of science in present society" to be presented at the meeting of ICSU in London, July 22–24, 1946, §1, indicates the ICSU EC meeting, held in London, December 4 and 5, 1945, box 158 (ICSU 1945–1951), IUPAC archives (1919–1965), Othmer Library of Chemical History, Science History Institute, Philadelphia (hereafter IUPAC archives).

[15] ICSU, Minutes of the Executive Committee meeting at the Royal Astronomical Society, Burlington House, London, July 19, 1946, box 158, IUPAC archives.

October 1945, under the authority of Frédéric Joliot-Curie.[16] The circumstances for the field of radioactivity were therefore somewhat different from any other interdisciplinary areas, as they were infused with issues of geopolitics and national security.

1946 was a year of intense activity for the unions to prepare the first meetings after the end of the war. In the case of IUPAC, the exchanges between members had been virtually interrupted for eight years.[17] Marston T. Bogert (USA), President since 1938, had obtained the resignation of the Secretary General Jean Gérard (France), compromised for his collaboration with the German occupiers during the war. The new Secretary General, Raymond Delaby, an organic chemical pharmacist at the faculty of pharmacy in Paris, proposed by Frédéric Joliot-Curie to Bogert, reactivated the Union of Chemistry. As he wrote to Joliot-Curie, he had many difficulties with three of the commissions: that on atomic weights, reduced to three members; that on atoms, whose chairman Francis Aston had died; and the Commission on Radioactive Constants, chaired by F. Joliot-Curie himself, and of which several members had passed. These three commissions replaced the IUPAC Commission on Chemical Elements in 1930. The third one was to serve as a liaison with the Radium Standard Committee (RSC) created by Marie Curie, Ernest Rutherford, and Stefan Meyer back in 1910; but its Chairman, Rutherford, had died in 1937.[18] The Commission on Atoms currently included Niels Bohr, William D. Herkins (Chicago), Joliot-Curie (Paris), Robert S. Mulliken (Chicago), and Marcus Oliphant (Birmingham). F. Joliot-Curie had proposed to appoint Niels Bohr as President of the Commission on Atoms, but the latter refused. Finally, at Delaby's insistence, Joliot-Curie accepted the presidency in April 1946.

As President, he gave an update on the commission of radioactive constants and on the commission of atoms at a so-called "*Reprise de contact*" meeting of IUPAC following that of ICSU from July 24 to 27. The first thing was to take stock of the situation. The Commission on Radioactive Constants was in fact reduced to two members, F. Joliot-Curie and Samuel C. Lind of Minneapolis. Members of the former Reich were excluded de facto.[19] It was the case for Otto Hahn who had been an active member of the two commissions on atoms and radioactive constants before the war. The case of Meyer of Vienna was considered carefully[20] as he had suffered from Nazi anti-Jewish laws and as a result lost his position.[21]

[16] ICSU: "Draft Report of the CSSR," § 18, box 158, IUPAC archives.

[17] See D. Fauque and B. Van Tiggelen, "Rebuilding IUPAC after WWII," *Chemistry International* 41 no. 3 (2019): 22–5.

[18] See Soraya Boudia, *Marie Curie et son laboratoire. Sciences et industrie de la radioactivité en France* (Paris: Éditions des archives contemporaines, 2001).

[19] Roger Fennell, *History of IUPAC. 1919–1987* (Oxford, UK: Blackwell Science Ltd, 1994), 80. Ibid., 100–1: The Federal Republic of Germany was re-admitted to IUPAC in 1951.

[20] R. Delaby to F. Joliot-Curie, February 19, 1946. BnF, mss: *NAF 28161*, kept at Musée Curie, Irène Joliot-Curie Papers IFJC_F115 (hereafter IFJC_F115).

[21] F. Joliot to R. Delaby, March 32, 1946. IFJC_F115. Meyer's reinstatement was approved in 1947 (but he died in 1949).

At the start of the war, the Commission on Atoms was able to establish and publish an international table of stable isotopes thanks to Émile Briner based in Geneva, and this 6th report for 1941–42 was the last to reach the Union. It was urgent to quickly complete the one for 1943–45, a period that witnessed many changes in the list of elements.

IUPAP after World War II

Meanwhile, IUPAP necessitated a reorganization. The Secretary General, Henri Abraham, had passed at the Auschwitz camp in 1943. Manne Siegbahn, IUPAP President since 1937, asked Paul Peter Ewald, a German physicist and crystallographer, who had taken refuge in the UK from 1937, to succeed Abraham. He was tasked with resuming contact with the members of the Union and preparing the coming General Assembly. In this task, he was helped by the physicist Albert Pérard, Director of the *Bureau international des poids et mesures* (BIPM) (Sèvres, France) as interim Treasurer. This 5th General Assembly was held in Paris on January 3 and 4, 1947, and all of the Parisian organization was managed by Pierre Fleury, former student of Abraham and head of the *Institut d'optique* as well as Secretary of the French National Committee. At this General Assembly, Hendrik A. Kramers succeeded Siegbahn as President of the Union, and Fleury was elected General Secretary, remaining in office until 1963.[22]

Before the war, IUPAP had only three commissions, the Finance Commission, the Symbols, Units and Nomenclature Commission known as SUN, and the Publications Commission, the latter of which remained inactive. The SUN Commission had submitted its Report in 1934, then continued for a while afterwards.[23] In a literal sense, the Union no longer had any commissions in 1947 and was on the verge of disappearance because of the isolation of its members.[24]

This 5th General Assembly completely reorganized the Union, creating numerous commissions (see Table 5.1); the statutes were reviewed; a new Executive Committee was appointed.[25] Fleury proposed that the International Commission for Optics that he was then creating outside the Union be attached to IUPAP. A Commission for Radioactivity Units was approved (see Table 5.2).

Published in September 1947, the report of this General Assembly took into account the events that had taken place during the summer, in particular the recommendations of ICSU and the provisions offered by UNESCO concerning the financing of the travels of the union members. We can therefore take September as the birth date for the definitive constitution of the new structure.

[22] See chapters by Fauque and Fox, Navarro and Lalli in this volume.

[23] See chapters by Fauque and Fox, and Navarro in this volume.

[24] Report of the 5th General Assembly, September 1947, 11, series B2aa "General Reports," vol. 1 "1923–1966," IUPAP, Gothenburg Secretariat (hereafter IUPAP Gothenburg), Center for the History of Science, Royal Swedish Academy of Science.

[25] See chapters by Fauque and Fox, and Lalli in this volume.

Table 5.1 IUPAP: Commissions approved at the 1947 General Assembly

Special IUPAP Commissions (1947)	**Joint Commissions (1947)**
I. Symbols, Units, Nomenclature (SUN)	IV. Physico-chemical Constants
II. Optics (ICO preparatory Committee)	V. Rheology (viscosity)
III. Data and thermodynamic notations	VIII. Ionosphere
VI. Radioactive units	IX. Radio-meteorology
VII. Cosmic rays	

Report of the 5th General Assembly, September 1947, 6–10, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg

Table 5.2 IUPAP: Membership of the Commission on Radioactive Units as of January 1947

Name	**Localization**
Edward Uhler Condon	National Bureau of Standards, Washington DC, USA
Leon Francis Curtiss	National Bureau of Standards, Washington DC, USA
Sir Charles Darwin	National Physical Laboratory, Teddington, UK
Cecil Ernest Eddy	Commonwealth X-Ray and Radium Laboratory, Melbourne University, Australia
Robley Duglinson Evans	Massachusetts Institute of Technology (MIT), Cambridge, Mass, USA
Jacob C. G. Jacobsen	*Institut for Teoretisk Fysik*, Copenhagen, Denmark
Irène Joliot-Curie	*Institut du Radium*, *Laboratoire Curie*, Paris, France
Gerardus J. Sizoo	Amsterdam, The Netherlands

Report of the 5th General Assembly, September 1947, 6–10, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg

The Making of a Joint Commission *for* Radioactivity (1947–1949)

On July 1 and 2, 1947, at the meeting of the ICSU Executive Committee at UNESCO House in Paris, the question of international tensions was still topical. Fleury and Delaby attended, for IUPAP and IUPAC respectively. The constitution of the Joint Commissions was the subject of long debates.[26] Fleury specified that the Chemistry Union had two commissions, that of Atoms and that of Radioactive Constants, which were almost exclusively composed of physicists. He therefore proposed to send correspondents to the following meeting of IUPAC in London to discuss this situation and suggested that in the meantime the Joint Commissions would remain, to a certain extent, under the control of ICSU, while leaving the parent union responsible of the quality of the works they produced.

[26] ICSU meeting, Paris, July 1–2, 1947: 3rd session, July 2, 9.30 a.m., 7–11, 4th session, 2 p.m., 1–3. Typewritten in French and dated August 4: ICSU/Com.exp/S.R.I.2.3.4 (see: BNF Catalogue, 4-GW Pièce-215).

Another proposal came from the French Georges Champetier (IUPAC) for a new Commission on Macromolecular Chemistry of the Union of Chemistry to become a Joint Commission between IUPAC and IUPAP, since there were already physicists in this commission. In the end, however, it remained a commission of the Union of Chemistry, but with the addition of representatives of other unions concerned by this branch. The discussion then continued with the project of a Joint Commission on Radiobiology. Eventually, a point was made on the existing Joint Commissions and their attachment to a parent union (item 14). But clearly, requests for the creation of Joint Commissions followed one another independently, without clear rules being established; it was not until 1949 and a reform of the ICSU statutes that strict regulations were drawn up which each Joint Commission had to fulfill. The years 1947–49 therefore should be viewed as years of trial and error and implementation, and it is in this experimental context that the Joint Commission for Radioactivity was formed.

Two weeks after the General Assembly of ICSU, IUPAC met in London from July 17 to 24, 1947. In particular, several commissions (SUN, thermodynamics, radioactivity, physico-chemical constants) bringing together chemists and physicists met in plenary session with the new Commission for Physico-Chemical Constants created by ICSU with the aim of making overall decisions in order to avoid duplication.[27] The aim of this latest creation was to study the general problem of physico-chemical constants, therefore concerning all the aspects of this field currently dispersed in specialized commissions.

The former members present of the Commission on Atoms (IUPAC), Ellen Gleditsch (Norway),[28] and F. Joliot-Curie declared that the matter with which it had to concern itself had become too vast: most issues would necessarily be examined during the preparation of the Tables of Constants under the responsibility of the Union of Chemistry. They thus proposed its abolition.[29]

Concerning the Commission on Radioactive Constants of IUPAC, the only member present was Joliot-Curie himself. He asked Gleditsch, Hevesy, Paneth, and William A. Noyes Jr to be substitute members.[30] To these members were added the IUPAP delegates: Irène Joliot-Curie, Gerardus J. Sizoo (The Netherlands), and Jacob C. G. Jacobsen (Denmark). And, half an hour after, their meeting was held during which radical decisions were taken. First of all, the commission was dissolved, because it had become devoid of purpose, the subjects it dealt with also falling within the scope of the IUPAC Tables of Constants. Then, the creation of a Joint Commission

[27] *Union internationale de chimie*, [International Union of Chemistry], *Comptes-rendus de la Quatorzième Conference*, *Londres, 17–24 juillet 1947* (Paris: R. Delaby, S. G., no date), (hereafter, "IUPAC 1947" then "IUPAC year n"), Timmermans's Report, 125. All the *Comptes rendus* have been very recently digitized and are accessible on https://archive.org/details/chemistryinternational.

[28] Ellen Gleditsch (1879–1968), worked with Marie Curie as postdoctoral student (1907), professor of inorganic chemistry in Norway, who became a close friend of the Joliot-Curies. See A. Lykknes, "Ellen Gleditsch: Woman Chemist in IUPAC's Early History," *Chemistry International* 41 (2019): 26–7.

[29] IUPAC 1947, F. Joliot-Curie's Report, 66.

[30] George de Hevesy (1885–1966), the co-discover of hafnium, a specialist on radiotracers, Nobel Prize winner (1943), who worked in Stockholm; Friedrich A. Paneth (1887–1958), who worked at the Institute of Radium, Vienna, then left for Great Britain in 1933, came back to Germany in 1953, a specialist in the use of radiotracers and the helium method of dating; William A. Noyes Jr (1898–1980), a photo-chemist, very involved in international activities at both IUPAC and the ICSU.

of Standards and Units of Radioactivity was proposed. This new commission took on the nature recently recommended by ICSU, replacing both the Commission on Radioactivity Units freshly created by IUPAP, and the Commission on Radioactive Constants of IUPAC, the mother union being the latter for historical reasons.[31] This proposal for a new Joint Commission was therefore to be presented to the next meeting of the ICSU Executive Committee, in 1948.[32]

One of the first tasks of this commission would be to propose a merger with the RSC, which in practice meant asking Joliot-Curie, Secretary of this RSC Committee, and the surviving members (André Debierne, Stefan Meyer, and James Chadwick) for their approval. The former members of the Commission on Radioactive Constants would be part of the new commission (see Table 5.3).

This "Provisional Joint Commission" started working immediately. It had read the letters of Leon Francis Curtiss and Edward Uhler Condon of May 18, 1946, of Sizoo of May 1947, and of Debierne, Jean Cabannes, Fleury, Garnier, Antoine Laccassagne, André Strohl, and I. Joliot-Curie of April 22, 1947, concerning *the radioactivity unit and the unit of gamma ray intensity*.[33] In conclusion, the committee proposed clear definitions, in great part based on decisions taken during the last meetings of the RSC before the war.

The 6th General Assembly of IUPAP took place in Amsterdam in July 1948. Between its plenary sessions, the Executive Committee, the SUN Commission and the Commission on Radioactivity held their meetings, and the question of documentation in physics was the occasion of an exchange of views. Thanks to grants from UNESCO, newsletters, memoirs and other documents could be printed and distributed to members of the Union. On April 1 of the following year, the Union consisted of twenty-two acceding countries. Its activities were shared between special commissions specific to the Union, and Joint Commissions for those concerning several unions. For the latter, Fleury recalled the recent rules set out by ICSU. Then, upon presentation by Irène Joliot-Curie, the IUPAP General Assembly approved the plan transforming the Commission on Radioactivity Units into a Joint Commission with IUPAC. The Joint Commission was recognized by the ICSU Executive Committee under the name of Commission on Radioactivity (units, constants, standards, nomenclature) or Commission on Radioactive Standards, Units, and Constants,[34] and composed of twelve members and a list of advisory members, mostly members from the former RSC.

Its first meeting was held in Amsterdam in 1949 during the IUPAC 15th conference. The chemist Paneth was elected as its President and the physicist Sizoo as its Secretary. It was also at this General Assembly that IUPAC restructured itself into sections gathering together specialties within the science concerned. As a result, the Commission on Radioactivity became attached to the IUPAC physical chemistry section.

[31] IUPAC 1947, F. Joliot-Curie's Report, 66–68. The proposed French name is "Commission mixte des étalons et unités de la radioactivité," 67.

[32] IUPAC 1947, Commission membership, 11.

[33] IUPAC 1947, F. Joliot-Curie's Report, 67.

[34] Report of the 6th General Assembly (1948), Commissions Mixtes, 8, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

Table 5.3 Membership of the Joint Commission on Radioactivity, 1947–1955. This table is given for information as the ICSU, and the IUPAC lists differ. These lists do not always provide full names, nor do they distinguish the attributions of the members of a given union. It seems that Seaborg never attended meetings

	1947–1948 Provisory Commission	1948	1949–1951–1953	1953–1954	Before September 1955
Sources	**IUPAC 1947**	**IUPAP 1948**	**IUPAC 1951, 1953 ICSU 1954**	**ICSU 1955**	**Paneth's proposals**
Chairman	Frédéric Joliot-Curie,		Paneth,	Paneth,	Paneth,
IUPAC	Ellen Gleditsch, George de Hevesy, Warren C. Johnson, Frédéric Joliot-Curie, Samuel C. Lind, Stefan Meyer, Friedrich A. Paneth, Glenn T. Seaborg, (William A. Noyes Jr)	Gleditsch, Hevesy, Johnson, Joliot-Curie, F., Lind, Paneth, Seaborg	Gleditsch, Johnson, Joliot-Curie, F., Paneth, Seaborg	Gleditsch, Hevesy, Joliot-Curie, F., Paneth, Seaborg	Gleditsch, Joliot-Curie, F., Karlik (Secretary), Paneth, Seaborg

Continued

Table 5.3 *Continued*

IUPAP	Leon F. Curtiss, Charles Darwin, Robley D. Evans, Irène Joliot-Curie (Secretary), Gerardus J. Sizoo (Jacob C. G. Jacobson)	Curtiss, Darwin, Evans, Jacobsen Joliot-Curie, I., Sizoo	Curtiss, Evans, Jacobsen, Joliot-Curie, I., Sizoo (Secretary)	Curtiss, Evans, Jacobsen, Joliot-Curie, I., Sizoo	Curtiss, Evans, Joliot-Curie, I., Manov, John L. Putman
Advisory Councilors	No information. Proposal: members of the old RSC	James, Cockcroft (UK)	James, Chadwick, Otto Hahn, Lind, Berta Karlik, Paul Kipfer, Jacques Piccard	Chadwick, Cockcroft (1954–), Hahn, Johnson, Karlik, Kipfer, George G. Manov, Piccard	

In 1951, the name of the commission was formally modified, with ICSU's approval, to that of the JCR, and this name was quickly adopted in practice.

Negotiating a Space for Joint Commissions within ICSU, IUPAP, and IUPAC (1948–1955)

ICSU reformed its statutes in 1949, and enacted stricter rules for Joint Commissions, the number of which grew too quickly, as did the number of member unions.[35] Otherwise UNESCO grants allocated to each could only decrease. Each Joint Commission, covering a limited area, was to be reduced to ten members, their appointment being the responsibility of ICSU on the proposal of the unions concerned. In the future, their term of reference would be subject to renewal every three years from their first meeting.[36] Consequently, the JRC was reduced to five against six members for each of the two unions, without real change in its membership (see Table 5.3).[37]

Therefore, at the seventh General Assembly in 1951, IUPAP presented six special commissions, participated in seven Joint Commissions, and delegated representatives to three commissions of another union. IUPAC only acted as mother union in two cases: rheology (viscosity) and spectroscopy. Other Joint Commissions were requested but that on the solid state of matter was postponed to a later date, to be eventually rejected by the ICSU Executive Committee in October 1951, which advised to consider this commission as suitable for IUPAP itself.[38] IUPAP requested the suppression of the Joint Commission of Abstracts on Pure and Applied Physics in anticipation of the creation by ICSU of an "International Abstracts Service" to be regarded as one of its permanent scientific activities with a Secretary appointed by it.[39]

However, the Union's commissions did not yet cover all areas of physics, for which other avenues of institutional collaboration were envisaged, outside of the framework of the Joint Commissions.

In 1953, Ronald Fraser, the ICSU Administrative Secretary, reminded the policy of only maintaining productive and assiduous Joint Commissions. As a result, ICSU abolished five Joint Commissions:

- the Commission on Rheology of which IUPAP had been the parent union (an international association of rheology societies was being considered);

[35] See Frank Greenaway, *Science International. A History of the International Council of Scientific Unions* (Cambridge: Cambridge University Press, 1996).

[36] Report of the 7th General Assembly (1951), § 9, 23–4, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

[37] Report of the 8th General Assembly (1954), Joint Commissions, 1. series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg. A member of each union, Sir John Cockcroft (UK) and Warren C. Johnson (USA), became Councilors of the Advisory Committee, of which Lind (USA) and Auguste Piccard (Be) were no longer a part.

[38] Report of the 7th General Assembly (1951), 14–15, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

[39] Ibid., 13.

- the Commission for the High-Altitude Research Stations to which IUPAP sent a representative was reduced to the Jungfraujoch station in Bern;
- the Commission on Radiobiology, which planned to cooperate in the construction of an international radiobiology laboratory attached to the European Organization for Nuclear Research (CERN);
- the Joint Committee on Physicochemical Data, which would become an IUPAC committee;
- the Commission on Radio-Meteorology, which had the project of becoming a commission specific to URSI.

As for the JCR, the reports indicate that "its future was under consideration." In fact, the Executive Board of ICSU recommended that this Joint Commission should in the future become a commission of a union either of IUPAC or IUPAP. In 1953, at the IUPAC General Assembly in Stockholm, the Chairman and the Secretary of the JCR, however, were re-elected for another period of three years. In 1954, IUPAP no longer participated either in the Commission for Oceanography (IUGG and IUBS) whose activity was now limited to the study of the deep sea, nor in the Commission on Terrestrial and Solar Relationships (IAU, IUGG, and URSI) of which a large part of the work was devoted to radioastronomy, but it continued its collaboration with the Joint Commissions on Spectroscopy, Electron Microscopy, Radioactivity, and for the Ionosphere.

In fact, if in the report of ICSU for the period 1953–54, the JCR had been confirmed with a minor renewal in its membership, this had probably not been enough. It was at a next meeting during the General Assembly with a new Executive Board in Oslo in August 1955 that the cleaver of ICSU fell. The JCR was dissolved and immediately replaced by a Joint Commission on Applied Radioactivity. The dissolution had apparently come as a total surprise, but the study of the archives gives another answer more subtle, as we will see later in this chapter. It is therefore appropriate now to look specifically at the work of this commission between 1947 and 1954, also paying attention to the weight of the tradition established by the RSC, which can be considered as its forerunner in many instances.

A Closer Look at the Workings of the Commission on Radioactivity (1947–1953)

From 1947 to 1955, the decisions taken by the JCR related mainly to the radium standard, to the name of the units of radioactive quantities, to the property of the primary radium standard, and to the fate of the secondary standards prepared in Vienna. Other topics were also discussed on radiotracers and on the determination of standard sources suitable for low radiations. The JCR thus fulfilled its main role of standardization. In doing so, it achieved the role that the RSC had in fact performed before the war, continuing its work. It is therefore necessary to look at who were the members of this commission, and their work before the war.

After the death in October 1937 of Rutherford, President of the RSC, Stefan Meyer, Director of the Institute of Radium in Vienna, took the initiative to write to the whole of the committee, asking for the election of a new President. After discussion, he was elected by a very large majority.

On the other hand, the international nomenclature of radioactive quantities was not established, but it was proposed to note the isotopes with their mass number at the top left of the symbol, and the order number at the bottom left. In December 1938, Lind had announced the creation of a "committee on standards of radioactivity" by the division of physics of the National Research Council (NRC) (Washington).[40] Lind was responsible for liaising with the RSC, of which he was a member. The objective of this new committee could be to establish "new and revised tables of radioactive constants," an objective that the RSC had decided not to achieve, since the number of artificial radioelements was increasing too rapidly. Among the responses received by Lind, two are noteworthy, first from Meyer deploring that America created its own authorities and separated itself from Europe, and from Irène Joliot-Curie who skillfully wrote: "We had a very homogeneous radium-bearing barium carbonate prepared a long time ago to make weak standards; we will be very happy to be able to compare them with the standards which could be sent to us by the committee of Washington." This was to underline once again the main role of the *Service des mesures of the Laboratoire Curie*, a role which Marie Curie had secured after a hard fight, and which according to her daughter Irène, it had to keep.[41]

In 1947, during the first meeting of the provisional JCR, the rule already established before the war concerning the radioactivity unit, the "curie," and a unit called "rutherford" for the cross section for nuclear phenomena were adopted. Regarding the choice of the gamma radiation unit of the sources, the question depended on the field of use. For physiological effects, a comparison between X sources and gamma sources encouraged the use of "roentgen." Physicists working on gammas, specifying each time the nature and the energy, did not need this unit, but asked for a practical unit.

The JCR Meetings

Several meetings were organized by the JCR respectively in 1949 (Amsterdam), where Paneth (IUPAC) and Sizoo (IUPAP) were respectively elected President and Secretary, in 1951 (New York), and 1953 (Stockholm), on the occasion of the General Assemblies of IUPAC, and in 1950, in Paris, combined with the celebration of the discovery of radium, the first day on July 17 at the UNESCO House, and the second at the Laboratoire Curie.[42]

The JCR began its proper functioning in 1949 in Amsterdam. In 1950, at its second official meeting, Berta Karlik from the Radium Institute of Vienna replaced

[40] Centre de ressources historiques du Musée Curie, Institut du radium, Paris: Fonds du Laboratoire Curie, Service des mesures, AIR LC.SDM/5975 (hereafter AIR LC.SDM/folio).

[41] AIR LC.SDM/5968–81. See also the analysis concerning the RSC in Boudia, *Marie Curie et son laboratoire* in chs. 8 and 9 on radioactivity metrology.

[42] AIR LC.SDM/6017, containing a typed report to the ICSU, IUPAC, and IUPAP, July 27, 1950, p. 6.

the recently deceased Meyer, following the proposal by Irène Joliot-Curie. The second point concerned "the ownership and use of existing International Radium Standards," and the third point dealt with the preparation of new standards as secondary radium standards, gamma- and beta-ray's standards. Finally, the fourth point addressed the issue of units. One result of the JCR was the adoption of its definition of radium standard by the International Commission on Radiological Units (ICRU) in 1950.[43]

In 1951, in his report to the IUPAC General Assembly in New York, Sizoo specified that a meeting should take place in connection with the Radiological Congress at Copenhagen in July 1953.[44] The question of the standardization of radioisotopes and nomenclature would be also discussed.[45] And, that same year, at the seventh IUPAP General Assembly, after he presented all the decisions taken by the JCR, he asked IUPAP for a meeting at the next IUPAP General Assembly in 1954.

In 1953, for the IUPAC General Assembly in Stockholm, Paneth reported that "the work of standardization is carried out in several countries by experts, on their own initiative and responsibility; but the Joint Commission acts as a clearing house and ensures that these valuable contributions are available for discussion at the meetings of the Commission."[46] It was further decided that the Paris international radium standard, "which is the property of the commission and has so far been regarded as the responsibility of the BIPM at Sèvres, shall in the future be entrusted to the care of the director of the *Laboratoire Curie*, but without change in the conditions regulating its use." The BIPM Director would be informed accordingly by the chairman.[47]

Discussion Topics

The main work of the Joint Commission, taking up the questions debated before the war, fell into two parts. One was already concerned with the unit of radioactivity and the radium standard, the other with measurements and standards of beta and gamma radiations. Associated questions concerned diverse terms of nomenclature and the standards to be used for weak radioactive sources. This last subject was debated with great vigor, notably by Irène Joliot-Curie, and tensions were perceptible in the group. As the work proceeded, the question of the ownership of the primary radium standard was to be one of the recurring issues, eventually gaining particular prominence.

[43] See https://www.icru.org/about-icru/history/.

[44] IUPAC 1951, *Comptes-rendus de la Seizième Conférence, New York and Washington, 8–15 septembre 1951* (Paris: R. Delaby, Secretary General, no date), 86. Third meeting of the JCR, September 8, 1951, Sizoo's Report to IUPAC, September 14, Washington, 86, § 7 (English). See also AIR LC.SDM/6019: typewritten.

[45] AIR LC.SDM/6017-6019.

[46] IUPAC 1951. Today, the unit used is the becquerel, and the curie is defined as 3.700×10^{10} bq.

[47] IUPAC 1953, *Comptes-rendus de la Dix-Septième Conférence, Stockholm*, *Juillet 29–août 4, 1953* (Paris: R. Delaby, Secretary General, no date), Paneth's Report, 93 (with the list of reports). See also AIR LC.SDM/6025: 4th meeting, Stockholm, July 30–1, and August 1, 1953.

Unit of Radioactivity

The curie, named in honor of Pierre Curie, was first defined by Marie Curie in 1911 on the basis of one gram of radium, and was officially adopted two years later, following some rather bitter exchanges in the RSC. It was discussed again by the JCR and then the definition finally adopted, after minor modification, at a meeting of the commission in Paris in 1950 was: "The curie is a unit of radioactivity defined as the quantity of any radioactive nuclide in which the number of disintegrations per second is 3.700×10^{10}."[48]

Choice of Beta- and Gamma-Ray Standards

Regarding beta- and gamma-ray standards, complete consensus was never achieved, principally because the wish of a number of national representatives to develop new standards themselves, notably for weak radioactive sources (the radium standard unit is too huge for this purpose). In 1950, for example, concerning gamma-radiation measurements, it was suggested that ^{60}Co "might be used in future" but "the time is not arrived to accept it."[49]

Similarly, the JCR agreed on the importance of developing dependable standards for beta-radiation. But here too the relevant scientific data was too unreliable for a decision to be taken. Despite this, a number of recommendations had to be made to laboratories. As an example of difficulties to accept the independent proposals of making a beta-ray standard, Irène Joliot-Curie replied to those from the Bureau of Standards in Washington, to assert the dominance of the *Laboratoire Curie* in the field: "In one or two years there will probably be a service in France, which will be sufficiently equipped to make measurements of this kind."[50]

The Radium Standard Ownership

Over the years, however, most discussions focused on the radium standards and on questions of their ownership. The original primary historic standard dated from 1911, and was made available for the purpose to the *Laboratoire Curie*, although it remained the property of the RSC. In 1912, Hönigschmid made a second standard for the Vienna Institute of Radium Research. Its comparison with the Paris standard confirmed its good value and it was considered as another primary radium standard, and was also the property of the RSC. In 1947, following discussion and a vote, it was decided that the property of the Paris standard should be transferred from the former

[48] AIR LC.SDM/6017, 2nd meeting, 1950, 5–6.
[49] AIR LC.SDM/6017, 4. Our translation.
[50] Ibid., 4.

RSC to the new JCR, but maintained in the *Laboratoire Curie*.[51] But this proposal met a legal difficulty with the Parisian Faculty of sciences of which the Laboratoire depended. And the question was without solution when the JCR was dissolved.[52]

An Injunction from ICSU

The agenda of this fourth meeting of the JCR also included an injunction from ICSU: "Future of the Joint Commission on Radioactivity: The Executive Board of ICSU has recommended that the Joint Commission should in future become a commission of a union either of IUPAC or of IUPAP."[53] The committee of the IUPAC section of physical chemistry recommended that the JCR should keep its status of Joint Commission, and the Joint Commission itself was "strongly in favour of the maintenance of its joint status …."[54]

Towards an Abrupt Ending (1954–1955)

In accordance with ICSU's statutes, a Joint Commission was initially to run for three years.[55] In October 1954, the ICSU Executive Council duly renewed the commission for a further three years, with the proviso that the membership should be reviewed according to art.5.3 of the rules.[56] During the first term of 1955, several correspondences were exchanged between Paneth and Letort, President of the Physical-Chemistry Section of IUPAC to which the JCR reported. For Paneth, it was not necessary to replace more than the two members proposed, because there were sufficient experts in the Advisory Committee to help the actual titular members of the commission.[57] In March, the Executive Board of ICSU reiterated demands for greater

[51] A suitable radium sample consisted of a small quantity of exceptionally pure radium chloride (22,99 mg of $RaCl_2$, Paris 1911) enclosed in a small glass vessel of tiny diameter: 1 mm in the case of the Paris standard, and 32 mm long. What was measured was the level of emitted gamma radiation with an ionization chamber. As it decays, a radium nucleus gives off a nucleus of radon and one of helium, which is trapped in the salt and gamma radiations. With time, over a matter of decades, the pressure resulting from the accumulation of helium leads to a danger of explosion, making it essential for new samples to be prepared. With this risk in view, in 1934 Otto Hönigschmid from Vienna prepared a set of primary samples of which one became the new Paris radium standard, and then a series of secondary specimens for distribution to the different national laboratories. See *Prace Marii Skłodowskiej-Curie*, zebrane przez Irene Joliot-Curie (Warszawa: Państwowe wydawnictwo naukowe, 1954), [*Works of Maria Skłodowska-Curie*, collected by Irène Joliot-Curie [Warsaw: National Scientific Publishing House, 1954], figure on p. 419. See also the Collection Institut du radium, MCP456.

[52] See Boudia, *Marie Curie et son laboratoire*.

[53] 4th meeting of the JCR, Stockholm, July 30–1, August 1, 1953, AIR LC.SDM/6025.

[54] IUPAC 1953, Report of the Committee of the Physical Chemistry Section, 60.

[55] These rules were published every year in the *Year Book of the ICSU*. For 1954 they are to be found on p. 43.

[56] Sizoo to the JCR members, April 4, 1955, cited a letter from A. V. Hill (ICSU General Secretary) to Sizoo, 25 October 1954, series E1, vol. 5 "Fleury's correspondence 1954–1960," folder 32 "Commission de radioactivité appliquée," Quebec secretariat (hereafter IUPAP Quebec), Center for the History of science, Royal Swedish Academy of Sciences.

[57] Ibid., reference to Letort's letter to Paneth, January 19, 1955, and Paneth's answer to Letort, February 11 and 18, and March 24 (see also Letort's Report, April 5, 1955, AIR LC.SDM/6163).

change in the review of the membership and deferred the $2000 grant awarded for meeting scheduled for 1955.[58] ICSU did not however specify how to carry out a more complete renewal: should the decision come from the commission itself or be made at a higher level, that of the unions? Depending on the interlocutors, the answer varied. Finally, according to Delaby, each union had to designate its representatives; IUPAC as parent union then had to validate the complete list, before it being submitted to the approval of ICSU.[59]

In fact, Paneth was faced with a moral problem: should he decide himself who should be dismissed? So, after several exchanges with Sizoo, they decided that all members should resign, be re-elected or, if they did not wish to be, they should propose a new member.[60] The results revealed some divergences in the commission. The Swedish committee considered that the work of the commission had been achieved and did not nominate a candidate; the British committee proposed Norman Feather; the Canadian committee desired new members, insisted that the JCR had to be more active, and proposed Lloyd G. Elliott.[61] According to Curtiss, there was a high constraint on the criteria for new members: "In any replacement of existing members great care should be taken to ascertain prior to appointment that (1) a selected individual is interested in standards of radioactivity, (2) is willing to work on the Commission and (3) is acceptable to the President, Professor Paneth, who has served in this work so well."[62]

On April 12, Letort wrote to Joliot-Curie communicating confidentially a part of his report on the physical-chemistry section to the IUPAC Bureau for its meeting on April 18, adding the feeling of the IUPAC Bureau on the JCR: "I understand that this Council [of ICSU], as well as the office of the Union of chemistry and that of the Union of physics express certain reservations on the functioning of this commission."[63] Indeed, at this date, Paneth had not yet proposed a substantial change and above all had failed to send its reports to Letort in due time. The latter feared that the solution to the difficulties he had set out to solve was doomed to disappear and wanted F. Joliot-Curie to intervene. But Joliot-Curie did not respond until two weeks later, on April 25, when he returned to Paris after a long rest. The IUPAC board meeting had passed and Sizoo had launched its investigation. If Joliot-Curie agreed with the ICSU rules for most commissions, to him their application to the JCR was simply wrong. The main concern of the JCR was to deal with standards and units of

[58] Ibid., reference to the ICSU meeting, March 7–12, 1955.

[59] Delaby to Sizoo, April 6, 1955, with copy to Fleury, series E1, vol. 5, folder 32, IUPAP Quebec. See also, Delaby's correspondence to Sizoo in IUPAC Archives, box 10.

[60] Reference to Sizoo's letter to Fraser, March 15, 1955 in Sizoo to the JCR members, April 4, 1955, see note 55, series E1, vol. 5, folder 32, IUPAP Quebec.

[61] Fleury to Sizoo, June 10, 1955, Fleury to Feather and Elliot, January 19, 1956, UIP-5538, Feather to Fleury, January 2, 1956, UIP-5652 and Elliott to Fleury, February 7, 1956, UIP-5697, series E1, vol. 5, folder 32, IUPAP Quebec. N. Feather (1904–78), a nuclear physicist then at Edinburgh, had been colleague of Chadwick; L. G. Elliott (1919–70), then director of the Chalk River Nuclear Laboratories (Canada).

[62] Correspondence list: Swedish Committee, Erik Rudberg to Fleury, April 30, 1955, UIP-55179, Royal Society, D. C. Martin, Assistant Secretary, to Fleury, May 6, UIP-55191, Canadian Committee, Alexander Edgar Douglas to Fleury, May 19; Curtiss to Fleury, April 7, UIP-55137, series E1, vol. 5, folder 32, IUPAP Quebec. Leon Francis Curtiss, a nuclear physicist, was consultant to the National Bureau of Standards, Washington, DC, at that time.

[63] Letort to Joliot-Curie, April 12, 1955. AIR LC.SDM/6142 bis.

radioactivity, and for this experts with long experience were needed, but these were rare: "For the moment, this category is small, the younger generation having mainly tackled problems of nuclear physics."[64]

Eventually, Paneth proposed a few changes: Berta Karlik, head of the Institute of the Radium in Vienna, in place of Hevesy, taking over as the Secretary from Sizoo. IUPAP sent George G. Manov and John L. Putman in place of Jacobsen and Sizoo who resigned.[65] This new composition was presented at the General Assembly of IUPAC at Zürich on July 22–8 1955, Letort's report concluded that a satisfactory answer would be given to ICSU by the application of the art. 5.3.[66]

At this General Assembly, the Vice-President, Arthur Stoll, from Sandoz Company, was elected as the new President of IUPAC (1955–57).[67] William A. Noyes, the former ICSU Treasurer, was elected to the IUPAC Bureau, and Delaby announced his resignation; but with no successor in view, he had to continue as a Secretary General delegate for some months. It was during this General Assembly that Paneth wrote a long letter to Delaby and Fleury. He reported all his correspondence with Letort during the last seven months, as well as that between Fraser and Sizoo, concerning all information about the JCR, signaling the incoherent decisions of ICSU, and the lack of guidelines on the election of delegates. In the case of the JCR, Paneth argued, it would be difficult to change all the membership at once. At the Stockholm IUPAC's General Assembly in 1953, he had noted only five titular members present for fifteen scientists who attended, the ten others having been invited by Paneth himself. As a result of Sizoo's inquiry, all the members had resigned except two. Irène and Frederic Joliot-Curie gave reasons why in "the interest of the continuity of the work they did not approve of the scheme and did not wish to resign."[68] And finally, about the new composition of the commission, Paneth added "I should think that IUPAC, IUPAP and ICSU could be quite satisfied with this arrangement" adding that it was necessary "to have a certain number of more or less permanent members to ensure continuity of our deliberations,"[69] a statement in square antagonism to the ICSU terms of reference.

The now Defunct International Commission on Radioactivity

But in August 1955, ICSU suddenly reversed its previous decision and proceeded to abolish the commission, replacing it with a totally new commission. To the JCR members this came as a shock. In fact, a document kept in the IUPAP archives provides more information on this decision.

[64] Joliot-Curie to Letort, April 25, 1955. AIR LC.SDM/6143.

[65] George G. Manov, Atomic Energy Commission, Washington DC (US), and John L. Putman, Harwell Atomic Research Center, Oxford (GB).

[66] IUPAC, *Comptes-rendus de la XVIII^{e} conference, Zurich 20–28 juillet, 1955* (Basel: Dr R. Morf c/o Sandoz, S. A., no date), 63 (French), 66 (English).

[67] Arthur Stoll (1887–1971), professor in Munich, before being hired as head of the pharmaceutical department of the Sandoz Firm (Basel, Switzerland), he was elected IUPAC Vice-President in 1951, and President (1955–59). He had a profound effect on developing the Union's affairs.

[68] Paneth to Delaby and Fleury, July 27, 1955, series E1, vol. 5, folder 32, UIP-55364, 3, IUPAP Quebec.

[69] Ibid., 2.

On August 8, the Executive Board of ICSU, after discussion, decided to name an ad hoc committee to examine the question of the JCR. It was composed of Pierre Auger (UNESCO), Fleury (IUPAP), Sven Hörstadius (IUBS), Noyes (IUPAC), Kapathi Ramanathan (IUGG), and Stoll (IUPAC). In this special meeting on August 9, they proposed that the study of radioactivity should be exclusively the responsibility of IUPAP, and that a new Joint Commission be formed, totally different from the previous one. As an applied science, radioactivity increasingly gained in importance for a wealth of different disciplines, and it was crucial that ICSU would step up to its responsibility in such interdisciplinary matters: it was decided to ask the council to create, in place of the old commission, a new JCAR gathering of six unions: IUPAC as parent union (two delegates), IUPAP (two), the IUBS (two), the IUPS (one), the IUB (one), and the IUGG (one). They also specified the tasks for the commission. On the 10th, at the plenary session of the Executive Committee of ICSU, the new JCAR and its provisional program were approved, and the involved unions were asked to nominate their delegates. Stoll, who signed the report, wrote to Delaby to inform him of the ICSU decision. Delaby in turn sent a copy of the report to Paneth on September 5, then to Letort asking him for the names of the new IUPAC delegates.[70]

On September 15, the ICSU Administrative Secretary, Fraser wrote to Paneth saying that he had received a copy of Paneth's letter to Delaby and Fleury dated July 27, which came too late and was "unfortunately to no purpose. ...." Fraser ended the letter with this abrupt sentence: "It will be for the Parent Union to organize this new Joint Commission, and for you there is nothing left to do but to notify all concerned with the now defunct Joint Commission of Radioactivity accordingly."[71] The terms employed by Fraser shocked Paneth: the letter was irreverent—addressed to Dr Paneth in place of Professor—and the tone was disparaging. There wasn't even a single note of thanks for past service.

On October 6, Paneth sent the members a long letter with the heading expressing the situation unambiguously: "to the Members of the now defunct International Commission on Radioactivity," echoing Fraser's own words. Paneth also referred to the question, "forgotten by ICSU," of the ownership of the standard, which was in fact the commission's property, underlining that "it seems that none knew anything about the existence of our standard." After recalling the history of this standard, he proposed that the ownership should now pass to the *Institut du radium*, id est the *Laboratoire Curie*. As events were soon to show, the fact that this laboratory depended on the Paris Faculty of Science, and was hence under the control of the Ministry of Education, was going to present difficulties.[72]

Clarifications demanded by Letort never came, and Delaby wrote "[i]t seems difficult to go against the decisions of the ICSU, which is sovereign in the matter, even if it changes its mind and after a promise made the year before."[73] In December, to Joliot, Letort expressed again his deep regret at "the strange procedure that ICSU has followed in this affair." F. Joliot-Curie, who just returned from a long stay in hospital

[70] Delaby to Stoll, September 3, 1955; Delaby to Paneth and Letort, September 5, 1955, box 10, IUPAC archives.

[71] Fraser to Paneth, September 19, 1955, series E1, vol. 5, folder 32, UIP-55399, IUPAP Quebec.

[72] Paneth to the JCR members, October 6, 1955, AIR LC.SDM/6151.

[73] Delaby to Letort, October 1, 1955, box 10, IUPAC archives.

and had not been informed about the ICSU decision, annotated Letort's letter with comments that reveal unmistakable bitterness: "[t]o discuss with Irène… the question of standards? Make-up of the new commission? Dictatorial measure! !"[74] Evidently, the Joliot-Curies had not been consulted or kept informed earlier, any more than the commission's other members. Reading the archival documents reveals the tensions between the members, and a certain blockage on the part of the Joliot-Curies, particularly from Irène, about the question of the radium standard. The beginning of the next year went to reveal how strong the "mise à l'écart" of the Joliot-Curies was.

Personal Power Politics, Institutional Opposition, and Academic Mistrust

The dissolution of the JCR took place in a context where personal tensions are palpable. First, we have to consider the institutional position and the personal situation of the Joliot-Curies which had been pivotal figures in the interwar period.[75] F. Joliot-Curie's position in the frame of the international community of scientists at the turn of the fifty's was difficult. The CERN project was developing without him, having been one of his dreams for a long time, as the project aimed to give European scientists a strong role in front of the Americans. On the national level, he was moving his laboratories to the new university campus in Orsay in the south of Paris, meant to become the future *Institut de physique nucléaire* (Nuclear Physics Institute). But his official engagement with the French Communist Party—he was member of its bureau at this time, and it was the Cold War period—provoked a great mistrust from the academic community and the governmental authorities. In particular, Pierre Auger, a powerful member in the matter of science policy in France at this time, was suspected to have contributed to this "*mise à l'écart*" of Joliot-Curie.

Moreover, F. Joliot-Curie was one of the eleven renown scientists, including nine Nobel Prize winners, who signed the Russell-Einstein Manifesto, published in London on July 9, 1955, stressing the dangers of nuclear weapons.[76] This no doubt impacted his reputation among scientists meeting in Zurich or in Oslo that same summer, and certainly fed into the conversations. Both Frédéric and Irène were furthermore frequently ill and had to stay away from research activities as well as organizational matters. In addition to the internal difficulties of the JCR, this all contributed to the fatal decision to end the term of the Joint Commission, and at the same time, to protect the new commission from the Joliot-Curies' influence while getting rid of the old guard all together.

A second factor played into the decision to brutally put an end to the JCR. Since the beginning, IUPAC was very strongly opposed to the admission of the Union of

[74] Letort to Joliot, December 23, 1955. In Joliot's handwriting, the French text is: *"[e]n discuter avec Irène… Et la question des étalons du radium? Quand la composition de la nouvelle commission? Mesure dictatoriale! !."* AIR LC.SDM/6156.

[75] On this subject see Michel Pinault, *Frédéric Joliot-Curie* (Paris: Odile Jacob, 2000), ch. XXI; and Louis-Pascal Jacquemont, *Irène Joliot-Curie. Biographie* (Paris: Odile Jacob, 2014), ch. 9.

[76] And furthermore, F. Joliot-Curie was an active member of the Pugwash Movement, along with Russell. See Pinault, *Frédéric Joliot-Curie*.

Biochemistry within ICSU.[77] IUPAC had had a Biological Chemistry Commission since its creation and did not intend to disperse forces in this field. In 1949, an International Committee of Biochemistry had presented its candidature to ICSU with a view to creating a union, but this had been refused, likewise in 1952. Finally, the International Union of Biochemistry (IUB) was created in 1953 outside of ICSU. The first General Assembly was held in January 1955. And in August of the same year, ICSU recognized the IUB as one of its unions.[78] It was therefore a very serious defeat for IUPAC, forced to deal with the newly unwelcomed sister union,[79] which considerably weakened the moral authority of IUPAC on fields neighboring the chemical discipline.

Also in 1955, the American Lloyd Viel Berkner (Washington DC), a strong personality, succeeded Bertil Lindblad as the new President of ICSU.[80] This specialist in the ionosphere, Vice-President of CSAGI (Special Committee for the International Geophysical Year which will establish the IGY in 1957) was also a delegate member of the IUGG of the Joint Commission on the Ionosphere, which also brought together members of IUPAP, URSI, and the IAU. He was probably aware of IUPAP's request, repeated without success, to be the mother union of the JCR which in reality counted more physicists than chemists. The study of the atmosphere also involved radioactive works, low doses for which standardization was still far from being achieved. It had become an urgent matter given the Cold War tensions and the multiplication of nuclear tests at that time. And of course, the radiotracers were now regularly used in biochemistry and physiology, paleogeophysics, and so on. So, this was certainly a third factor that played into the decision to completely abandon the JCR and form a new commission that was more in tune with the present challenges posed by radioactive measurements.

In that context, the dragging of feet by the Joliot-Curies, amounting to a refusal to go beyond work on the radium standard and beta and gamma rays, was strategically unfortunate, and seems to have played a crucial role. The Joliot-Curie stance was supported by Paneth, always a loyal interpreter of the wishes of the pioneers Marie Curie, Ernest Rutherford, and Stefan Meyer, and that loyalty position seems to have had its consequences in the way the decision was communicated to him. It served to encourage other parties to become involved, and this led in turn to the undermining of the *Laboratoire Curie*'s dominant position in the realm of standardization. As mentioned previously, Soraya Boudia has stressed Marie Curie's determination that her laboratory should remain the leading laboratory for radioactive standards.[81] As Marie Curie intended, this view was maintained by her intellectual heirs, both within the family (in the case of the Joliot-Curies, husband and wife) and among close associates

[77] *The Year Book of the International Council of Scientific Unions 1956* (London: ICSU, c/o the Royal Society, no date), 46. The IUB, born out of an international biochemical organization created in the late 1940s, had just been admitted to ICSU by forty-one votes to three, and four abstentions, ibid., 48. IUPAC had vehemently opposed it for years, believing that it competed or duplicated its biological chemistry division. See also the IUPAC Comptes Rendus from 1949 to 1955.

[78] Edward C. Slater, "The History of IUB (MB)," *IUBMB Life*, 57/4–5 (April–May 2005), 203–11.

[79] See Fennell, *History of IUPAC,* 133–7.

[80] Greenaway, *Science International*, 155.

[81] Boudia, *Marie Curie et son laboratoire*, ch. 9: le Laboratoire Curie comme institution métrologique, 167–8.

and colleagues, such as Paneth and others. In this way, the tacit power unwittingly exercised by the Joliot-Curies had the effect of placing severe constraints on the work of the commission.[82] The consequences of this were profoundly damaging at a time when the commission desperately needed to incorporate new perspectives that were rapidly transforming both fundamental research and applications in the field of radioactivity.

Within the Joint Commission of Radioactivity, power had rested, however discretely, in the hands of the Joliot-Curies, and had done so from the beginning. Even though the Joint Commission had gathered members of IUPAC and IUPAP, it had been principally the Joliot-Curies' commission, and the JCR activities had been, in a sense, poisoned by the endless discussions on the whereabouts of the primary international standards and the issue of their ownership.

The Joint Commission on Applied Radioactivity: Continuity or Discontinuity?

Things had changed, and by 1955 it was time to turn to matters of greater immediacy. The whole field of radioactivity underwent significant changes. Applications of radioactivity multiplied in such areas as geological dating, archaeology, medicine, military and civil research; the number of artificial isotopes proliferated; and research on weak sources of radioactivity proceeded quite independently of the commission. Investment in specialized laboratories led to an expansion of facilities and the groups devoted research in the field, to say nothing of the international organizations devoted to atomic research, such as the International Atomic Energy Agency (IAEA) and the European Atomic Energy Community (Euratom). The JCAR roadmap had been set in August 1955. The new "Joint Commission on Applied Radioactivity will work in the field of tracer elements, new radioactive elements and reaction kinetics, and its composition will be of nine members: IUPAC (two), IUPAP (two), the IUSB (two), the IUGG (one), the IUPS (one), the IUB (one)."[83]

The shock on the abrupt end of the JCR however continued to ripple. In March 1956, during the 32nd meeting of the IUPAC Executive Council, the new Secretary General Rudolf Morf, underlined the surprise and incomprehension of the Physical Chemistry Section at the dissolution of the JCR, even though it had started to reorganize itself.[84] His regrets were again expressed at ICSU in June. For ICSU, now composed of fourteen unions, the Joint Commissions were in direct competition with the unions, and hampered the efficiency of ICSU's own initiatives; the already mentioned IGY, and the Scientific Committee on Oceanic Research (SCOR), were in the works. The physical chemistry section of IUPAC even proposed "to terminate its

[82] The break with the past was sharp and painful, the more so as it coincided with a deterioration in the health of both Irène and Frédéric. Irène died in March 1956, Frédéric two years later.
[83] ICSU, *Year Book 1956*, 46.
[84] IUPAC, *Bulletin d'information*, 1 (Basel: Rudolf Morf c/o Sandoz S. A., June 1956), 3.

collaboration with ICSU."[85] The composition of the new commission however was approved by ICSU, and a meeting was scheduled for December 15 (see Table 5.4). Its agenda was to specify its goals and program, and elect its President. Noyes and Auger were invited to attend this first meeting.[86]

Among the nine members of the JCAR we find: Harry W. Melville (Birmingham, UK), Vice-President of IUPAC, specialist on polymers kinetics, member of the Commission on Kinetics of Chemical Reactions; Pierre Süe, Collège de France, a newcomer to IUPAC, specialist in analysis by activation (use of radiotracers), but also faithful collaborator of F. Joliot-Curie; George de Hevesy, Nobel Prize winner in 1943 for the use of radiotracers in physiology, having left IUPAC for the IUB, and also the only member of the former JCR. On the side of IUPAP, Lloyd G. Elliott of Atomic Energy of Canada Ltd (Ontario), a specialist in subatomic particles, and Norman Feather, a specialist in alpha and beta radiations (Edinburgh, UK), had both

Table 5.4 Membership of the Joint Commission on Applied Radioactivity (JCAR), 1955–1957

Unions	1956 (constituted on June 25, 1956)	1957
IUPAC	Harry Work Melville, Secretary of the Department of Scientific and Industrial Research (London, UK). Pierre Süe, Collège de France (Paris, F), chairman in December, but passed away in 1957.	Henry Seligman, Chairman, AERE Harwell (UK). Marguerite Perey, Professor of nuclear physics, (Strasbourg, F), replacing the late Süe.
IUPAP	Lloyd George Elliot, Atomic Energy of Canada, Chalk River, Ontario (Canada). Norman Feather, Department of Natural Philosophy, Edinburgh (UK).	Elliot Feather
IUBS	Melvin Ellis Calvin, Department of Chemistry, Berkeley (USA). Peter Reichard, Medicinsk-Kemiska Inst., Stockholm (Sweden).	Calvin Reichard
UGGI	John Tuzo Wilson, department of physics, Toronto (Canada).	Wilson
IUB	George de Hevesy, Stockholm (Sweden).	Hevesy
IUPS	Alexander Von Muralt, Bern (Switzerland).	Von Muralt

For 1956, Rudolf Morf to JCAC members, June 25, 1956, series E1, vol. 5, folder 32, UIP-55,399, IUPAP Quebec. See also IUPAC 1957, *Comptes-rendus de la Dix-Neuvième Conférence, Paris, Juillet 16–25*, 17, and for 1957, *The Year Book of the International Council of Scientific Unions 1957* (London: ICSU, no date), 14.

[85] IUPAC, *Bulletin d'information*, 2 (Basel: Rudolf Morf c/o Sandoz S. A., Autumn, 1956); *Compte rendu de la réunion du Conseil exécutif de l'ICSU, Bagnères de Bigorre, France, juin 15–20, 1956*, 6. See also Rudolf Morf to the JCAR members, June 25, 1956, series E1, vol. 5, folder 32, IUPAP Quebec.
[86] IUPAC, *Bulletin d'information*, 2, 39.

given their agreement to Pierre Fleury from January 1956.[87] All the members of this new commission were specialists in the use of radiotracers, their radiation, and their energy, in very varied fields and several of them ran dedicated laboratories. This composition, which underlines the exponential progress in the use of radioactivity, further reinforced the obsolescence of the former commission, whose objectives were too restricted, all the while nuclear physics and chemistry were advancing rapidly, and the measurement of low doses required suitable standards.

On December 15, 1956, in Paris, during this first meeting, Süe was unanimously elected President. The presence of Noyes and Auger probably allowed for clarification, and warranted the compliance with the objectives set by ICSU. But the next year Süe unexpectedly passed away, the JCAR had not yet started its work, and a planned symposium was therefore postponed. That same year, more changes in membership and leadership occurred: Marguerite Perey (IUPAC), discoverer of francium, and a member of the Atomic Weights Commission (IUPAC), and Henry Seligman (IUPAC) of AERE (Harwell, UK) replaced Melville and Süe. Seligman was also elected President of the commission. In 1958, Charles Fisher, head of the radioelements department at the CEA (Saclay, F.) became Secretary, raising the composition of the JCAR to ten members.

Despite its agenda, structure and composition, the commission however inherited the problem of the Radium Standard ownership, which did not enter into its original objectives. No other known commission was in charge of it according to Letort and Morf, also present, so … why not the JCAR? After reviewing the history of radium standards, and the admitted fact that the *Laboratoire Curie* possessed a considerable amount of data on the subject, the principle of a sub-commission dedicated to this specific subject was proposed, comprised of Hevesy, Paneth, and F. Joliot-Curie. The question had certainly arisen during a conversation between Süe and Joliot-Curie in the previous months.[88] This creation seems incongruous today in the light of the archives, but the new commission had not experienced the tensions of the old one. In fact, nothing happened since Paneth and F. Joliot-Curie passed away in 1958 before a meeting could even be held. However, a solution to that issue was sought from the side of the BIPM, the International Bureau of Metrology, the ISO, ICRU, and finally the IAEA.[89] This latter agency had just been created in 1957 by the United Nations, and the creation of an International Union of Nuclear Sciences, once envisaged by ICSU in 1957, was abandoned.[90] The JCAR then focused on disseminating the information concerning the radioactive measurement techniques, based on the data provided by the Saclay and Harwell Centers.[91]

[87] The other members were Melvin E. Calvin, Berkeley (IUBS), on the use of ^{14}C in biochemical reactions, Peter Reichard, on medical-chemistry, Stockholm then Uppsala (IUBS), John Tuzo Wilson, Toronto, on the use of lead isotopes in geochronology (IUGG), and Alexander von Muralt, Bern, a physiologist (IUPS).

[88] It is Süe who had proposed the question of the Radium Standard. See Süe to F. Joliot-Curie, July 17, 1956. BnF, mss: *NAF 28,161*, kept at Musée Curie, Irène Joliot-Curie Papers IFJC_F115.

[89] IUPAC 1959, *Comptes-rendus de la Vingtième Conférence, Munich, 26 août–8 septembre 1959* (Basel: Dr. R. Morf c/o Sandoz S.A., no date), Report of the Physical-Chemistry Section, 159 (French) and 168 (English).

[90] IUPAC, *Bulletin d'information*, 3 (Basel: Rudolf Morf c/o Sandoz SA, December 1957), 10.

[91] IUPAC 1959.

Finally, the commission proposed a dense program of work and symposia at its meeting in Paris in October 1959. It also underlined the difficulties of relations with ICSU, in particular concerning the radium standard, that was no longer financed at all, and the JCAR drew closer to the IAEA, in particular by organizing several symposia with the support of the latter up to 1965.[92] It then operated solely by correspondence from 1966, and by 1968, its work was limited to "co-sponsoring international meetings."[93] In July 1969, IUPAC, in agreement with the President of the JCAR, proposed its dissolution to the council of ICSU.[94] And IUPAP in turn announced this termination in Dubrovnik in 1969. ICSU definitively abolished the notion of Joint Commissions, devoting itself to its own committees, the number of which was ever growing.[95]

The evolution of membership, however, showed the new promising links:[96] for example, Seligman was a member of the IAEA and, for IUPAP, André Allisy, a member of ICRU, represented the BIPM where he was responsible for the recently created Department of Ionizing Radiation.[97]

On the side of IUPAP, and after the disappearance of the JCR, a special Commission on Radioactivity was envisaged as early as 1955. In 1957, it created the Commission on High Energy of Nuclear Physics (IX) and, at the same time, announced the possible creation of a Commission on Low Energy of Nuclear Physics (XII) in 1957. The latter was actually created in 1960 and envisaged to study questions such as standards and units of radioactivity.[98]

At the end of this trajectory, it clearly appears that the JCR certainly suffered from the lack of openness of its members to recent progress in applied radioactivity, due in particular to a Joliot-Curies' blockage grounded on the principle that the commission was strictly dedicated to units and nomenclature, even though its name, in 1951, could have suggested a broadening of objectives. In doing so, was it not, in fact, a question of retaining leadership in the control of radium standards at the *Institut Curie*, in the name of the legacy of Marie Curie?

But then the JCAR, despite a high quality and voluntary membership, could not fully meet its own first objectives either. Whereas these goals were clearly at odds with those of the JCR, the JCAR was forced to accept the toxic succession of its predecessor and the haunting question of the radium standard. The question of standards and

[92] IUPAC, *Comptes-rendus, XXIII Conference, Paris, 2 to 9 July 1965* (London: Butterworths Scientific Publications, no date), JCAR report, 164. IUPAC, *Comptes-rendus, XXIV Conference, Prague, 4 to 10 September 1967* (London: Butterworths Scientific Publication, no date), JCAR report, 122 (four lines).

[93] IUPAC, Bureau Minutes 22, October 29–30, 1968, Report on the activity of the commissions, 6, available at https://iupac.org/wp-content/uploads/2020/04/22_Bureau-Minutes_1968.pdf.

[94] IUPAC, Bureau Minutes 23, July 4, 1969, Cortina d'Ampezzo, minute 54, 9, available at https://iupac.org/wp-content/uploads/2020/04/23_Bureau-Minutes_1969.pdf.

[95] For the ICSU special and scientific committees, see Greenaway, *Science International*, 121–2.

[96] IUPAC 1965, 47.

[97] Allisy, the ICRU President from 1985 to 1997. Other members: Edgardo Picciotto, a geochemist, specialist on air radioactivity in the Antarctic; Richard D. Keynes, ARC, Cambridge (UK) who will be General Secretary, Vice-President, and President of the IUBS some years after; Hans Henriksen Ussing (IUB), a specialist on radio-isotope technology in living organisms, following the path opened by Hevesy in Sweden.

[98] Report of the 10th General Assembly (1960), 11, series B2aa, vol. 1 "1960–1966," IUPAP Gothenburg. See the chapter by Hof in this volume.

units of radioactivity ended up being mainly the responsibility of more appropriate international bodies, such as the BIPM, ICRU, or the ISO. Joint Commissions, and especially the topic of radioactivity and nuclear sciences were now dispersed across many national transnational and international agencies and multiparty ventures, and the international scientific organizations such as ICSU no longer held the monopoly of coordinating nodes of overlapping interest and expertise. The time of Joint Commissions had passed, beyond the inadequacy reached by the specific trajectory of the Joint Commission for Radioactivity.

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6
Restoring Physics
IUPAP's Commission on Education, Signature Pedagogies, and the Inter-National Politics of Science in the 1960s

Josep Simon

Between the late 1950s and early 1960s a series of initiatives in different parts of the world aimed at changing how physics was taught. Concerns about the outdated nature of physics teaching and its differentiated national character were considered an obstacle to the restoration of physics' universality for the sake of professional, social, and economic progress. Accordingly, a series of international conferences were planned through organizations such as the International Union of Pure and Applied Physics (IUPAP), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Organization for European Economic Co-Operation (OEEC; later OECD, Organization for Economic Cooperation and Development) and the Organization of American States (OAS). Concurrently, meetings were held in national contexts and some national projects developed their own internationalization strategies.

In 1960, IUPAP organized its first International Conference in Physics Education in Paris (with UNESCO and the OEEC) and appointed an ad hoc permanent Commission. Three years later, in Rio de Janeiro, its second conference (with UNESCO and the OAS) gathered physicists and educators from across Latin America. Conferences discussed issues from curricula and training strategies to laboratory work and new educational means. While emphasizing the universal benefits of science, they coupled pedagogical innovation to the politics of the physics profession, economic recovery after World War II, development, and national sovereignty. They were also public representations of behind-the-scenes interactions to reshape both physics and society that involved boundary work, diplomacy, and the demarcation between scientific and pedagogical knowledge, across geopolitical scales.

In this paper, I analyze these IUPAP conferences and the early workings of its Commission on Physics Education. First, I discuss the relevance of studying physics as a profession shaped in the pedagogical battlefield. Second, I provide an overview of the organization of these conferences and commissions. Third, I analyze their contents and dynamics. Finally, I characterize the signature pedagogy of post-war physics and its role in the making of physics as a profession.

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Physics as a Profession

Physics has rarely been discussed as a "profession." It is usually portrayed as a disciplined body of knowledge that emanates from universities as well as from national and international (disciplinary) societies controlled by university physicists. Occasionally, we admit that it has fundamental intersections with other disciplines such as chemistry and engineering, and tend to differentiate this type of physicists as "professional"—in a restrictive sense meaning "industrial" or "applied."[1]

That physics is a profession—in an unrestricted sense—is evident, unless we believe that universities are not employment bodies, but immaterial temples.[2] In addressing the workplace and the marketplace, the "profession" offers a stronger socio-political perspective than the "discipline." It comprehends not only a knowledge base but also a code of ethics, performance standards, regulatory and organizational practices and a group identity. Thus, we are able to focus "not on knowledge alone but on the professional groups representing disciplines or bodies of knowledge that claim the right to control particular areas of social policy that affect particular areas of human life."[3] The "profession" concept has been relevant for historians of medicine, engineering and chemistry who have characterized the emergence of national communities of specialized workers and the tensions across the scientific and technical professions.[4] It is a useful tool for the analysis of the interactions between the physicists, engineers, science teachers, educationists, psychologists, government officials, and organization and corporation representatives attending the aforementioned conferences.

Traditional views assume simplistic dichotomies between "pure" and "applied," "university" and "industry," "research" and "teaching." A discipline (physics) would

[1] An exception is Yves Gingras, *Physics and the Rise of Scientific Research in Canada* (Montréal-Kingston: McGill-Queen's University Press, 1991). As he argues, most authors do not focus on the "profession" or use the term superficially. Examples of this are Daniel J. Kevles, *The Physicists: The History of a Scientific Community in Modern America* (New York: Alfred K. Knopf, 1977); Dominique Pestre, *Physique et physiciens en France, 1918–1940* (Paris: Editions des archives contemporaines, 1984); Paul Forman, John L. Heilbron, and Spencer Weart, "Physics circa 1900: Personnel, Funding, and Productivity of the Academic Establishments," *Historical Studies in the Physical Sciences* 5 (1975): 1–185; Iwan Rhys Morus, *When Physics Became King* (Chicago: University of Chicago Press, 2005). On physics as a discipline see Josep Simon, "Writing the Discipline: Ganot's Textbook Science and the 'Invention' of Physics," *Historical Studies in the Natural Sciences* 46, no. 3 (2016): 392–427.

[2] John D. Bernal, *The Social Function of Science* (London: George Routledge & Sons, 1939), 9–10; Edward Shils, "The Profession of Science," *The Advancement of Science* 24, no. 122 (June 1968): 469–79.

[3] Eliot Freidson, *Professional Powers: A Study of Institutionalization of Formal Knowledge* (Chicago: University of Chicago Press, 1986), ix.

[4] See John C. Burnham, *How the Idea of Profession Changed the Writing of Medical History* (London: Wellcome Institute for the History of Medicine, 1998); Colin A. Russell, Noel G. Coley, and Gerrylynn K. Roberts, *Chemists by Profession: The Origins and Rise of the Royal Institute of Chemistry* (Milton Keynes: Open University Press [for] the Institute, 1977); Gerald L. Geison, *Professions and the French State, 1700–1900* (Philadelphia: University of Pennsylvania Press, 1984); Jack Morrell, "Professionalisation," in *Companion to the History of Modern Science*, ed. Robert Olby, Geoffrey N. Cantor, John R. R. Christie, and M. Jonathan S. Hodge, (London: Routledge, 1990), 980–9; Colin F. Divall and Stephen F. Johnston with James Donnelly, *Scaling Up: The Institution of Chemical Engineers and the Rise of a New Profession* (Dordrecht: Kluwer Academic, 2001); Sean F. Johnston, *The Neutron's Children: Nuclear Engineers and the Shaping of Identity* (Oxford: Oxford University Press, 2012).

be defined by "pure" knowledge produced in universities governed by research and subsequently transferred to industry and teaching.[5] This is a platonic vision, a labor organization scheme bestowing the top of the disciplinary and professional pyramid on university research physicists. It is unsustainable when we acknowledge the epistemological relevance and differential status of engineers' and teachers' ways of knowing, the relationships between university, disciplinary practices, and industry, and the feedback between research and teaching.[6]

According to David Kaiser, university enrolments and the Cold War problem of scientific manpower shaped in the United States not only "a less overt, yet longer-lasting form of politicization for the nation physicists," but also—through pedagogy—a different "American physicist's style of work." This phenomenon shaped "[p]hysicists' attitudes and judgements about what counted as appropriate topics for research and teaching."[7] Kaiser falls short, though, in interpreting its consequences for the physics discipline and profession. John Rudolph has emphasized the relationship between the 1960s new science education projects and the "professional desires of the American scientific community."[8] Research physicists turned to educational research to keep their funding while preserving their autonomy and refashioning their public image. This entailed collaboration with physics teachers and educational researchers, but also tensions. These tensions, I argue, were related in fundamental ways to dynamic processes of professional formation affecting these actors.

In line with Lee Shulman, I propose to place the focus of disciplinary and professional formation in the foundational role of pedagogy "in shaping the character of future practice and in symbolizing the values and hopes of the professions." I engage with his concept of *signature pedagogies* as the specific ways of teaching characterizing particular forms of professional preparation and "the three fundamental dimensions of professional work—to think, to perform, and to act with integrity," and I apply it to physics.[9] I contend that professionalization did not only happen in the national context, but was especially forged at the international level. Thus, I suggest the relevance of a focus on physics as a profession and on educational debates as expressions of the anxieties of professionalization among a wide range of actors.

[5] On the distinction between pure and applied physics in IUPAP's history see Martin's chapter in this volume.

[6] Daniel S. Greenberg, *The Politics of Pure Science* (New York: New American Library, 1967); Eugene S. Ferguson, *Engineering and the Mind's Eye* (Cambridge, Mass: MIT Press, 1992); John V. Pickstone, *Ways of Knowing: A New History of Science, Technology and Medicine* (Manchester: Manchester University Press, 2000); Terry Shinn, "The Industry, Research, and Education Nexus," in *The Cambridge History of Science*, vol. 5, ed. Mary Jo Nye (Cambridge: Cambridge University Press, 2003), 133–53; Kathryn Olesko, "Science Pedagogy as a Category of Historical Analysis: Past, Present, and Future," *Science & Education* 15, nos. 7–8 (2006): 863–80.

[7] David Kaiser, "Cold War requisitions, scientific manpower, and the production of American physicists after World War II," *Historical Studies in the Physical and Biological Sciences* 33, no. 1 (2002): 131–59, on 133–4.

[8] John Rudolph, *Scientists in the Classroom: The Cold War Reconstruction of American Science Education* (New York: Palgrave, 2002), 7.

[9] Lee S. Shulman, "Signature Pedagogies in the Professions," *Daedalus* 134, no. 3 (2005): 52–9, on 52–3.

American Hegemony and the Post-War Restoration of Physics (Education)

IUPAP's 1960 conference gathered delegates from twenty-eight countries in UNESCO's premises.[10] Europeans were the most numerous, with around four delegates from each of fourteen Western European countries and two delegates from each of five socialist European states (Czechoslovakia, Hungary, Poland, USSR, and Yugoslavia). Asia was only represented by Japan, Turkey, and the United Arab Republic; Latin America, by Chile and Mexico; the African continent, by South Africa; and Oceania, by Australia. The smallest representations were from Austria, Spain, Greece, Turkey, Czechoslovakia, Chile, Mexico, and Australia; the largest, from France (eight) and the United States (nine). There were also representatives from UNESCO, the OEEC, the International Atomic Energy Agency (IAEA), and the (US) National Science Foundation (NSF). The size of each delegation was determined according to the "number of contributory units donated" to IUPAP, aiming to represent "a rough measure of the development of physics and physics teaching" in each country.[11] It also depended on relative economic and political muscle: the highest monetary contributions were by the USA and USSR, followed by the UK, France, Italy, and West Germany.[12]

The conference was chaired by Sanborn Brown (physics professor at the Massachusetts Institute of Technology (MIT)) and Norman Clarke (a Bachelor of Science from the University of Manchester representing both the (British) Institute of Physics and the OEEC). According to Brown, the Paris conference resulted from conversations between him and William Kelly (head of the brand-new education department of the American Institute of Physics (AIP)) in the summer of 1958. Both had served in the committee on Apparatus for Educational Institutions of the American Association of Physics Teachers (AAPT). They allegedly realized that US physics teaching could benefit from international comparison, especially with Europe. Receiving AAPT support, Brown convinced IUPAP to plan an international conference. He then formed a committee with experienced physicists from the UK (Norman Clarke), Germany (Werner Kroebel), France (Pierre Fleury, as the IUPAP Secretary General, and Louis Weil, as the OEEC representative), Italy (Enrico Persico), Japan (Toshiro Kinbara), the USA (Elmer Hutchisson, AIP President), and UNESCO (Hilliard Roderick,

[10] Among IUPAP national members, only Bulgaria, Romania, Egypt, Israel, India, Pakistan, The Republic of China, New Zealand, Argentina, and Brazil did not send delegates. Greece, Turkey, the United Arab Republic, and Chile were not IUPAP members, but they sent delegates. The delegate of Chile was in fact a UNESCO officer.

[11] Sanborn C. Brown and Norman Clarke, "Preface," in *Proceedings of the International Conference on Physics Education* (Norwood, MA—New York: The Massachusetts Institute of Technology—John Wiley & Sons, 1960), v–viii, on v–vi.

[12] Larkin Kerwin, "The International Union of Pure and Applied Physics," *Physics Today* 22, no. 5 (1969): 53–5; G. R. Laclavère to Secretaries General and Treasurers of all the Unions, May 6, 1965; Larkin Kerwin, "IUPAP list of National Committees 1965;" Larkin Kerwin to G. Laclavère, May 26, 1965; H. W. Thompson, "I.C.S.U. Appeal," May 8, 1965, Fonds Larkin Kerwin, IUPAP series P202/B4, folder 34 "International Council of Scientific Unions, ICSU 1966–1984," Archives Université Laval; Larkin Kerwin to the chairman of IUPAP National Committees, November 3, 1965, series E1 "Larkin Kerwin's and Pierre Fleury's correspondence," vol. 1, folder 3 "Argumentation des parts 1969–1974," IUPAP, Quebec Secretariat, Center of History of Science, Royal Swedish Academy of Science (hereafter IUPAP Quebec).

Stanford nuclear physicist and Foreign Service Reserve Officer).[13] In the meantime, the AIP President had contacted IUPAP's President (Edoardo Amaldi) with a similar proposal. Secretary General Fleury agreed with Hutchisson on their common interest to strengthen collaboration between physics and teachers' societies (highlighting two fundamental sides of the physics profession).[14]

The US delegation at the Paris conference included physicists serving in the AAPT, in executive positions or in special committees. Most of them worked as physicists in engineering schools and were used to receive funding from both federal agencies and corporations. Some of them were renowned textbook authors (e.g., Francis Sears). Others, such as Francis Friedman and Jerrold Zacharias (the Physical Science Study Committee (PSSC)), and Harvey White (Continental Classroom) led educational projects shaped by the frenzy of topical technologies (film and television). Some of them had participated in a series of national conferences for the improvement of physics teaching organized in the USA since the mid-1950s.[15]

IUPAP's conference followed the model of previous US conferences in many ways partly due to the larger number of US delegates, including an NSF representative and US physicists in UNESCO and IAEA positions, even to the extent of surpassing the French hosts. It is almost certain that there was a concerted joint operation of this national community of physicists. They had institutional and professional relationships, which in certain cases dated back from their engagement in the World War II military effort and, later, in educational reform. In 1960s America, the network of physicists involved simultaneously in educational projects, professional societies, scientific foundations, and governmental advisory committees was closely tight and prone to revolving doors and cronyism.[16]

Months earlier, the OEEC released the report *A Modern Approach to School Physics* for discussion at the conference. It was produced by a "Group of Experts" (coordinated by Clarke), some of whom would join IUPAP's Commission on Physics Education (Clarke, Antonius Michels, Daniele Sette). Others were part of the Paris conference organizing committee (Clarke and Weil). The conference resolutions established that such a commission should be set "possibly in collaboration with other international organizations," as "an international committee of professional physicists." It would conduct evaluative international surveys on physics education (at all levels), develop experiments in physics teaching improvement, review the

[13] Brown and Clark, "Preface," v–viii; William C. Kelly, "Witness at Creation: I.C.P.E.'s Founding and Early Years," in *I.C.P.E. Histories*, comp. E. Leonard Jossem, 1985–88, series B4 "Essays of IUPAP's activities," incl. its commissions," vol. 1, IUPAP, Gothenburg secretariat (hereafter IUPAP Gothenburg), Center of History of Science, Royal Swedish Academy of Science; United States Department of State, "Obituaries: Hilliard Roderick," *State. The Newsletter* 291, July (1986): 79.

[14] Pierre Fleury to Professor E. Hutchisson, February 5, 1959, and Elmer Hutchisson to Pierre Fleury, January 8, 1959, series E1 "Larkin Kerwin's and Pierre Fleury's correspondence," vol. 3, folder 24 "Commission on publications, also report to the President of ICSU 1960," IUPAP Quebec.

[15] Josep Simon, "The Transnational Physical Science Study Committee: The Evolving Nation in the World of Science and Education (1945–1975)," in *How Knowledge Moves: Writing the Transnational History of Science and Technology*, ed. John Krige (Chicago: University of Chicago Press, 2019), 308–42; Archie K. Lacey, "'Continental Classroom' and the Small Science Department," *Science Education* 43, no. 5 (1959): 394–8; Raymond J. Seeger, "Progress Report on Physics in Engineering Education," *American Journal of Physics* 24, no. 2 (1956): 70–7.

[16] See Rudolph, *Scientists in the Classroom*.

methods of student and teacher assessment as a measure of pedagogical effectiveness, and promote the "exchange of information and ideas" through for instance international conferences.[17] Contemporaries noted the 1960 conference recommendations of "a major improvement in the degree of professionalism and the working conditions of physics teachers and a closer relationship between universities and secondary schools in the area of physics education."[18]

A month after the Paris conference, the IUPAP General Assembly held in Ottawa confirmed the formation of the Commission on Physics Education, chaired by Brown, with Clarke as Secretary, and members Pierre Fleury (France), Antonius M. J. F. Michels (Netherlands), Daniele Sette (Italy), Jayme Tiomno (Brazil), and Vasily S. Fursov (USSR). Correspondent members were Mahmoud A. El Sherbiny (Egypt) and Miloslav Valouch (Czechoslovakia).[19] Tiomno would be the prime mover of the second IUPAP conference which, even before the Paris conference, IUPAP's Secretary General was taking for granted would be in Rio.[20]

With support from the new commission, Kelly coordinated the publication of *A Survey of the Teaching of Physics at Universities*, with data from Czechoslovakia, Germany, France, Great Britain, the USA, and the USSR; and he also produced a specific report only for the USA.[21] In 1966, Kelly substituted Clarke as Secretary of the commission. He had by then great experience in an analogous role at the AIP.

Following the Paris conference, the PSSC—an MIT project—organized a workshop to introduce its pedagogical materials in Europe. The OEEC sponsored both IUPAP's conference and the PSSC workshop. Conversations between the PSSC and OEEC officers illustrate the robust connections of science pedagogy with disciplinary knowledge and the international politics of science: knowledge content or subject matter were closely linked with pedagogical techniques, making both aspects hardly separable. This matches Shulman's concept of *pedagogical content knowledge* characterizing *signature pedagogies* that I use in the next sections.[22] Moreover, an integrated transformation of physics and its pedagogy would only be attained through focused

[17] IUPAP, "International Conference on Physics Education. Resolutions," in Brown and Clarke, *Proceedings*, on 1–3.

[18] Anthony P. French, "The International Commission on Physics Education," *Contemporary Physics* 21, no. 4 (1980): 331–44, on 335.

[19] Pierre Fleury, ed., *L'Union Internationale de Physique Pure et Appliquée. État au 1er janvier 1961. Procès-verbal de la dixième Assemblée Générale (1960). Janvier 1961. U.I.P. 8* (Paris: Secrétariat. IUPAP, 1961), 12, 28, IUPAP Gothenburg, series B2aa "General Reports," vol. 1.

[20] Cesar Lattes to Pierre Fleury, March 1, 1960, and Pierre Fleury to César Lattes, July 21, 1960, series E6 "Correspondence with Liaison Members," vol. 2, folder 6 "Brazil (Brasilien) 1950–1999," IUPAP Gothenburg.

[21] William C. Kelly, coord., *A Survey of the Teaching of Physics at Universities* (Paris: UNESCO, 1966); and *Survey of Education in Physics in Universities of the United States* (New York: American Institute of Physics, 1964).

[22] This concept encapsulates the relationship between how a school discipline is taught and what is taught: what teachers know about their practice (pedagogical knowledge) and what they know about what they teach (subject matter or disciplinary knowledge). Pamela L. Grossman, Suzzane M. Wilson, and Lee S. Shulman, "Teachers of Substance: Subject Matter Knowledge for Teaching," in *Knowledge Base for the Beginning Teacher*, ed. Maynard C. Reynolds (Oxford: Pergamon Press, 1989), 23–36; Lee S. Shulman, "Paradigms and Research Programs in the Study of Teaching: A Contemporary Perspective," in *Handbook of Research in Teaching*, ed. Merlin C. Wittrock (New York: Macmillan, 3rd edn, 1986), 3–36.

and intensive practice. Finally, US hegemony in physics pedagogy required hard work through sustained negotiations by individuals, professional societies, and national organizations in the framework of international meetings.[23]

The workshop was held at the Cavendish Laboratory (UK), one year after the Paris conference, and attended by teachers from fourteen European countries. The OEEC group of experts discussed the PSSC proposal, and Clarke managed all the practical arrangements.[24] While the OEEC desired a diverse program (in the mold of IUPAP's conference) displaying its own initiatives and the views of European physicists and physics teachers, the PSSC strove for an exclusive focus on PSSC material and staff. The PSSC perspective prevailed and IUPAP's participation was null (Clarke attended only as an OEEC representative).[25]

IUPAP's second conference on physics education (Rio de Janeiro, 1963) was similar to the first one in the number of participant countries (twenty-nine) and attendants (more than 150). It was hosted by the *Centro Brasileiro de Pesquisas Físicas* (CBPF), the *Centro Latino Americano de Física*, UNESCO, Brazil's Ministry of Education and Culture, and its national research council, and coordinated with the OAS—which a week earlier held an analogous (but inter-American) conference at the same place. The only change in the Commission on Physics Education was the substitution of Fursov by A. S. Akhmatov (Moscow's Institute of Machines and Instruments).

There was a large representation from Brazil, more than eighty delegates (around half of the conference participants) from across the country, but especially from Rio and São Paulo. Because of the OAS conference, there were representatives from all American countries, except Cuba, Haiti, Jamaica, and a few small Caribbean states.[26] After Brazil, the largest delegations were from Argentina and Chile, followed by Peru, Mexico, and Venezuela—each of these quantitatively comparable to the US delegation, which however included additional representatives from the OAS, the AIP, the NSF, the Ford Foundation, the US Regional Science Office for Latin America, and the embassy. Brazil, Argentina, Venezuela, France and the Netherlands sent representatives of their ministries of education. The only European delegates represented Czechoslovakia, France, Italy, the Netherlands, Spain, Sweden, and the UK. This time, Canada, South Africa, and Japan sent representatives, but not Australia. Morocco had a delegate for the first time, but there were no others from the Arab world.

The *Centro Latinoamericano de Física* (co-host of the conference), had been established in the CBPF's premises in March 1962, in coordination with the Brazilian Ministry of Foreign Affairs and fifteen Latin American countries, following a

[23] Francis Friedman to Robert Ganeff, January 25, 1961, PSSC Records, series MC626, box 12, folder "Correspondence 1961–1962," the MIT Archives.

[24] Robert Ganeff to Professor Friedman, January 13 1961, PSSC Records, series MC626, box 12, folder "Correspondence 1961–1962."

[25] Robert Ganeff to Professor Friedman, January 25, 1961, PSSC Records, series MC626, box 12, folder "Correspondence 1961–1962"; Friedman to Ganeff. January 25, 1961; James Ronald Gass to Uri Haber-Schaim, December 12, 1960 and Uri Haber-Schaim to J. R. Gass, January 27, 1961, PSSC Records, series MC626, box 12, folder "Correspondence 1961–1962."

[26] IUPAP Latin American members were Mexico (1925), Brazil (1951), and Argentina (1951). Bolivia joined in 1963, Cuba in 1969.

UNESCO resolution. It intended to further research and training in physics with a focus on technical advice, large-scale problems, and Latin American professionals.[27]

Pedagogical Content Knowledge in IUPAP's Paris Conference, 1960

In his opening address, René Maheu, UNESCO's acting director general considered that "it is obviously an impossibility to draw up a universal textbook for the teaching of physics, because even though physics is universal, the conditions of teaching of physics most certainly are not, and the degree of progress in the various countries varies considerably."[28]

The conference resolutions considered physics as a "unique interplay of logical and experimental disciplines," and the study of its subject matter and "physicist's methods of acquiring and evaluating knowledge" as a must for all school students. There was a critical need of "specialized teachers who can keep abreast of developments in a rapidly growing subject." A main goal was "to improve both the efficiency and the attractiveness of physics teaching as a profession" and to demarcate the physics teacher profession: in secondary and university education, "physics should be taught by physicists, that is, by men and women who have received a professional training in physics." This might seem obvious, but it diverged with most school contexts (with a diversity of training profiles, in the sciences, engineering, and teaching). It aired the university physicist's anxiety for bringing the school physics teacher to the university ways of conceiving and practicing specialized knowledge. Improving the salary and status of physics teachers was only secondary to providing them with the conditions for performing experimental work (time, apparatus, training). It was thus that teachers would "feel that they form an integral part of the development of physical knowledge."[29] Clearly, a top-down approach, in which university physicists would enlighten schoolteachers with their knowledge and practice. The conference itself was a perfect illustration of this view since school physicists were practically absent.[30]

The OEEC report stressed the development of a new way of teaching physics in general education (subsequently the topic of the Rio conference). Clarke emphasized the need for distinguishing science from technology and appreciating the cultural value of science for all students. He suggested changing the traditional sequence of physics courses (governed by mechanics), rounding the concept of atoms and molecules, and a balanced combination of theory and experiment.[31]

The conference discussion of examinations (and their evaluative vs. selective function) contained empirical experience and some reflection, but a dearth of pedagogical methodology (from educational psychology and science education research).[32] One

[27] Gabriel Fialho to IUPAP President, March 18, 1962, series E6 "Correspondence with Liaison Members," vol. 2, folder 6 "Brazil (Brasilien) 1950–1999," IUPAP Gothenburg.

[28] René Maheu, "Greetings from UNESCO," in Brown and Clarke, *Proceedings*, on xv–xvi.

[29] IUPAP, "International Conference on Physics Education. Resolutions," on 3.

[30] The only physicists with experience in school contexts were arguably Marcel Eurin, Antonius Michels, Ruud L. Krans, and Malcolm R. Gavin.

[31] Norman Clarke, "Physics as a Part of General Education," in Brown and Clarke, *Proceedings*, 12–22.

[32] "Examinations in Physics," in Brown and Clarke, *Proceedings*, 23–33.

of the presenters considered that what universities produced was "training in an intellectual discipline." The physics professional was only made subsequently through practice[33]—something that applies to every profession.

US initiatives were given prominence. In a monograph session early in the conference, Zacharias presented the PSSC. He stressed the requirement for physics students to "acquire insight into the scientific process, not merely a catalogue of scientific and technological facts." The PSSC advocated for selective subject matter, general connective principles across classroom materials, and a set of "interrelated learning aids," a combination of "exploration in the laboratory, analysis in the text, and illustration by means of films" (also able to substitute complex or expensive experimental sets). The PSSC package was on the market just one month after the Paris conference, and early this year, they were already planning to export it.[34]

The working program of the conference closed after seven days, with a monograph session on film and television, as a cutting-edge means of physics teaching dominated by a US initiative. White discussed his involvement in televised physics courses, and the capacity of television for large-scale audiences, to strengthen teacher authority, multiply pedagogical clarity, and focus student attention. Television and film were the modern replacement of the traditional textbook. Kelly (as AAPT representative) emphasized the capacity of films for focused classroom practice introducing research physicists and laboratories to school students. Discussants expressed, however, concerns about television and film substituting the teacher's practice, their teaching efficiency, cumbersome technical handling, and pedagogical limitations (unidirectional communication). The OEEC also informed of its projects in that field.[35]

Between MIT's *Physical Science Study Committee* and Berkeley's *Continental Classroom*, a series of monograph sessions staged a more diverse range of national delegate interventions, across a conference week devoted to finding the soul of physics inside its fundamental educational problems.

"The Place of Laboratory Work in Teaching Physics," was tackled by Malcolm Gavin (University College of North Wales), experienced both in school teaching and industrial physics. For him, laboratory teaching allowed acquiring practical skills and methods, and introducing students into the physics way of thinking. Aspects to consider were the role of lecture demonstrations vs. laboratory experiments conducted by the teacher or by students themselves, measurement errors and recreation of real situations, and experiment interpretation. The selection of experiments for a non-specialist course depended on various pedagogical priorities: subject matter, problem experiments framed in school research projects, or relative availability. It was relevant to consider how laboratories could be fruitfully used with large student numbers. A historical approach (through classic experiments) could be motivational and generally useful.

[33] G. K. T. Conn, "The Selection of Students," in Brown and Clarke, *Proceedings*, 34–9.
[34] Jerrold R. Zacharias, "The Work of the American Physical Science Study Committee," in Brown and Clarke, *Proceedings*, 40–53, on 41; Simon, "The Transnational," 317–26.
[35] "The Use of Television and Films in Physics Teaching," in Brown and Clarke, *Proceedings*, 100–21.

The question of science equipment supplies in countries with limited resources (e.g., Latin American countries) was raised by Hilliard Roderick and Nahum Joel (representing UNESCO). It was necessary to design experimental work with simple apparatus, for instance using domestic appliances. In this context, Kelly advertised the work of the AAPT's Committee on Apparatus, which had established programs with commercial companies and circulated apparatus designs amongst US universities. An exhibition of physics teaching apparatus was available throughout the conference, dominated by French and British university laboratories together with US, British, and West German companies, and one or two stands by Swedish and Swiss instrument makers.[36]

Discussions on subject matter, methods, and materials flowed in several streams debating the training and profiling of physicists. In a monograph session, Boris Rosen (Université de Liège), valued particularly the professional task of the teacher: "at a higher level of teaching, ... research and teaching inevitably go together, and, while it is agreed that mediocre teachers can do excellent research, the opposite is difficult to conceive."[37] The field was characterized by lack of communication between schools and universities. It was thus necessary to develop in-service university training opportunities for teachers and research groups in order to integrate high-school and university professionals. The OEEC report followed analogous lines and displayed the tension between educational interest (the "educators" or "educationalists") and specialized interest ("the physicists").[38]

The dichotomy between acquiring new physical knowledge vs. new pedagogical techniques was also explicit among professional teacher trainers. Ruud Krans (*Universiteit Utrecht*) suggested that after choosing the teaching profession late in their physics degrees, the non-specialized nature of most pedagogical training deterred many students to follow this career. While Krans emphasized the urge of a special physics didactics, Hans Staub (a Swiss nuclear physicist) stressed that "the training of a physicist should be exactly the same whether he goes into research or he goes into teaching. We simply want to educate him to be a good scientist." For him, the importance of pedagogical courses was overrated. His view that "[a] good physics teacher is simply a good teacher" was shared by many conference attendants. He also claimed that "a good teacher, is just born, we cannot educate him to be one."[39]

The epistemological fragility of these firm beliefs among university physicists is evidenced by simply substituting "physicist" for "teacher" in the last quotation, and asking: is formal training required or not for the making of physics researchers, professors and teachers?

The following conference sessions intended to define physics by demarcating it from neighboring fields. A major theme was physics for engineers, chemists and other science students. Pierre Aigrain, a French solid state physicist, considered that mathematics played the essential role (distinguishing physicists from chemists). He reckoned that "the distinction between engineer and physicist is disappearing," and

[36] "The Place of Laboratory Work in Physics Teaching," Brown and Clarke, *Proceedings*, 54–72.
[37] Boris Rosen, "The Training of Teachers," in Brown and Clarke, *Proceedings*, 73–87, on 74.
[38] In the following paragraphs, I analyze the discussion developed in the session opened by Rosen.
[39] Rosen, "The Training of Teachers," on 80.

engineers were more needed in growing economies (e.g., those of developing countries). The physics curriculum should be the same for engineers and physicists, but the former should periodically take refresher courses given by the latter.[40]

Conversely, C. Guy Suits (from General Electric) expressed the great interest of industry for physicists, but the required adaptation of their university training to industrial research.[41] This view was shared by conference attendants affiliated to engineering schools—especially the Polish, Finnish, Soviet, and German delegates: engineering required different types of physics courses. In a lengthy report, the Soviet delegate characterized "technical or engineering physics" and described how it was organized in the USSR, with an emphasis on avoiding segmentation by physics subdisciplines.[42]

While the conference ended with a session looking at the (US) present and future of film and television physics teaching, its organizers preferred to end the published proceedings with a discussion on "The Impact of Organizations of Professional Physicists," based on pre-circulated papers. Societies were the most powerful organizations acting on the demarcation of the discipline and regulation of the profession. The session was strongly driven by Anglo-US perspectives, with contributions by Kelly (AIP), Leonard Olsen (AAPT), and Clarke ((British) Institute of Physics).

Kelly informed once again on the wide range of activities developed by the AIP. Olsen emphasized the relation between teachers' competence and command of subject matter. The AIP's and the AAPT's projects were developed by university research physicists who had recently become interested in educational reforms. According to Clarke, a professional society was responsible for advancing the subject it represented by defining professional competence. It was constituted by a restricted number of (competent) members responsible for advancing the interests of the discipline. As Clarke revealed, the Institute of Physics' membership included university professors, research students, and directors of industrial firms, but not schoolteachers.[43]

Clarke's expression of the mission of professional and disciplinary societies (national or international) is naive. The professional aim of advancing physics as a discipline is particularly visible across IUPAP's Paris proceedings. At the same time, the conference represented quite exclusively the professional interests of university physicists and their particular vision of the subject and its teaching. Another relevant question is to what extent the conference favored the interests of particular national communities of physicists (e.g., US, British, and French delegations)?

The Paris and Rio conference proceedings were also full of prejudiced and patronizing views on physics in countries beyond Europe and the USA. In one of the Paris opening addresses, Yves Rocard (École Normale Supérieure) used a deterministic geo-climatic approach (as old as the French Enlightenment),[44] to characterize scientific progress in different areas of the world. Moreover, he considered

[40] Pierre Agrain, "The Teaching of Physics to Engineers, Chemists, and Other Science Students," in Brown and Clarke, *Proceedings*, 122–7.

[41] C. Guy Suits, "The Postgraduate Training of Physicists," Brown and Clarke, *Proceedings*, 88–95.

[42] Brown and Clarke, *Proceedings*, 122–40, esp. 124.

[43] "The Impact of Organizations of Professional Physicists," in Brown and Clarke, *Proceedings*, 149–64.

[44] See David Arnold, *The Problem of Nature: Environment, Culture and European Expansion* (Oxford: Blackwell, 1996).

that in underdeveloped countries—that he characterized as places "without airplanes, without motor cars, and without radios"—experimental physics teaching would be increasingly required to introduce school children to modern civilization.[45] In developed countries, this might be redundant since pupils would easily find a natural familiarization with scientific and technical cultures at home.

This argument would be mentioned again in the Rio conference by one of the Brazilian delegates (engineer Paulo Leite), despite the rather advanced early development of aviation, automobility, and radio in Latin America.[46] Moreover, Brazil had organized its first national course for the improvement of physics teaching in secondary education a decade before IUPAP's 1963 conference. The second edition of this course (1955) was held at the Technological Institute of Aeronautics, in São José dos Campos—a town immersed in the process of becoming a major technological cluster. The meeting proceedings displayed premises with well-catered laboratories.[47] This level of equipment would not apply to most educational institutions across the country. Still, Brazil had a large network of physics and engineering institutions already performing critical physics research and teaching.[48]

IUPAP's 1957 General Assembly had raised the question of helping some countries to develop physics further. The proceedings' French version referred to "physics knowledge and research;"[49] the English version, to "physics teaching and research"—thus emphasizing the role of teaching in the making of disciplinary knowledge.[50] Debates referred to "countries where this seems desirable;" the resolutions termed them as "*under-developed* countries" (note the italics suggesting a novel and not yet standardized linguistic use). It was agreed to channel this aim through UNESCO and that it could only succeed when some capability was already in place.[51] The Eleventh General Assembly of the International Council of Scientific Unions (ICSU) (Bombay, 1966) established a Committee on Science and Technology in Developing Countries.[52] In the 1970s, IUPAP's assemblies favored the use of the binomial "developing"/"developed" (country). We thus know that a country might become "developed" by developing its physics more. However, beyond a common—techno-deterministic, lineal, and asocial—use of the term "development," there was no real

[45] Rocard, "Opening Address," in Brown and Clarke, *Proceedings*, 5–6, on 6.

[46] Araceli Tinarejo and J. Brian Freeman, eds., *Technology and Culture in Twentieth-Century Mexico* (Tuscaloosa, AL: The University of Alabama Press, 2013); David Pretel and Helge Wendt, eds., "Special Issue: History of Technology in Latin America," *History of Technology* 34 (2019): 1–256.

[47] IBECC, *II Curso de aperfeiçoamento para professores de física do ensino secundário* (São Paulo: Instituto Brasileiro de Educação, Ciência e Cultura, 1955).

[48] Simon Schwartzman, *A Space for Science: The Development of the Scientific Community in Brazil* (Philadelphia: The Pennsylvania State University Press, 1991), 199–214; Simon, "The Transnational."

[49] In French, "*connaissances*" (not generic, but plural).

[50] More on this in Simon, "Writing the Discipline," and John L. Heilbron, "History of Science or History of Learning," *Berichte zur Wissenschaftsgeschichte* 42, nos. 2–3 (2019): 200–19.

[51] IUPAP. *État au 1er janvier 1958. Procès-verbal de la neuvième Assemblée Générale (1957)*, 24 (article d) and 28 (Résolution 2), and *Position at 1 January 1958. Report of the Ninth General Assembly (1957)*, 23 (article d) and 27 (Resolution 2), series B2aa, vol. 1 "General Reports," 1923–1966, IUPAP Gothenburg.

[52] Frank Greenaway, *Science International: A History of the International Council of Scientific Unions* (Cambridge: Cambridge University Press, 1996), 123 and 133.

discussion at IUPAP's conferences on the complex, multi-sided, and contested aspects of the rhetoric and actions of "development."[53]

The week before the IUPAP conference, the OAS conference had displayed a full picture of the physics profession in Latin America. Kelly and Rogers gave papers at that conference too, and Brown was in its advising committee, although he might not have attended. All pre-circulated papers were written in Spanish and Portuguese except those by Kelly and Rogers; none of them were cited in the proceedings of IUPAP's Rio conference. Many US and European participants in IUPAP's conferences evidenced they had a biased and misinformed view of Brazil and Latin America, analogous to that of an "empty continent" held by European colonizers.[54]

Pedagogical Content Knowledge in IUPAP's Rio de Janeiro Conference, 1963

In their preface to the 1963 conference proceedings, Brown and Clarke (with the acquiescence of Tiomno as third signing author) justified the selection of Rio "because of relatively easy accessibility from other Latin American countries" and "the attractiveness of the city itself." In parallel, they stressed that "the less developed countries of the world are obviously unable to offer such clear advantages" as the "virtually unlimited amount of experienced assistance and advice," research laboratories, scientific apparatus manufacturers, and other scientific resources available in Europe and the USA. According to them, "import formalities and restrictions made it impossible to have a truly international exhibition of equipment, and no exhibition of books could be arranged" at Rio.[55] This was inaccurate, and a sign of the biased politics of the conference—conceived as a platform for acculturating Latin American research and teaching physicists in the US and European physicists' gospel. Nonetheless, in Rio, there was an exhibition of teaching apparatus from Brazil (Instituto Brasileiro de de Educação, Cinência e Cultura, IBECC), the USA (AAPT), and Sweden.

The conceptual organization of the meeting was run by Brown and Clarke as representatives of the interests of US and British/European university physicists. Only the practical aspects were handed to the Brazilian hosts, and the availability in Brazil of scientific facilities, research teams, specialized libraries and laboratories, and science teaching innovation projects were considered very partially. Moreover, while European and especially US physicists had indeed superior material means, they analogously struggled with critical needs of educational reform and science teaching

[53] See Ricardo Bielschowsky, (org.), *Cincuenta años de pensamiento en la CEPAL: Textos seleccionados* (Santiago: CEPAL-Fondo de Cultura Económica, 1998); Arturo Escobar, *Encountering Development: The Making and Unmaking of the Third World* (Princeton: Princeton University Press, 1998).

[54] Unfortunately, the scientific, technological and educational developments of the 1950s were truncated by the military coup d'état in Brazil, nine months after IUPAP's conference, which forced relevant physicists (e.g., Tiomno) and educationists (e.g., Raw) to go into exile. IUPAP's conference proceedings, had no mention to this fact. On the "empty continent," see Eduardo Subirats, *El continente vacío: La conquista del Nuevo Mundo y la conciencia moderna* (México DF: Siglo XXI, 1994).

[55] Sanborn C. Brown, Norman Clarke, and Jayme Tiomno, "Preface," in *Why Teach Physics? Based on Discussions at the International Conference in General Education* (USA: IUPAP-The MIT Press, 1964), v–viii, on vi–vii.

apparatus supply.[56] The fourteen talks at the Rio conference were all—except two—by European and US physicists. There was a greater effort to include members of most delegations in the organized discussions of the papers.

In his opening address, Tiomno delved into the then common discourse of scientific and technological progress for development, and considered that "[i]t is a propitious sign for humanity as a whole that the cold war between the world's two greatest powers is being replaced by technological and educational competition."[57] A decade earlier, he had co-authored a diagnostic paper on school physics teaching in Brazil, and a translation of a 1940s textbook by Oswald Blackwood, revised in the mid-1950s with the help of Kelly.[58] The resolutions of the First Inter-American Conference on Physics Education, appended to Tiomno's paper, were chiefly a refined version of the Paris conference resolutions.[59]

In his presentation, entitled "Observations on the Teaching of Physics in Developing Countries," Paulo G. de P. Leite underlined the excessive emphasis in Brazilian school and university teaching on "description of facts and apparatus" and "formal development of equations," against a more essential understanding of "physical phenomena and concepts," and the ability to perform experimental teamwork. According to him, these flaws were connected to lack of training in educational psychology and a curriculum oriented towards engineering school entrance examinations.[60] Leite described, in fact, a state of affairs characterizing any of the countries attending IUPAP's conferences—which, for instance, had triggered the US school science reform in the mid-1950s. The same emphasis was given by Brown in his address "Cultural Values in Science Teaching," but he referred more restrictively to the conceptual structure of physics—much in the PSSC mold.[61]

In the discussion of Brown's rather general and clumsy paper, a tension emerged between a number of physicists with different profiles and commitments across pedagogy, management, and research. Picking on a general reference made by Brown, Zacharias criticized him by stating that the suggestion that "any subject can be taught effectively in an intellectually honest form to any child at any stage of development" was only applicable to mathematics. This occasion was picked up by Richard Feynman—who joined the US delegation while a visiting physicist at the CBPF—to jump into the discussion by asking "whether anyone yet knew enough about teaching physics to nonspecialists to justify discussing the subject on an international basis." Oppositely, Clarke and Sette reacted with arguments and data in defense of Brown.[62]

[56] Simon, "The Transnational."

[57] Jayme Tiomno, "Science Education in the Contemporary World," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 7–10, on 9.

[58] Jayme Tiomno and José Leite Lopes, "O ensino da física nos cursos secundários," *Ciência e Cultura* 5, no. 1 (1953): 45–7; Ildeu de Castro Moreira, "Feynman e suas conferências sobre o ensino de física no Brasil," *Revista Brasileira de Ensino de Física* 40, no. 4 (2018): e4203-1-e4203-7; Ostwald H. Blackwood, Wilmer B. Herron, and William C. Kelly, *Física na Escola Secundária* (Rio de Janeiro: Fundo de Cultura, 1958).

[59] Tiomno, "Science Education in the Contemporary World."

[60] Paulo G. de P. Leite, "Observations on the Teaching of Physics in Developing Countries," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 11–12.

[61] Sanborn Brown, "Cultural Values in Science Teaching," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 13–19.

[62] Ibid., 18–19.

Feynman's intervention was particularly insolent, but no more so than the keynote address he had given at the OAS conference, pompously entitled "The Problem of Teaching Physics in Latin America."[63]

This tension also appeared in the defense by practicing physicists of pedagogical approaches resting on different epistemological and socio-political foundations. Feynman contended that there was an essential epistemological difference between science and the humanities and mixing "the two together at too early an age is a danger and a destroyer of the true cultural value of science." Science was exceptionally characterized by "clear thinking, a knowledge of one's hypothesis and constant reference to experiment which was a guide to truth that was independent of authority or of opinion," thus, it "should be taught in the purest way possible."[64] This has been a typical perspective of many research scientists.[65] It was nonetheless in stark contrast with the views of Gerald Holton, as presented in an inaugural talk in Rio. Holton considered that,

> Indeed, "pure" physics is an invention that exists only in the old-fashioned classroom. As soon as a real problem in physics, or any other field, is grasped, it appears that there hang from it connections to a number of expected and unexpected problems in fields that, by habit, we make our students think of as "belonging" to other professions.[66]

The challenge of developing a physics course for non-physicists offered the opportunity of rebuilding physics pedagogy on more solid foundations and demonstrating the relevance of physics in general culture. He proposed a "connective approach to the teaching of physics" based on the articulation of a "constellation" of related disciplines: A new picture would emerge in any student, of "physics as a member of a constellation of concerns, so different from the usual, artificial picture of physics as the isolated and stern subject that has nothing to contribute to anything but more physics."[67] Holton did not only seek greater pedagogical efficiency, but also a civic ethos applied through schooling to the "university" (as scholarly community) and the USA (as a diverse society). Other conference delegates such as Xavier Roser and Antonius Michels advocated for a similar ethos.

Like Holton, and in contrast with Feynman, Eric Rogers considered too that "[w]e must not hope to train our nonscientists to be scientific, with a full knowledge and practice of some mysterious ideal 'scientific method' such as that artificial scheme set forth by Sir Francis Bacon, and still preached by philosophers but not practiced by real physicists!"[68] Rogers was the author of *Physics for the Inquiring Mind* (1960)

[63] Richard Feynman, "The Problem of Teaching Physics in Latin America," *Engineering and Science* 27, no. 2 (1963): 21–30; Moreira, "Feynman," e4203–2– e4203–3.

[64] Brown, Clarke, and Tiomno, *Why Teach Physics?*, on 18.

[65] David Locke, "The Putative Purity of Science," in *Science as Writing* (New Haven: Yale University Press, 1992), 133–66.

[66] Gerald Holton, "The Goals for Science Teaching," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 27–44, on 38.

[67] Holton, "The Goals for Science Teaching," on 39–41.

[68] Eric M. Rogers, "Teaching Physics for Understanding in General Education," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 51–60, on 52.

and one of the (British) Nuffield Science Teaching Project coordinators. He emphasized a selective subject choice on which to get in depth and build clear and durable understanding. However, he admitted many possible choices, as long as the selected subjects allowed linkages across physics. He also wanted students to build their own guided classroom and laboratory research with simple equipment (available in the domestic context). In his update on the PSSC, Zacharias noted the connections with Rogers' approach and expounded the expanding use of the PSSC course in the USA and adaptation in several European, Latin American and Asian countries.[69]

Isaias Raw emphasized the need to develop elementary science teaching in relation with daily life, through experimental teaching with the aid of cheap scientific kits, television programs and science fairs. Raw had started his work in the 1940s and subsequently had a major role in UNESCO's Pilot Physics course and the Brazilian PSSC's adaptation. He had also constituted a team with its own educational projects through UNESCO's IBECC, the Universidade de São Paulo, national and international funding, and the attempt to establish a teaching equipment company, analogously to the scheme developed by PSSC.[70]

Connectedly, Albert Baez, head of UNESCO's Division of Science Teaching, explained their Pilot Physics course: UNESCO developed a large number of actions and served more than a hundred member states. However, its budget was typically the same as that of the PSSC for just one country and one science. Its physics project used programmed instruction, low-cost experiments, film, and television. It relied on the IBECC's cumulated experience in the production of inexpensive science teaching equipment, and teacher training. The project had the potential to congregate teachers and university lecturers from across Latin America.[71]

In his presentation, Daniele Sette informed about other pilot courses, developed by the OECD in the Scandinavian countries, Spain, Italy, and Yugoslavia, using PSSC materials and their adaptations. Amongst these, a project in Sicily with mobile units for physics teaching with experiments, in places with little access to this expertise and equipment.[72] Christina A. M. Michels-Veraart (*Universiteit van Amsterdam*) focused on educational psychology, the relevance of understanding how children build their notions of causality, and how physics could contribute to the development of their interest in the world around them.[73]

John L. Lewis explained that the UK had not adopted the PSSC, due to having a different physics teaching tradition, enough pedagogical expertise, and a better-suited course by the Nuffield Foundation. He stressed that like the PSSC, the Nuffield course included atomic physics—a novel teaching subject able to catch student's attention, promoting critical thinking, integrating historical and philosophical perspectives,

[69] Jerrold R. Zacharias, "Curriculum Reform in the U.S.A.," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 66–70.

[70] Isaias Raw, "The Brazilian Institute of Education, Science and Culture (IBECC)," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 61–4; Simon, "The Transnational," 321–23.

[71] Albert Baez, "UNESCO and Science Teaching," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 75–7.

[72] Daniele Sette, "Some European Developments in Science Teaching," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 64–6.

[73] Christina A. M. Michels-Veraart, "Science in Elementary and Secondary Education," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 45–50.

connecting with chemistry, and allowing a good amount of experimental work. Nuffield had also produced some films, but favored classroom experiments and had collaborated with British instrument makers to produce low-cost teaching apparatus. The project explicitly engaged schools and schoolteachers (such as Lewis himself).[74] Analogously, Swedish delegates advocated for a pedagogical approach focused on demonstrative experiments with the aid of simple and inexpensive designs. Like the British, they had been able to involve local instrument makers in a Swedish line of teaching experiments and apparatus, displayed at the conference.[75]

The closing session of the conference, chaired by Brown, recommended educationists and governments all over the world to "be acquainted with the important work in this field currently being done in Europe, the U.S.A., and elsewhere," and adapting or using it according to their needs. As the conference theme was "physics in general education," and since only "a very small proportion of the population of any country will be professional physicists," its focus was to make physics "a working tool in the life of the educated man." According to Brown, it was therefore agreed that the stress should be on the "conceptual framework of physics, … and not merely individual facts" (although this was actually not a simple and inconsequential pedagogical choice). Physics should be taught across the school curriculum and start at an early age. Depth should be favored against breadth, but a core of the more distinctive topics should be given to all students, even to those not expecting to become "professional physicists." Examples of new pedagogical schemes discussed at the conference were the PSSC, Nuffield (for Brown "in a way similar to PSSC but designed to cover several years"), UNESCO's pilot project (developed in Brazil), and the project of Mobile Units in Sicily (useful in countries with scarce teaching resources and trained staff). Films and their role in physics education took a large part of the conference discussions. They were valuable for several reasons, including that of substituting lack of apparatus or teachers trained to perform experimental work, but they should be designed adequately to fit a certain teaching philosophy.

We know that the participants designated for the discussion of Brown's closing summary were Zacharias, Georges Boutry (France), A. Bueno (Peru), Juan Herkrath (Colombia), João Jesus de Salles Pupo (Brazil), and IUPAP's Secretary General Pierre Fleury. Raw was Secretary of the session chaired by Brown. However, the proceedings are silent about any closing discussions and transferred Brown's summary to the opening pages of the publication.[76] Although the relative prominence of the PSSC in the Rio conference was less explicit than in the Paris program, it is noteworthy that Zacharias was the first speaker in the list of discussants. Brown's summary shows both explicitly and implicitly the penetration of the PSSC (on questions such as subject matter, pedagogical method, teaching aids, and professional politics). This was also clear across the conference presentations, in which the MIT's project was referenced and recommended more than any other.

[74] John Lewis, "The Place of Atomic Physics in General Education," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 70–5.

[75] Erik Ingelstam and Karl Gustav Friskopp, "Principles of Classroom Demonstrations and Laboratory Work," in Brown, Clarke, and Tiomno, *Why Teach Physics?*, 79–83.

[76] Brown, Clarke, and Tiomno, *Why Teach Physics?*, 1–2 and xxiii–xxv.

Conclusion

The signature pedagogy of physics, presented at IUPAP's early conferences on physics education, was characterized by a focus on laboratory teaching, the introduction of atomic physics in the school curriculum, and the segmentation of the physics subject matter, the provision of teaching apparatus, and the design of controlled pedagogical experiments. Furthermore, the development of techniques to cope with a prospective increase in university enrolments, and the desire of university physicists to control professional certification and university training in physics across the sciences and engineering were also major features.

The conferences display a variety of views on the disciplinary characterization of the knowledge base of physics and how to put it into practice—although the experimental approach was arguably gaining momentum. Laboratory teaching equipment had a central role in any project of pedagogical reform. Most proposals advocated for low-cost and simple equipment produced in university or school workshops, or the appropriation of domestic technologies. However, the projects with a more powerful repercussion, such as the PSSC, established companies to commercialize self-contained pedagogical packages. Educational projects had still a relevant dependence on instrument making firms or adopted their strategies.

The process of making the physics profession through educational reform was full of tensions between physicists and engineers, science teachers, educationists, and policy managers, and between US physicists and other professionals in Europe and Latin America. A top-down approach characterized the ethos of IUPAP's earliest conferences in the relationship between university physicists and physics teachers, and between European/US physicists and professionals from other countries (in Latin America, but also southern and eastern Europe). However, the time between the two conferences saw the burgeoning of a larger number of projects, and some more germane to the professional and disciplinary concerns of schoolteachers and general citizens.

Feynman's participation in IUPAP's Rio conference was marginal but illustrative. He was just one of many discussants in a conference session. Taken literally, his intervention could make us think he was just passing by—but, actually, it was not casual. He had had a relevant role as a keynote speaker in the OAS conference. His address was, in fact, a recycling of a talk given a decade earlier during a sabbatical year spent in Rio. It basically expressed personal opinions and provided no evidence (national, regional, comparative data), or conceded it could be wise to ask conference participants (who had pre-circulated detailed national reports on physics teaching in Latin America). He had some anecdotic university teaching experience in Brazil and could echo some of his Brazilian colleagues' comments. He was undoubtedly the author of the forthcoming *Feynman Lectures in Physics* (1964) based on a course given at Caltech between the years of the two IUPAP conferences. However, he did not have any substantial teaching experience in Latin America.

In spite of this, some of Feynman's remarks were relevant and surely applicable to Brazil. However, they were analogous to the problems pinpointed in most countries in this period, which had triggered—more or less simultaneously—movements for science education reform in the USA, Europe, and Latin America. Feynman's pretension of tutoring his colleagues from across the continent is ludicrous, but illustrative of the international epistemic politics of physics teaching and "development" in that period. Due to the professional prestige of the foreign visitor and his powerful nationality, he might still have been useful to the cause of Brazilian physicists asking their national government for more resources.

In his talk back in 1952, Feynman had focused on two topics: the value of science and the outdated nature of physics teaching in Brazil. He refrained from explaining how to teach properly, because he confessed to not being competent to do so, as his identity as a physicist was that of a researcher, not a pedagogue. In his talk in 1963, he dealt with the same topics, and refrained from revealing the substance of good teaching because, he claimed, this was the expected job of all conference participants (including himself) for the following days. If any, Feynman's recommendations were a melting pot of neo-liberal recipes, as his emphasis was on laissez-faire, competition, a linear model of economic progress through "applied science" and a preference for private over government intervention. In parallel, the US federal government model for (national and international) science education development involved a straightforward injection of humongous amounts of funding—however, indirectly administrated by private (non-profit) corporations such as the American Institute of Physics and the PSSC.[77] This also included contributions to international organizations such as IUPAP and UNESCO, and the development of a network of political caucuses operating in national and inter-national interests.

Feynman's contribution to the debates on the international reform of physics teaching did not appear to go much further. However, it helps us to see how between the 1950s and 1960s, and across IUPAP's first and second conferences on physics education, there were significant developments that contributed to reshape the identity of the professional physicist. The making of a signature pedagogy for physics contributed to developing an implicit understanding of what physics ought to be, what counted as knowledge, and how its communication and development in the classroom should proceed. In parallel, it increasingly defined a special profession in the emergence of the science education expert, with notorious examples in the managers and workers of national and international projects such as those from the MIT, the OEEC, Nuffield, UNESCO, and the IBECC. Their careers are worth analyzing, as professional connections and transferences happened, and interpretations connecting the individual and the collective, research, teaching and marketing, and the local, national, and international, take the central stage in further investigation. The third conference organized by IUPAP's Commission would be held in London in 1965, under the continuist lemma of "Conference on Education of Professional Physicists."

[77] On the complexities of the "neo-liberal" doctrine in the 1950s and its different parties (admitting or rejecting various degrees and cases of state intervention), see Philip Mirowski and Dieter Plehwe, eds., *The Road from Mont Pèlerin: The Making of the Neoliberal Thought Collective* (Cambridge, MA: Harvard University Press, 2009); and Angus Burgin, *The Great Persuarion: Reinventing Free Markets since the Depression* (Cambridge, MA: Harvard University Press, 2012).

7
The Role of IUPAP in Shaping Metrological Practice
International Negotiation and Collaboration

Connemara Doran

In 1996, the then-President of the International Union of Pure and Applied Physics (IUPAP), the Swedish mathematical physicist Jan Nilsson published in *Physics World*—a periodical of the UK National Physics Society, the Institute of Physics (IOP)—an article addressing the question of funding for physics in the post-Cold War world.[1] Titled "What can IUPAP Do for You?," Nilsson's article explains how the unique governing structure of IUPAP, governed by practicing physicists rather than by "hiring a professional administrative staff," can help the physics community obtain resources "when cash for research is in short supply."[2] The lack of administrative staff increases the proportion of the IUPAP budget (drawn from national funding sources in member nations and from the United Nations Educational, Scientific and Cultural Organization (UNESCO)) which can be used for sponsoring international conferences, for providing financial support for "young scientists from developing countries to go to IUPAP's major conferences around the world," and for providing conference proceedings and physics journals to "physics libraries in the third world."[3] To this end, and in order to ensure that each IUPAP commission is able to communicate the needs of its participants to the council, and receive the necessary funding for its own international conferences, IUPAP had recently restructured itself so that some commission chairs could simultaneously serve as council members.

In 1969, nearly three decades before Nilsson's article, the Canadian physicist Larkin Kerwin (the Associate Secretary General of IUPAP since 1962) published an article in *Physics Today*—a periodical of the US national physics society, the American Institute of Physics (AIP)—that introduces the structure and purpose of the organization to a wide audience of physicists and interested readers.[4] The lead reads: "With national committees from 37 countries directing its policies, IUPAP fosters international meetings, spreads information and hopes to advance international understanding." In this article packed with information about the structure and functioning of IUPAP, Kerwin gives special notice to the fact that the IUPAP committee on Symbols, Units, and Nomenclature (the SUN Commission, formed

[1] Jan Nilsson, "What can IUPAP Do for You?," *Physics World* (1996): 13–14.
[2] Nilsson, "What can IUPAP," 14.
[3] Nilsson, "What can IUPAP," 13.
[4] Larkin Kerwin, "The International Union of Pure and Applied Physics," *Physics Today* (1969): 53–5.

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in 1931 in coordination with the International Bureau of Weights and Measures (BIPM)) is "of a more general interest and all national committees are expected to … receive and exploit" publications delineating agreed-upon standards, and should "seek to implement the adopted proposals in their countries."[5] In process was the updated IUPAP manual on symbols, units, and nomenclature in physics which would be published in 1978 with funding from UNESCO.[6] Relatedly, IUPAP and the BIPM had coordinated the creation, in January 1965, of the first international journal of metrology, *Metrologia*, which would emphasize fundamental measurements but would also publish "reports of experiments or techniques of particular originality and importance in the area of secondary measurement," in particular reports of "high frequency electrical measurement—where there are substantial difficulties in the way of attaining high accuracy, precision and international uniformity."[7]

The IUPAP Commission SUN, later named Commission C2, regularly engaged with the BIPM in negotiating these definitions and in designing specialized commissions to organize and sponsor international meetings and conferences.[8] Many of the scientists who would publish in *Metrologia* from its first issue onwards were actively involved in IUPAP, such as Harvard University physicist Norman Ramsey, who explained the workings of the atomic hydrogen-maser frequency standard to this broad international audience.[9] In addition to publishing research articles, the journal would inform its readers of the "activities and decisions of the International Conference of Weights and Measures [CGPM], the International Committee of Weights and Measures [ICWM], and its Bureau at Sèvres, France, all of which operate under the oldest international scientific treaty—the Convention du Mètre of 1875—which continues to assure uniform, precise and accurate measurements throughout the world."[10] The Metric Convention of 1875, which founded the BIPM to systematize international scientific conventions for fundamental units, was part of a long 19th-century history of many negotiations over the definitions of units of measure, first focused within European nations and imperial interests and later globalized.[11] Already in 1921, amidst the development of novel metrological instrumentation including in timekeeping, the scope of the

[5] Kerwin, "The International Union," 55.

[6] Larkin Kerwin, *Symbols, Units and Nomenclature in Physics* (IUPAP SUN Commission, 1978). Frank Dufour, "Quantum Leaps for Peace: Physics at UNESCO," in *Sixty Years of Science at UNESCO 1945–2005* (Paris: UNESCO, 2006), 107–14. Also see Hof's chapter in this volume.

[7] L. Howlett, "The Role and Policy of *Metrologia*," *Metrologia* 1, no. 1 (1965): 1.

[8] For the history of the formation of other specialized commissions related to gravitation, see Roberto Lalli, *Building the General Relativity and Gravitation Community During the Cold War* (Cham: Springer, 2017), 47–59. Regarding other commission formation, also see Lalli's chapter and Fauque and Van Tiggelen's chapter in this volume.

[9] Norman F. Ramsey, "The Atomic Hydrogen Maser," *Metrologia* 1, no. 1 (1965): 7–15.

[10] Howlett, "The Role and Policy," 1.

[11] Wise, M. Norton, ed., *The Values of Precision*. Princeton: Princeton University Press, 1995. Simon Schaffer, "Metrology, Metrication, and Victorian Values," in *Victorian Science in Context*, ed. Bernard Lightman (Chicago: The University of Chicago Press, 1997), 438–74. Ken Alder, *The Measure of All Things: The Seven-Year Odyssey and Hidden Error That Transformed the World* (New York: Free Press, 2003). Peter Galison, *Einstein's Clocks, Poincaré's Maps: Empires of Time* (New York: Norton, 2004).

treaty had been extended to accommodate all physical measurements.[12] In particular, as the next section shows, the origin and continuing advancement of the International System of Unitis (SI) lay in the negotiations of physicists within IUPAP.

At issue in metrology is consistency and stability of the fundamental units and standards of measurement that enable "uniform, precise, and accurate measurements throughout the world."[13] Metrology spans pure and applied physics, astrophysics, space science, and engineering, and it is foundational not only for the instrumental and experimental sciences but also for the modern world's infrastructure, industrial and commercial production, communications technology, health care, defense, and global transportation, and trade. Moreover, as Joseph Martin's chapter in this volume notes, so-called pure physics was never completely independent from applied concerns, and applied research "often opened avenues into fundamental insight."[14] Martin argues further that IUPAP increasingly recognized the importance of industrial physics within "applied physics" in the final decades of the 20th century, in particular with regards to the needs and interests of developing nations.

Nowhere is this more visible than in the field of metrology and in the activities of SUN Commission. When IUPAP was reformulated in 1931, electing the American experimental physicist Robert Millikan as President, IUPAP recognized the importance of universally agreed-upon units and standards of measurement by naming its second commission, "Symbols, Units, Nomenclature," foremost in consequence only after its first commission, "Finance," also established that year.[15] As for the updates to the IUPAP report on metrology, the goal for the articles in *Metrologia* was to provide an international audience of physicists—not just specialists in metrology but experimental physicists across sub-disciplines—a compendium of reliable, certified, universally agreed upon definitions and standardized measurements. Already by the mid-1960s, these physicists included those from a growing number of developing countries that recognized the importance of both the standardization of instrumentation and greater accuracy in measurement for a nation's scientific experimentation, its industrialization, and its economic growth.[16] The updated IUPAP Metrology Manual was widely known as the SUN Commission Report, but, as announced at the 1966 General Assembly in Basel, Switzerland, "it will also be known as booklet IUPAP 11."[17] Because of the universal importance of the topic, Kerwin believed that

[12] Shaul Katzir, "Variations and Combinations: Invention and Development of Quartz Clock Technologies at AT&T," *Icon: Journal of the International Committee for the History of Technology* 22 (2016): 78–114.

[13] Howlett, "The Role and Policy," 1.

[14] See Martin's chapter in this volume.

[15] See Navarro's chapter in this volume.

[16] See, for example, Elisabeth Crawford, Terry Shinn, and Sverker Sörlin, "The Nationalization and Denationalization of the Sciences: An Introductory Essay," in *Denationalizing Science* ed. Elisabeth Crawford et al. (New York: Springer, 1993), 1–42, at 20–1. Naomi Oreskes and John Krige, eds., *Science and Technology in the Global Cold War* (Cambridge: The MIT Press, 2014). John Krige, Angelina Long Callahan, and Ashok Maharaj, eds., *NASA in the World: Fifty Years of International Collaboration in Space* (New York: Palgrave Macmillan, 2013).

[17] Folder 1,1 "Assemblée générale 1966—Basle (Suisse) 1965–1966," Larkin Kerwin fonds (P202), subseries P202/B4 IUPAP (hereafter IUPAP Kerwin), Division de la gestion des documents administratifs et des archives, Université Laval, Quebec, Canada.

SUN-sponsored conferences "should attract a wider audience from all countries than the meetings of the more specialized commissions."[18]

Elisabeth Crawford, Terry Shinn, and Sverker Sörlin describe international standardization as the main (indeed the only) scientific role of such international institutions.[19] As they explain, beginning in the late 19th century, international organizations for science "were set up specifically to accomplish the goals of standardization of nomenclatures, methods and units in both the laboratory and field sciences."[20] The growth in homogeneity (universality) of methods and units of measurement, the increase in rapidity of communication, and the growth of standardization of scientific instruments and technological products, separately and together "furthered the *standardization* of scientific work."[21] Crawford et al. argue further that, in the early 20th century, "This wholesale intermingling of ideology and practice where lofty ideals about science promoting world peace were put on a par with the much more mundane tasks of standardization of methods and nomenclature was specific to this historic period."[22] Elements of this "internationalist ideology" continued in the post-World War II era, albeit tempered with realism about deterrence and movements for détente during the Cold War.[23] Kerwin was very aware, for example, of difficulties within the Cold War context of enabling true international exchange across the iron curtain, with visa impediments often an issue of negotiation for IUPAP leadership as reflected in archived correspondence with representatives from countries that had difficulty entering Yugoslavia for the September 1969 General Assembly in Dubrovnik.[24]

Kerwin served as both an anchor and a driver for the work and goals of IUPAP, with a particular focus on how metrology and other sub-disciplines of physics interface and engage with wider societal concerns and applications. Continuously, for almost three decades, Kerwin had multiple official roles in IUPAP: as Associate Secretary General (1963–72 while Clifford Butler was the Secretary General); Secretary General (1972–84 while Jan Nilsson was Associate Secretary General); Vice-President (1984–87); and President (1987–90). Most significantly, at different times in his career, Kerwin's IUPAP roles overlapped with his particular physics research interests and his activities within related professional associations, demonstrating something very important about the nature and structure of IUPAP as an association of physicists doing cutting-edge research with ever-emergent technologies, research that often interfaced multiple sub-disciplines. Kerwin served as President of the Canadian Association of Physicists (1954–55); became President

[18] Kerwin, "The International Union," 55.
[19] Crawford et al., "The Nationalization and Denationalization."
[20] Crawford et al., "The Nationalization and Denationalization," 16.
[21] Crawford et al., "The Nationalization and Denationalization," 14.
[22] Crawford et al., "The Nationalization and Denationalization," 17.
[23] Crawford et al., "The Nationalization and Denationalization," 17. Crawford et al. characterize "the essence of the internationalist ideology" as the following: that international scientific organizations "organizing and meeting per se, irrespective of specific needs and purposes, but on as broad a scale as possible, would further international understanding."
[24] Folder 1,2, "Assemblée Générale 1969—Dubrovnik (Yougoslavie) 1969," IUPAP Kerwin. Regarding East-West relations including debates over travel restrictions and bans, see Turchetti's chapter, Hof's chapter, and Silva Neto and Kojevnikov's chapter in this volume.

of the National Research Council of Canada (1980–85), which overlapped with his assuming the role of Vice-President of IUPAP; and became the first President of the Canadian Space Agency (1989–92). Also, Kerwin's service as President of IUPAP overlapped with his serving as President of the Canadian Academy of Engineering in 1989, where he applied his knowledge of metrology outside of physics proper. The Canadian government valued Kerwin's skill and long-proven experience in promoting scientific research and development (R&D) such that during the recession of the early 1980s (during Kerwin's 10th year as Secretary General of IUPAP), Kerwin represented Canada in a working group set up after the June 1982 Economic Summit to strategize how R&D could spur economic recovery and job creation globally.[25]

In addition to his aptitude for managerial and diplomatic leadership, Kerwin's lifelong career as Professor of Physics at Université Laval in Québec City researching and teaching in atomic and molecular physics draws attention to the fact that work to advance standardization and metrology was *fundamental*, propelling and shaping research undertaken in all areas of physics, engineering, and space science. On October 8, 1975, early during his tenure as Secretary General of IUPAP, Kerwin wrote to J. Terrien (Director of the BIPM in Paris), thanking Terrien for his "interventions" at the IUPAP General Assembly in Munich, and for Terrien's "belle contribution" to international physics, asking whether Terrien would be able to maintain his role as representative from the BIPM to IUPAP for another three years during the final pre-publication stages of the IUPAP manual on symbols, units, and nomenclature. Terrien accepted on October 15: "*j'accepte très volontiers d'être encore member associé désigné par l'IUPAC [sic IUPAP] et le BIPM à la Commission SUN*," and, as this article will show, the IUPAP committees and membership were kept informed and provided with education and training in several venues regarding these metrological advances.[26] The SUN report (booklet IUPAP 11) was finally published in 1978.

This chapter uses the case of light as an instrument of precision metrology for measuring distance and time as an example of the central role played by IUPAP's Commission C2 in the development of international standards. The story of how light has come to be used as the central instrument of precision metrology, enabling international conventions to change definitions of fundamental units of time and distance to depend on the instrumentation of light, is both an international and a national story. It is international in the transnational negotiation and coordination processes necessary to formulate international conventions of fundamental units. It is national because national funding sources within countries provided the support necessary for the equipment and the research undertaken in these areas, and likewise created and funded the international conferences that enabled the exchange of ideas on fundamental physics: "Irrespective of the organizational form given government-supported science … it always remained nationally based."[27] In the area of precision metrology featured in this paper, IUPAP's funds for international conferences have come from both the individual member countries and from UNESCO. Moreover,

[25] "Biography of Dr. Larkin Kerwin," Government of Canada, available at https://www.asc-csa.gc.ca/eng/library/bio-larwin-kerwin.asp.

[26] Folder 4,1 "Bureau international des poids et mesures, BIPM 1966–1975," IUPAP Kerwin. Kerwin's letter carbon copies the Associate Secretary General, Jan Nilsson.

[27] Crawford et al., "The Nationalization and Denationalization," 22–3.

both inside and outside IUPAP, the majority of funding for international conferences comes from state governments (civilian and military agencies), which sometimes flow through intermediary organizations (such as UNESCO) which at times remove national-based restrictions on those receiving funding.[28]

Advancing Precision Metrology Using Light (Electromagnetic Radiation) as an Instrument: Roles of IUPAP Physicists

Light has been used as an instrument of precision measurement throughout the history of the experimental physical and astronomical sciences. One of the key high-precision instruments for measuring *distance* is the interferometer, first developed in the 19th century to use the interference of light waves to distinguish differences in length at the smallest scales: beams of light are reflected in mirrors and split and recombined by beam splitters, and the measurement is made by observing differences in the resulting interference fringes to give information about changes in optical path lengths. Conversely, and crucially, interferometry and the velocity of light also came to play a central role in the definition and precision measurement of *time*, as evidenced by the long history of the development of the hydrogen maser atomic clock and later optical laser clocks, a development firmly anchored by theoretical and technical advances during the period 1945–65. A maser (microwave amplification by stimulated emission of radiation) is a quantum-electrodynamic device that establishes and sustains the frequency precision and accuracy of an atomic clock.

The origin of the SI system lay in the negotiations of physicists within IUPAP. In 1948, IUPAP "expressed to the Conference Générale their desire that a practical international system of units should be adopted, and offered some suggestions."[29] Into the 1960s, negotiations within the BIPM and IUPAP gave rise to well-established definitions of length measurement, mass measurement, temperature measurement, electrical measurement, photometric measurement, time and frequency measurement, and ionizing radiation measurement.

Measurement of Distance with the Interferometer

The Michelson Interferometer, first developed by the American physicist Albert Michelson in the 1870s, enables comparison of changes in the optical path lengths of light traveling along two arms at 90 degrees to each other. The precision of the interferometer used in the Michelson Morley experiment of 1887 led to suggestions that a particular wavelength of light could be established as a standard of length. Seeking "to provide a link between the standard of length (the meter bar) and the

[28] Naomi Oreskes, *Science on a Mission: How Military Funding Shaped What We Do and Don't Know about the Ocean* (Chicago: University of Chicago Press, 2021). John Krige, "Introduction: Writing the Transnational History of Knowledge Flows in a Global Age," in *Knowledge Flows in a Global Age: A Transnational Approach*, ed. John Krige (Chicago: University of Chicago Press, 2022), 1–30.

[29] J. Terrien, "Scientific Metrology on the International Plane and the Bureau International des Poids et Mesures," *Metrologia* 1, no. 1 (1965): 15–26, 19, 25–6.

wavelengths of spectroscopy," the IBPM invited Michelson to "use his methods and his interferometer in collaboration with the director of the Bureau International," and they successfully "measured with an accuracy 100 times better than the tables of Rowland, the wavelength of the red line of cadmium (1892–1893)." Similar measurements elsewhere in dry air at 15 degrees Celsius and normal atmospheric pressure gave a more accurate result that could be used as a standard for interferometric measures of length.[30]

In 1960, the CGPM of the BIPM adopted this approach, defining the metre as 1,650,763.73 times the wavelength of light emitted during a transition of the krypton 86 atom in vacuum. After solving a number of technical problems with using laser interferometry to measure length, by 1967 the National Bureau of Standards and similar national laboratories in other countries were using laser interferometry routinely in some of their *length* measurements.[31] With the development of atomic clocks in 1967 the BIPM changed the definition of the *second* from a fraction of the mean solar day to the duration of repeated oscillations of a cesium 133 atom. The increasing precision of atomic clocks over the next two decades would in turn enable using the *second* and the *velocity of light* together to define the *metre*. Indeed, in 1983, the BIPM changed the definition of metre from the wavelength of light emitted during an atomic transition instead to the distance that light travels in a vacuum during a specific time interval.

Measurement of Time with the Maser

What made the use of time in the definition of distance possible? The development of highly precise atomic clocks. The origin and later development of these clocks lies in the work of several physicists who were members of IUPAP's Commission C2. The developers of the laser, maser, and atomic clocks were mainly young physicists whose careers had been interrupted by World War II and who subsequently undertook research at specialized laboratories in industry and academia.

The physicists Norman Ramsey at Harvard University, Charles Townes at University of California Berkeley, and Robert Dicke at Princeton University—each of whom had developed microwave oscillators and waveguides for radar components during World War II—spent the post-war years applying the microwave radar technique to spectroscopy as a means to study atomic and molecular structure. By the mid-1950s, Ramsey and Townes had independently created techniques to sustain the atoms or molecules in a gas in an excited energy state, and then send a stream of photons into the gas at energies equal to that excited state. This combination of conditions results in the emission of two photons for every one sent into the chamber—serving as a novel type of atomic clock. These "masers" solved the problem of noisy vacuum tubes as amplifiers of electronic signals by finding another way to amplify a photon stream. Funded by both the Air Force Office of Scientific Research (AFOSR) and the Office of Naval Research (ONR), Townes at University of California Berkeley pioneered

[30] Terrien, "Scientific Metrology" (1965), 19–21.
[31] Joan Bromberg, *The Laser in America, 1950–1970* (Cambridge: The MIT Press, 1991), 198–9.

the ammonia maser technique in 1954, and in 1958 received AFOSR funding for laser research, arguing that "marked improvement in interferometry and measurements of length by interferometric techniques" was one of the benefits that could be derived from his research.[32] His laboratory built the first working maser, an ammonia maser, and he was awarded the 1964 Nobel Prize in physics: "for fundamental work in the field of quantum electronics, which has led to the construction of oscillators and amplifiers based on the maser-laser principle."[33]

Ramsey, who had been trained in magnetic resonance research working in Isidor I. Rabi's laboratory at Columbia University in the latter 1930s, undertook experiments after World War II in his Harvard University laboratory on high-precision microwave and radiofrequency techniques. These experiments led to the creation in 1960 by Ramsey and his students Michael Goldenberg and Daniel Kleppner of the atomic hydrogen-maser frequency standard that would become their atomic clock; they published the "Theory of the Hydrogen Maser" in the *Physical Review* in 1962.[34] The Canadian-American physicist Robert Vessot at the Massachusetts Institute of Technology (MIT) began a collaboration with Ramsey's laboratory in 1957, experimenting on high-precision microwave and radiofrequency techniques to perfect the hydrogen maser as a commercial laboratory time standard. The teams jointly developed design principles and techniques published in the *Physical Review* in 1965.[35] They also jointly worked on perfecting the hydrogen maser for use in space. Vessot filed an application for a National Aeronautics and Space Administration (NASA) contract in 1962 for creating a hydrogen maser clock that could be used in space missions, and his team designed and began experimental studies of frequency beat and stability of various hydrogen masers. Vessot's team presented and published their experimental studies in the *Proceedings of the 21st Annual Symposium on Frequency Control*, April 24, 1967 in Ft. Monmouth, NJ. This collaboration led to their creation of the atomic hydrogen-maser frequency standard that became their atomic clock, which had the precision and stability necessary to test Einstein's Equivalence Principle in space in NASA's 1976 Gravity Probe A experiment, and became a model for hydrogen maser atomic clocks used in the European Space Agency's Galileo Global Positioning System.[36] Vessot would also play major roles for three decades in international training of physicists and engineers in metrology related to atomic clocks.

The big umbrella of "wide-ranging subjects" that Howett specified in inaugurating the *Metrologia* journal in 1965 had begun coalescing around such quantum-electrodynamic devices during the 1930s in experimental studies (in laboratories

[32] Bromberg, *Laser in America*, 197.

[33] Charles Townes Nobel Prize statement, https://www.nobelprize.org/prizes/physics/1964/townes/facts/.

[34] M. Goldenberg, D. Kleppner, and N. Ramsey, "Atomic Hydrogen Maser," *Physical Review Letters* 5 (1960): 361–362. D. Kleppner, M. Goldenberg, and N. Ramsey, "Theory of the Hydrogen Maser," *Physical Review* 126 (1962): 603–615.

[35] D. Kleppner, H. Berg, S. Crampton, N. Ramsey, R. Vessot, H. Peters and J. Vanier, "Hydrogen–Maser Principles and Techniques," *The Physical Review* 138, no. 4 (1965): 972–983. *Proceedings of the 21st Annual Symposium on Frequency Control*, April 24, 1967 in Ft. Monmouth, NJ.

[36] Connemara Doran, and David DeVorkin, "Robert Vessot's Gravity Probe A: Perfect a Hammer, and the World Looks Like a Nail," forthcoming.

across the globe) of the "atomic beams" that occur when "an atom is placed in a static magnetic field and a perpendicular rotation magnetic field," as Ramsey explained in a detailed retrospective, "History of Atomic and Molecular Standards of Frequency and Time," that he published (upon request) in the *IEEE Transactions of Instrumentation and Measurement* (1972) reporting on researches leading to atomic clocks.[37] In 1978, Ramsey was appointed the US representative to the Inter-Union Commission "ICSU-Spectroscopy" by IUPAP at the September 1978 council meeting in Stockholm. In this new role, Ramsey updated this history in another requested article, "History of Atomic Clocks," which was published in the *Journal of Research of the National Bureau of Standards* in 1983.[38] In 1949, Ramsey had developed the "separated oscillatory field method," and in 1989—six years after his updated "History of Atomic Clocks" article and forty years after the discovery of his method—Ramsey obtained a Nobel Prize in physics for this method and its use in the hydrogen maser and other atomic clocks, and for the SI definition of the second.[39]

These innovations in the physical understanding and instrumentation of precision metrology were essential for the creation of international standards for units of time and distance at the levels of precision and accuracy for research in quantum mechanics and in gravitational physics. How did these metrological researchers communicate these developments to other practitioners?

International Conferences and the Dispersion of Metrological Knowledge

Beginning in the 1950s, metrologists seeking to increase atomic clock precision and stability would meet to explain their techniques and findings in papers given at regularly scheduled conferences, symposia, and workshops around the world. A compilation, in 1994, of the literature on time and frequency measurements indicated that by 1994, there had been forty-eight International Frequency Symposia; eight meetings of the European Frequency Control Symposium; four conferences separated by five to seven years of the Symposium on Frequency Standards and Metrology; and twenty-five meetings (through 1993) of the Annual Precise Time and Time Interval Applications and Planning Meeting, which were meetings funded by US military agencies (such as AFOSR) and civilian agencies (such as NASA) whose proceedings

[37] Norman Ramsey, "History of Atomic and Molecular Standards of Frequency and Time," *IEEE Transactions of Instrumentation and Measurement*, 21, no. 2 (May 1972): 90–9, at 90–1.

[38] Norman Ramsey, "History of Atomic Clocks," *Journal of Research of the National Bureau of Standards* 86, no. 5 (1983): 301–20, at 307–8.

[39] Norman Ramsey, *Molecular Beams* (Oxford: Clarendon Press, 1956). Norman Ramsey, "Experiments with Separated Oscillatory Fields and Hydrogen Masers," Nobel Lecture, December 8, 1989. Dudley Herschbach, "An Homage to Otto Stern," in *Molecular Beams in Physics and Chemistry: From Otto Stern's Pioneering Exploits to Present-Day Feats*, ed. Bretislav Friedrich and Horst Schmidt-Böcking (Cham: Springer, 2021), 1–22.

"have been published by NASA in recent years."[40] The goal throughout was to share expertise and train physicists from other countries, especially in the developing world, in the on-going theorization, experimentation, and instrumentation within metrology and its applications.

In 1990, for example, both Robert Vessot, then senior physicist at the Smithsonian Astrophysical Observatory (in his Advisory Committee role as Member US Study Group 7, Comité Consultatif International de Radio Emission), and Brian Petley (in his role as Chairman of the IUPAP Commission C2) each gave invited papers based on talks presented at the 6th European Conference on Time and Frequency (1990, published the next year).

Vessot's paper, "Applications of Highly Stable Oscillators to Scientific Measurements," begins by explaining the technological basis for experiments with clocks, noting that "the frequency stability of highly stable oscillators has improved by a factor of about 10 every decade since the 1960 era, when atomic clocks were first introduced." The emphasis in his talk was on "applications of highly stable oscillators, focusing on measurements using electromagnetic signals" to lead into the major focus of his own work, namely, "systems for Cancelling First-Order Doppler and Signal Propagation," which are vital for satellite-ground communication.[41]

Brian Petley's paper, "Time and Frequency in Fundamental Metrology," which appeared directly after Vessot's paper, discusses "the role of time and frequency in a wide range of measurements ..., particularly those involving the International System of Units (SI) and fundamental physical constants." Petley noted the importance and difficulty of formulating precise time standards: "It will probably become very important in the future to distinguish between a time standard and a possible frequency standard ... We can expect ... that the definitions of most of the other base units will rely on time in some way."[42] At that time, Petley was not only the Chairman of the IUPAP Commission C2. He also headed the Centre for Basic Metrology, Division of Quantum Metrology at the UK National Physical Laboratory and was a member of the Editorial Boards of journals including *Metrologia*. As Petley explains, modern "science and technology are placing increasingly stringent demands on our measurement system and associated units," and the "ultimate arbiters" of the SI system of units "are the General Conference on Weights and Measures (CGPM), the International Committee on Weights and Measures (CIIPM), and the Consultative Committee on Units (CCU)."[43]

These international negotiations over the precise definitions of units of measure occurred not only in the work of the BIPM, but also in the international

[40] Christine Hackman and Donald Sullivan, "Time and Frequency Measurement," *American Journal of Physics* 63, no. 4 (April 1995): 306–17; reprinted in *Time and Frequency Measurement* (College Park: American Association of Physics Teachers, 1996), 1–12, at 2.

[41] Robert Vessot, "Applications of Highly Stable Oscillators to Scientific Measurements," *Proceedings of the IEEE: Special Issue on Time and Frequency* 79, no. 7 (1991): 1040–53.

[42] Brian Petley, "Time and Frequency in Fundamental Metrology," *Proceedings of the IEEE: Special Issue on Time and Frequency* 79, no. 7 (1991): 1070–6, at 1075–6.

[43] Petley, "Time and Frequency," 1070–1.

meetings of IUPAP. At the September 1978 Council Meeting of IUPAP at the Royal Swedish Academy of Sciences in Stockholm, Sweden, the Executive Council delegated its members to the various International Commissions: "The Executive Committee decided that the following members be asked to establish liaison between the Executive Committee and the International Commissions for the period until the next General Assembly." Kerwin, Secretary General of IUPAP, headed the newly united C2+C13 (combining "Symbols, Units, and Nomenclature" with "Atomic Masses and Fundamental Constants").[44] These two commissions were unified due to IUPAP's recognition of the increasing use of fundamental constants in the definitions of units and standards in this period. We have seen that, in 1967, the BIPM had changed the definition of a second from an astronomically based definition to an atomic physics definition: the duration of repeated oscillations of a cesium 133 atom within a cesium atomic clock. We have also seen that the definition of the metre in this period was based upon the interferometric measurement of the wavelength of light emitted during an atomic transition, a definition likewise depending on atomic physics. Metrologists at IUPAP and the BIPM in the 1970s debated the merits of changing the definition of the metre to depend directly upon the definition of the second, using electromagnetic radiation as the link. Ultimately this led to the 1983 shift in the definition of metre to the distance that light travels in a vacuum during a specific time interval, which was dependent on the measurements of atomic clocks and thus still relied on atomic physics.

The council at the 1978 Stockholm meeting also assigned IUPAP representatives to inter-union commissions. The only inter-union commission with more than two representatives appointed was "ICSU-Spectroscopy," and of its four appointed representatives, Norman Ramsey represented the United States.[45] Ramsey, Vessot, Kerwin, and Petley shared a commitment to international cooperation in the determination of measurement units and the progress of high-precision measurement techniques. For instance, at the 1990 IUPAP council meeting in Dresden, Petley "spoke about the favorable experience of C2 with small conferences" that brought international groups of scientists together for focused workshops on subtopics within the field of metrology.[46] The results of these meetings often took the form of concrete guidebooks, training materials for universities and industrial laboratories, and direct education of younger colleagues. At the February 1997 IUPAP Executive Council Meeting at CERN in Geneva, Switzerland, Petley "described work through the SUNAMCO Commission with other international organizations in producing two guides in metrology" (The Guide to the Expression of the Uncertainties of Measurement and

[44] Jan S. Nilsson, "IUPAP Council Meeting, Stockholm 1978," IUPAP, series A1 "Minutes from Council Meetings," vol. 1, folder "IUPAP Minutes of Council Meeting, Stockholm, 1978," Gothenburg Secretariat, (hereafter IUPAP Gothenburg), Center for the History of Science, Royal Swedish Academy of Science.

[45] Jan S. Nilsson, "IUPAP Council Meeting, Stockholm 1978," series A1 "Minutes from Council Meetings," vol. 1, folder "IUPAP Minutes of Council Meeting, Stockholm, 1978," IUPAP Gothenburg.

[46] Jan S. Nilsson, "IUPAP Council Meeting, Dresden 1990," series A1 "Minutes from Council Meetings," vol. 1, folder "IUPAP Minutes of Meeting of Council, Dresden, GDR, September 24, 1990," IUPAP Gothenburg.

The International Vocabulary on Metrology) which "will likely have a wide impact on industrial physics."[47]

Recent Developments in Atomic Clocks Based on International Collaboration

In recent years, atomic clocks have achieved ever-greater precision and stability over long time periods due to the collaborative work of scientists and engineers in national laboratories, industrial laboratories, and university laboratories using cool atoms instead of hot atoms. This innovation was made possible from the research beginning in the 1980s carried out by Steven Chu at Bell Labs funded by AFOSR; William Phillips at the National Bureau of Standards (now the National Institute of Standards and Technology), funded in part by the Office of Naval Research; and Claude Cohen-Tannoudji at the *Collège de France* on the cooling and trapping of atoms with laser light, for which they shared the 1997 Nobel Prize in physics.[48] Given the importance of their researches for instrumentation worldwide, these three scientists communicated with each other during their extended years of research and with teams at other laboratories such as the Max Planck Institute for Quantum Optics in Germany.

Both Cohen-Tannoudji and Phillips emphasized in their Nobel lectures the inter-institutional and international collaborations that made possible their metrological research. Cohen-Tannoudji recalled attending lectures by Ramsey and many other leading physicists (including Schwinger and Pauli) at the 1955 Les Houches summer school, founded in 1951 and led for twenty-two years by Cécile DeWitt-Morette, based on funding she obtained from a French government ministry.[49] Phillips had carried out his PhD research in Daniel (Dan) Kleppner's lab at MIT, who was working "on a hydrogen maser experiment" (building on his work with Robert Vessot) when Phillips arrived in 1970.[50]

As part of Kleppner's lab, Phillips learned "a way of thinking about physics intuitively, and a way of inquiring about a problem that has shaped the way I approach physics to this day:"

> The style of open and lively discussion of physics problems that I found in Dan's group is one that I have tried to emulate in my own group at NIST [National Institute

[47] Jan S. Nilsson, "IUPAP Council Meeting, CERN/Switzerland, 1997," series A1 "Minutes from Council Meetings," vol. 1, folder "IUPAP Minutes of Executive Council Meeting, CERN, Geneva, Switzerland, February 7–9, 1997," IUPAP Gothenburg.

[48] Steven Chu, "AFOSR Proposal 1991," box 6, folder 1, Steven Chu Papers (SC0828), Department of Special Collections and University Archives, Stanford University Libraries, Stanford, California. Steven Chu, Nobel Lecture, December 8, 1997. William Phillips, Nobel Lecture, December 8, 1997. Cohen-Tannoudji, Claude. Nobel Lecture. December 8, 1997.

[49] Pierre Verschueren, "Cécile Morette and the Les Houches Summer School for Theoretical Physics; or, how Girl Scouts, the 1944 Caen Bombing and a Marriage Proposal Helped Rebuild French Physics (1951–1972)," *British Journal for the History of Science* 52, No. 4 (December 2019): 595–616.

[50] William Phillips, *Nobel Biography*, 1997, available at https://www.nobelprize.org/prizes/physics/1997/phillips/biographical/.

> of Standards and Technology]. I also try to follow the principle Dan taught by example: that one can do physics at the frontiers, competing with the best in the world, and do it with openness, humanity and cooperation.[51]

In his Nobel biographical statement, Phillips recalled Bengt Nagel's formal remarks to the three Nobel laureates in Stockholm (December 10, 1997) "that we were being recognized as leaders and representatives of our groups," groups that consisted of many collaborators who together developed the methods of laser cooling.[52] This collaborative approach served Phillips well when he carried out his photonics research at NIST and "the tremendously fruitful collaboration" he had "with Claude Cohen-Tannoudji's research group" in France in the 1980s, while Steven Chu's group at Bell Labs carried out a parallel research program. Like Kerwin, Ramsey, Petley, and other physicists serving roles in IUPAP, for many years, Phillips actively participated in the C2 commission of IUPAP, as a member since 2011 and as Vice-Chair of Commission C2 between 2014 and 2017.

Conclusion

In answer to Nilsson's question with which this chapter began—"What can IUPAP [Commission C2] do for you?"—the IUPAP Commission C2 played a central role in shaping modern metrological practice in three primary ways. First, through the international negotiations by scientists within the IUPAP that coordinated with the IBPM in defining and redefining fundamental units. Second, through the international collaborations made possible with the international conferences put together under the organizational guidance of IUPAP (and other international societies). Third, through the emphasis IUPAP placed on bringing leading metrological researchers into direct contact with researchers at differing stages of their careers and from countries at varying stages of development. While much of the funding for the metrological research itself, and for the international conferences and workshops at which this research was shared, was from national funders, the IUPAP Commission C2 served the international metrological community as an organizational framework which sought to expand and democratize the access to metrological techniques and technologies across the globe.

[51] Phillips, *Nobel Biography*.
[52] Phillips, *Nobel Biography*.

8

Repairing a Scientific Network

The International Conference of Theoretical Physics in 1953 and the Rehabilitation of the Japanese Physics Community

Kenji Ito

Richard Feynman was disappointed. In the Fall of 1953, he arrived in Tokyo on his trip to attend the International Conference of Theoretical Physics (ICTP) held under the auspices of the International Union of Pure and Applied Physics (IUPAP). He had been allotted a room in the Imperial Hotel, in an exquisite architecture crafted by Frank Lloyd Wright, which had hosted many dignitaries in the past, including high-profile scientists such as Albert Einstein and Niels Bohr. While the hotel had adapted its facilities and practices to cater to the needs of travelers from Europe and North America, making them feel at home, Feynman had hoped to have a more immersive experience in what he considered as the authentic Japanese culture. After spending a night there, he called up "the Japanese guy who organized everything," expressing his wish to relocate his room to a different hotel. Following a protracted negotiation with the reluctant organizer, he was able to convince the latter to arrange a room for him at a Japanese-style hotel, which brought him great delight.[1]

Feynman's famous autobiography features his perspectives on and depictions of Japanese culture, which are undoubtedly characterized by a significant amount of orientalism.[2] However, my focus is not on that matter. Instead, I am interested in the nameless and almost invisible "Japanese guy" in this episode and other anonymous organizers who catered for the requirements of the participants.

Organizing an academic gathering has become a significant aspect of scholarly life, although the skill set required for such an undertaking only partially overlaps with that required for scientific research. In this paper, I explore the motives and modalities of scientists in performing these academic obligations, shedding light on their inherent significance. I contend that organizing an international conference such as the ICTP can be characterized as a labor of care aimed at repairing and maintaining the international knowledge infrastructure. Transpiring in the immediate aftermath of World War II, the ICTP served as an extraordinary opportunity to reconstruct the international network of scientists that had suffered a fracture during the war. It was

[1] Richard P. Feynman, "*Surely You're Joking, Mr. Feynman!*": *Adventures of a Curious Character* (New York: W. W. Norton, 1985), 237–9.

[2] For the notion of orientalism, see, Ito Kenji, "Cultural difference and sameness: Historiographic reflections on histories of modern physics in Japan," in *Cultures without Culturalism: The Making of Scientific Knowledge*, ed. Karine Chemla and Evelyn Fox Keller (2017), 49–63.

Kenji Ito, *Repairing a Scientific Network*. In: *Globalizing Physics*. Edited by: Roberto Lalli and Jaume Navarro, Oxford University Press. © Oxford University Press (2024). DOI: 10.1093/oso/9780198878681.003.0009

an opportunity for repair work that was needed to rehabilitate the Japanese physics community within the global scientific community.

This line of inquiry is inspired by recent advancements in the field of engineering studies concerning maintenance. Lee Vinsel and Andrew L. Russell, for instance, highlight the detrimental consequences of an excessive focus on innovation, which undervalues the significance of maintenance and care. They discuss how this inclination leads to disastrous outcomes. According to their perspective, maintenance stands in stark contrast to innovation. It encompasses the practice of "keeping daily life going, caring for the people and things that matter most to us, and ensuring that we preserve and sustain the inheritance of our collective pasts." Maintenance is "the overlooked, undercompensated work that keeps our road safe, our companies productive, and our lives happy and secure."[3] While Russell and Vinsel consider innovations and maintenance in technological systems, knowledge practices also take place within an infrastructure, which we can call the knowledge infrastructure.[4] Furthermore, this work draws inspiration from recent numerous studies exploring the notion of care in science studies.[5] Maintenance in engineering and the ethics of care have much in common: the former pertains to the maintenance of technological systems, while the latter involves the maintenance of life itself. Both were frequently overlooked, unappreciated, and undercompensated.[6]

I contend that organizing an academic conference belongs to this kind of work. It appears mundane, trivial, and prone to be overlooked, but it is essential in scholarly life. An academic conference, especially a large one, can be regarded as a fundamental element for sustaining human (and non-human) relationships that are pivotal to local and global knowledge infrastructure. Despite being underappreciated, the care and work required for preparing and conducting conferences constitutes a substantial portion of the labor produced by academic organizations.

This research is also informed by the recent emergence of a sub-field within the history of science that centers on the diplomatic history of science, which emphasizes the significance of non-state actors in the realm of diplomacy.[7] Concerning the ICTP, the primary actors involved were IUPAP and the Japanese scientific community, while the Japanese national government only played a peripheral role.

[3] Lee Vinsel and Andrew L. Russell, *The Innovation Delusion: How Our Obsession with the New Has Disrupted the Work That Matters Most* (New York: Currency, 2020), 14–15.

[4] Helena Karasti et al., "Knowledge Infrastructures: Part I," *Science & Technology Studies* 29 (2016): 2–12.

[5] For example, see, Annemarie Mol, *The Logic of Care: Health and the Problem of Patient Choice* (Abingdon, Oxfordshire: Routledge, 2008); Aryn Martin, Natasha Myers, and Ana Viseu, "The Politics of Care in Technoscience," *Social Studies of Science* 45 (2015); Maria Puig de la Bellacasa, *Matters of Care: Speculative Ethics in More than Human Worlds* (Minneapolis: University of Minnesota Press, 2017); Wakana Suzuki, "Improvising Care: Managing Experimental Animals at a Japanese Laboratory," 51 (2021): 729–49.

[6] On the ethics of care, see, Carol Gilligan, *In a Different Voice: Psychological Theory and Women's Development* (Cambridge, Massachusetts: Harvard University Press, 1982); Joan Tronto, *Caring Democracy: Markets, Equality, and Justice* (New York: New York University Press).

[7] Kenji Ito and Maria Rentetzi, "The Co-Production of Nuclear Science and Diplomacy: Towards a Transnational Understanding of Nuclear Things," *History and Technology* 37, no. 1 (2021): 4–20. On the emphasis on non-governmental actors, or more generally on the so-called new diplomacy, see, John Robert Kelly, "New Diplomacy: Evolution of a Revolution," *Diplomacy & Statecraft* 21 (2010): 286–305.

Japan's Reversion to IUPAP

As one of the original members of the International Research Council (IRC), Japan was already a participant in an international scientific network in the 1920s.[8] World War II had a devastating impact on Japan's scientific connections. During the war, Japanese physicists were in total isolation from the allied scientific community. Repair work was needed to mend the broken bridge between the Japanese scientific community and the global one. Furthermore, immediately after the war, there was another incident that required a repair work. Carrying out the directive issued originally from Leslie Groves' office, the US occupying force destroyed all the cyclotrons in Japan. While the cyclotrons were never restored, the incident motivated US scientists to repair the trust in US science or to compensate for the damage in some other ways.[9]

During the occupation after World War II, the international scientific network gradually began to re-establish connections with the Japanese scientific community. Harry C. Kelly, who played a prominent role in shaping science policy during the occupation, was generally supportive of promoting science and technology in Japan.[10]

The early primary advocate for Japan's re-entry into the international scientific community was Nishina Yoshio, who maintained a close alliance with Kelly.[11] During his travels in Europe from 1921 to 1928, Nishina had met Niels Bohr, Henrik A. Kramers, and Ronald Fraser. Bohr was Nishina's mentor while he stayed in Copenhagen before the war and one of the primary reasons why Nishina became a quantum physicist. Kramers, a colleague of Nishina's in Copenhagen, became the President of IUPAP. Fraser, who was a colleague of Nishina's while he was working with Wolfgang Pauli in Hamburg, became a vital figure in the International Council of Scientific Unions (ICSU) as a liaison for the United Nations Educational, Scientific and Cultural Organization (UNESCO), which provided a significant portion

[8] James R. Bartholomew, *The Formation of Science in Japan: Building a Research Tradition* (New Haven: Yale University Press, 1989).

[9] On the destruction of the Japanese cyclotrons, see 伊藤 憲二 (Kenji Ito), *励起: 仁科芳雄と日本の現代物理学* (Excitation: Nishina Yoshio and Modern Physics in Japan) (Tokyo: みすず書房 Misuzu Shoō, 2023), vol. 2, 788–816; 伊藤憲二 (Kenji Ito), "占領下のサイクロトロン破壊を見直"す" (Revisiting the Destruction of Cyclotrons under the Occupation) 『みすず』 (*Misuzu*) (June 2023): 2–10. See also, Shigeru Nakayama, "Destruction of Cyclotrons," in *A Social History of Science and Technology in Contemporary Japan*, ed. Shigeru Nakayama (Melbourne: Trans Pacific Press, 2001), 108–18.

[10] Since the subject of this article is not to discuss the history of science in Japan, I omit most of the general local background. On science policy during the occupation, see the following articles and other studies cited there: Walter E. Grunden, "Physicists and 'Fellow Travelers': Nuclear Fear, the Red Scare, and Science Policy in Occupied Japan," *Journal of American East Asian Relations* 25 (2018): 343–83; Kenji Ito, "Transnational Scientific Advising: Occupied Japan, the United States National Academy of Sciences, and the Establishment of the Science Council of Japan," *British Journal for the History of Science* (2023): 1–15, available at https://doi.org/10.1017/S0007087423000031.

[11] I will write the Japanese personal names in the traditional order, the family name first, and the given name second, except when they appear in the references or as authors of European language publications. Romanization of Japanese names are mostly based on the Hepburn system, but I followed the person's preference whenever it is known. On Nishina, there is no good biography in English. There is a recent biography in Japanese: 伊藤 (Ito), *励起* (Excitation).

of ICSU's operational funding.[12] Additionally, Nishina was presumably acquainted with F. J. M. Stratton, the Secretary General of ICSU, who visited Japan as part of the British scientific expedition to observe the total solar eclipse in Hokkaido in 1936. One of Nishina's many endeavors to reintegrate Japanese scientists into the international scientific community involved his visit to Copenhagen to attend the ICSU meeting in September 1949, as a delegate of the Science Council of Japan (SCJ).[13] During Bohr's post-meeting dinner party, Nishina met Pierre Fleury, the Secretary General of IUPAP.[14] Following the President of the SCJ Kameyama Naoto's notification to IUPAP in January 1950 of the SCJ's desire to re-join, along with the presentation of the physicist Kotani Masao, the Chair of the Physics Research Liaison Committee (PRLC) of the SCJ, as the intermediary between the two organizations in January 1950, Nishina introduced Kotani to Fleury and Frazer and arranged Kotani's meeting with them.[15]

Kotani met Fleury and Fraser in September 1950. Fleury informed him that, since IUPAP had decided to separate politics and science, Japan's membership had never been revoked, and that Japan's reinstatement would be welcomed upon payment of the membership fee. Fleury went so far as to suggest that Japan should host an international conference, for which IUPAP and UNESCO would give approval and provide financial support.[16] Kotani's meeting with Fraser also reinforced Japan's possibility to return to IUPAP.[17]

The groundwork for Japan's return to IUPAP was thus laid. On September 22, presumably informed by Kotani about IUPAP's stance on Japan, Kameyama submitted a formal application to Fleury for Japan's inclusion in IUPAP.[18] The following month, Fleury responded and conveyed the IUPAP Executive Committee's approval.[19] The SCJ fully reinstated Japan's membership by remitting IUPAP's 1950 membership fee of $20 on February 19, 1951, completing Japan's return to IUPAP.[20]

[12] Yoshio Nishina to Niels Bohr (August 19, 1949), *NKZ Publications* 20, available at <https://www.nishina-mf.or.jp/wp/wp-content/uploads/2020/03/OCR_nkz-20.pdf>, 65–6.

[13] On the Science Council of Japan, see, for example, Ito, "Transnational Scientific Advising," and studies cited there.

[14] Yoshio Nishina to T.[sic] Fleury, July 6, 1950, IUPAP, Gothenburg Secretariat, series E6 "Correspondence with Liaison Members," vol. 9, folder "29. Japan 1948–1999" (hereafter, IUPAP-GS-J); 仁科芳雄 (Yoshio Nishina), "原子力・ユネスコ・平和: 国際学術会議に出席して" (Atomic Power, UNESCO, and Peace: Attending the International Council of Scientific Unions), *読売評論* (Yomiuri hyōron), no. 3 (1949), 12–19.

[15] Naoto Kameyama to the General Secretary of International Union of Physics, January 11, 1950, IUPAP-GS-J; Yoshio Nishina to T.[sic] Fleury (July 6, 1950), IUPAP-GS-J; Pierre Fleury to Yoshio Nishina, August 4, 1950, 中根良平 (Ryōhei Nakane) et al., eds., *仁科芳雄往復書簡集* (Nishina Yoshio Correspondence), vol. 3 (Tokyo: みすず書房 (Misuzu Shobō), 2007), "1424–1425"; Yoshio Nishina to Ronald Fraser, August 27, 1950, 中根 (Nakane), *書簡集* (Nishina Correspondence), vol. 3, 1426.

[16] 小谷正雄 (Masao Kotani), "1953 年国際理論物理学会議と IUPAP" (The 1953 International Conference of Theoretical Physics and the IUPAP), *日本物理学会誌* (Nihon Butsurigakkai shi) 32, no. 10 (1977): 760–1.

[17] Ronald Fraser to Nishina Yoshio, September 18, 1950, 中根 (Nakane) et al., *書簡集* (Nishina Correspondence), vol. 3, 1431–2.

[18] Naoto Kameyama to Pierre Fleury, September 22, 1950, IUPAP-GS-J.

[19] Pierre Fleury to Naoto Kameyama, October 17, 1950, IUPAP-GS-J.

[20] Hiroto Honda to Pierre Fleury, March 29, 1951, IUPAP-GS-J.

The Negotiation to Organize an International Conference in Japan

Following Japan's reintegration into IUPAP, Japanese physicists were able to host one of its conferences on their soil. In June 1951, Kotani journeyed to Europe to participate in the IUPAP General Assembly that took place in Copenhagen in July.[21] Prior to his journey, Kotani had a preliminary agreement with Japanese colleagues about a conference to be held in Japan.[22] However, he was not anticipating the Copenhagen meeting to yield any concrete decisions about it.[23] Following his participation in a conference on quantum physics organized by Bohr prior to the General Assembly, in which the majority of the delegates were present, Kotani discerned that there was adequate backing for the proposed meeting in Japan. Kramers, Fraser, and others responded positively. Kotani believed that the proposed event would provide numerous young, talented theoretical physicists in Japan with the chance to establish personal connections with top-tier physicists from overseas. Buoyed by this prospect, he presented a formal proposal for the planned meeting in Japan at the General Assembly. Harrie S. Massey delivered a speech to advocate for the proposal. The General Assembly unanimously accepted Kotani's proposal.[24]

It is possible that Bohr had a personal interest in supporting the idea of holding the conference in Japan. A later article in the *Nippon Times* reported that Bohr was overheard saying, "Let us hold the next session in the country of Nishina" during the meeting in Copenhagen.[25] Although the accuracy of this report is uncertain, it is plausible that the reporter obtained this information by interviewing physicists who attended the ICTP. Additionally, it should be noted that Nishina had passed away in January 1951, and news of his death had spread among the physics community in Europe and the United States.

A viewpoint that was perhaps more widely shared among the delegates of IUPAP is present in a letter from John C. Slater to Chester I. Barnard of the Rockefeller Foundation, written on March 17, 1952. Slater, who served as the chair of the US National Committee and one of the Vice-Presidents of IUPAP, believed that a conference in Japan would be highly beneficial for international science. He pointed out that Yukawa's work was indicative of "phenomenal progress" in theoretical physics in Japan and that closer scientific contact between physicists from around the world

[21] 小谷正雄 (Masao Kotani), "国際理論物理学会議について" (On the International Conference of Theoretical Physics), *日本物理教育学会誌* (Nihon Butsurikyōikugakkai shi) 2, no. 1 (1954): 21–5; 日本学術会議 25 年史普及版編集委員会 (Nihon Gakujutsu Kaigi 25-nenshi Fukyūban Henshūiinkai), ed., *日本学術会議 25 年史* (25-Year History of the Science Council of Japan) (東京: 学術資料頒布会, 1977).

[22] 小谷 (Kotani), "1953年国際理論物理学会議とIUPAP" (International Conference on Theoretical Physics in 1953 and the IUPAP).

[23] Kotani, "国際理論物理学会議について" (On the International Conference on Theoretical Physics).

[24] 小谷正雄 (Kotani Masao), "国際理論物理学会への期待" (Expectations for the International Conference on Theoretical Physics), *自然* (Shizen) 8, no. 3 (1953): 13–14; 藤岡由夫 (Yoshio Fujioka), et al., "国際物理学会議開催に至るまで" (The Path to the International Conference on Theoretical Physics), *日本物理学会誌* (Nihon Butsurigakkai shi) 6, no. 7 (1953): 458–464, at 458.

[25] Excerpts from *Nippon Times,* September 3, 1953, NARA, RG 307 Records of NSF, UD 23 Rec of Assoc Dir (Kelly) Subject Files, 1951–1962, box 3, folder "Japanese Correspondence 1953–1954" (hereafter "Kelly Correspondence 1953–1954").

and Japanese physicists would be mutually advantageous. While European and US scientists often enjoyed close personal contact with one another, Japanese physicists were generally known to them only by name. A conference in Japan, Slater believed, would have a "very profound effect in making the Japanese feel more a part of the international scientific world." Furthermore, such "strong internationalism" towards Japan and indirectly towards Asia, would provide a "most valuable gesture" by counteracting the contemporary tendency to create more barriers.[26]

Preparation for the Conference

Kotani acted fast. Immediately after the assembly, while he was still in Europe, Kotani contacted his Japanese colleagues. He wrote to Kobayashi Minoru and other physicists at Kyoto University, proposing to use the Yukawa Memorial Hall in Kyoto as the venue. On his way back to Japan, Kotani stopped by the United States and met Yukawa, who gave Kotani a blessing for this plan.[27] When Kotani came back to Japan, he raised the issue of hosting an international conference at the PRLC. He thought that at that point he gained a general approval from Japan's physics community.[28]

Kotani was, however, moving too fast. As he later realized, he should have sought approval from many others.[29] Additionally, he underestimated the challenges of hosting an international conference and its impact on the Japanese scientific community. This underestimation might be partly due to the expected size of the conference at the early stage. It is likely that initially the conference was intended to be of a relatively small size, as early correspondence among Kotani, Fraser, Fleury, and Slater referred to it as a "colloquium" or "seminar," rather than a "conference" or "congress."

Nevertheless, the SCJ approved the proposal and designated Kotani as the chairperson of the Preparatory Committee (later known as the Organizing Committee) for the conference, which included seventeen physicists and seven administrators. They held the first meeting on August 29, 1951, at the SCJ. In addition, the committee established local organizing committees in Tokyo and Kyoto to assist with the event's logistics.[30]

[26] John C. Slater to Chester I. Barnard [copy], March 17, 1952, folder "Japanese Correspondence 1951–1952," RG 307 Records of NSF, UD 23 Rec of Assoc Dir (Kelly) Subject Files, 1951–1962, box 3, National Archives and Records Administration, College Park, Maryland (hereafter "Kelly Correspondence 1951–1952").

[27] 藤岡 (Fujioka), et al., "至るまで" (The Path), 458; 小林稔 (Minoru Kobayashi), "1953年の国際会議と湯川記念館" (The International Conference in 1953 and the Yukawa Memorial Hall), *日本物理学会誌* (Nihon Butsurigakkai shi) 32, no. 10 (1977): 761–2; 小谷 (Kotani), "1953年国際理論物理学会議と IUPAP" (International Conference on Theoretical Physics in 1953 and IUPAP), 761.

[28] 小谷 (Kotani), "1953 年国際理論物理学会議と IUPAP" (International Conference on Theoretical Physics in 1953 and IUPAP).

[29] 小谷 (Kotani), "1953 年国際理論物理学会議と IUPAP" (International Conference on Theoretical Physics in 1953 and IUPAP).

[30] PQR, "国際理論物理学会始末記" (International Conference on Theoretical Physics from the Beginning to the End), *自然* (Shizen) 9, no. 2 (1954): 77–82; International Conference on Theoretical

Funding Crisis and the Rockefeller Foundation

The Japanese organizers encountered an array of obstacles, foremost of which was insufficient funding. When Kotani disseminated the initial news of the conference to Japanese physicists, he provided a tentative budgetary estimate of approximately ¥2,000,000. However, Fujioka expounded that the true expenditure would require an additional digit, totaling at least ¥10,000,000."[31]

From the outset, the general policy was that the expenses of the overseas scientists during their stay would be covered by funding from Japanese sources, while their international transportation would be financed by foreign sources. The earliest available document detailing the estimated funds from Japanese sources, dated October 5, 1951, amounted to $22,000 (equivalent to ¥8,000,000). This amount was based on the estimated expenses for the stay of fifteen overseas participants in Japan.[32] As for external sources, Kotani heard from Fraser in July 1951 that Pierre Auger, the Director of the Natural Science Department at UNESCO, suggested that Japanese physicists should apply for a special grant of $12,000.[33] Consequently, Wagatsuma Sakae, one of the Vice-Presidents of the SCJ, sent a formal request for $12,000 to Jaime Torres Bodet, the Director General of UNESCO, on October 5, 1951.[34]

However, in response to Kotani's request for a grant, Auger replied on January 4, 1952, expressing the regretful news that UNESCO was unable to finance the desired amount due to financial difficulties and previous commitments. Auger proposed that the conference be postponed until 1954 when UNESCO would be capable of providing a grant of around $10,000.[35] This decision was likely due to the Pacific Science Congress scheduled for 1953 in Quezon.[36] Subsequently, Fleury offered two possible resolutions in his letter on February 12. The first option was to defer the conference to 1954, and consequently receive direct subvention from UNESCO of approximately $10,000. The second option was to proceed with the conference in 1953, with the possibility that IUPAP might offer $5,000 from UNESCO through ICSU.[37]

UNESCO's decision posed a significant challenge for the Japanese organizers. Postponing the conference to 1954 was not a feasible option for various reasons. Firstly, the organizers had already begun publicizing the event and had obtained numerous approvals and pledges of support, including from the Japanese Government. This was evident from the cabinet decision issued on November 20, 1951, approving the conference for 1953 and requesting assistance from the relevant government agencies.[38]

Physics, *Proceedings of the International Conference of Theoretical Physics, Kyoto & Tokyo, September 1953: held under the auspices of the International Union of Pure and Applied Physics* (1954), xvii.

[31] 藤岡 (Fujioka), et al., "至るまで" (The Path), 459.

[32] Sakae Wagatsuma to Jaime Torres Bodet [copy], October 5, 1951, "Kelly Correspondence, 1951–1952." Also see: Naoto Kameyama to Harry C. Kelly, January 31, 1952, "Kelly Correspondence, 1951–1952"; 藤岡 (Fujioka), et al., "至るまで" (The Path), 459.

[33] Ronald Fraser to Masao Kotani [copy], July 19, 1951, "Kelly Correspondence 1951–1952."

[34] Sakae Wagatsuma to Jaime Torres Bodet [copy], October 5, 1951, IUPAP-GS-J (also in "Kelly Correspondence, 1951–1952"). See also, Sakae Wagatsuma to H. A. Kramers, October 5, 1951, IUPAP-GS-J.

[35] Pierre Auger to Sakae Wagatsuma [copy], January 4, 1952, "Kelly Correspondence, 1951–1952."

[36] 藤岡 (Fujioka), et al., "至るまで" (The Path), 459.

[37] Masao Kotani to John A. Wheeler [copy], March 12, 1952, "Kelly Correspondence, 1951–1952."

[38] "国際物理学会議開催について" (On holding an international conference on theoretical physics), Japan Center for Asian Historical Records (JACAR), Ref.A13111597800.

Delaying the conference would jeopardize their credibility. Secondly, obtaining additional funding from the Japanese government was not a viable solution.[39] Thirdly, scheduling the conference in 1954 would prove inconvenient for US scientists, as the IUPAP General Assembly was also planned to be held that year, presumably in Europe. Given the constraints of the era, it was unrealistic for US scientists to attend two international events in different parts of the world in a single year.[40]

Still technically under the Allied occupation, the SCJ sought the assistance of William K. Bunce, chief of the Religious and Cultural Resources Division of the Civil Information and Education Section of the General Headquarters of the Supreme Commander of Allied Powers (SCAP/GHQ) and primary point of contact between Japan and UNESCO until Japan joined UNESCO in July of that year. Bunce offered to write to UNESCO himself and recommended that the SCJ request a reconsideration of their decision.[41]

Although Kameyama wrote to Auger, as well as Fleury and Kramers, it was Harry C. Kelly, then the Deputy Director of the National Science Foundation (NSF), who played a crucial role in resolving this conundrum.[42] Kameyama had reached out to Kelly about the "predicament" on January 31, 1952, requesting him to speak to UNESCO in favor of their position if he could.[43] Although unable to intervene in Kameyama's negotiations with UNESCO, Kelly, who remained willing to assist Japanese scientists, could authorize funding from the NSF to support the trip of US scientists to Japan. Moreover, he was well-versed with potential funders for scientific research in the United States. On February 29, Kelly met with Chester I. Barnard, the President of the Rockefeller Foundation, who found the SCJ's request for support worthwhile for his foundation's consideration.[44] Kelly sent a telegram to Kameyama on March 3, suggesting that they seek support from the Rockefeller Foundation.[45] Kelly and Slater concurred that the funding from the Rockefeller Foundation should be allocated to scientists from countries other than the United States, while the NSF would cover the expenses of US delegates. Kelly conveyed this message to Kameyama on March 7, urging them not to postpone the conference.[46] This policy was generally followed, albeit creating some disparity between US and European participants. A limited number of European scientists could obtain funding to travel to Japan from local sources, whereas the NSF funding allowed more US participants. Consequently, more than half of the fifty-five overseas participants were from the United States.[47]

[39] Naoto Kameyama to Pierre Auger, January 21, 1952, "Kelly Correspondence, 1951–1952."

[40] From John C. Slater to Chester I. Barnard [copy], March 17, 1952, "Kelly Correspondence 1951–1952."

[41] Naoto Kameyama to Harry C. Kelly, January 31, 1952, "Kelly Correspondence 1951–1952."

[42] Naoto Kameyama to Pierre Auger [copy], January 21, 1952, "Kelly Correspondence, 1951–1952."

[43] Kameyama to Harry C. Kelly, January 31, 1952, "Kelly Correspondence, 1951–1952."

[44] Harry C. Kelly to Naoto Kameyama [copy], March 7, 1952, "Kelly Correspondence, 1951–1952."

[45] Harry C. Kelly to Naoto Kameyama [copy, telegram], March 3, 1952, "Kelly Correspondence, 1951–1952."

[46] 小谷正雄 (Masao Kotani), "1953年度の日本における国際理論物理学会議" (The 1953 International Conference of Theoretical Physics in Japan), *日本物理学会誌* (Nihon Butsurigakkai shi) 7, no. 4 (1952): 229–30.

[47] Kotani, "国際理論物理学会議について" (On the International Conference on Theoretical Physics); 日本学術会議 25 年史普及版編集委員会 (Nihon Gakujutsu Kaigi 25-nenshi Fukyūban Henshūiinkai), ed., *日本学術会議 25 年史* (25-Year History of the Science Council of Japan).

On March 9, 1952, the Preparatory Committee convened to deliberate on the financial predicament. After carefully considering the hopeful prospect of receiving aid from the Rockefeller Foundation, and the news that an additional subsidy of $2,000 ($7,000 in total) from UNESCO had been learned from Auger, the committee arrived at the resolution not to defer the conference.[48]

To enhance the possibility of acquiring the Rockefeller Foundation's assistance, Kelly requested Slater to compose a letter advocating for the conference to Barnard.[49] Slater's letter to Barnard dated on March 17 ardently supported the conference.[50] Personally meeting with Barnard and Warren Weaver, the head of the Natural Sciences Division of the Rockefeller Foundation, Kelly became confident that he had persuaded them.[51] Given that the SCJ had initially requested $12,000 from UNESCO and anticipated $5,000 from ICSU, the Japanese organizers petitioned for the remaining $7,000 from the Rockefeller Foundation.[52] The Rockefeller Foundation promptly notified of the $7,000 grant on April 9, 1952.[53] Furthermore, UNESCO augmented its award to $10,000.[54]

Thus, the organizers found themselves with ample funding to invite scholars from overseas. However, their success in securing funding from abroad meant that they then had to raise funds to cover the expenses of these participants during their stay in Japan. The task of fundraising from domestic sources was mainly carried out by Fujioka, who negotiated with officials from the Ministry of Treasury to secure partial support of approximately $18,000 (¥6,436,000).[55] Despite criticism from some quarters that the Japanese government had not provided sufficient financial support for the conference, Fujioka believed that the Ministry of Treasury had provided funding to the best of their capacities and justified their contributions. To raise the additional $40,000 (¥14,694,165) required, the organizers established the Fundraising Committee which included both scientists and prominent figures from the financial and industrial sectors.[56]

The largest contributors were Japanese newspapers, with the *Asahi* newspaper donating ¥3,000,000 (approximately half of the government's support), while *Mainichi* and *Yomiuri* each donated ¥1,000,000. The newspapers had amassed substantial profits during the war due to their monopoly, and a scientific event presented a favorable opportunity to increase their subscribers.[57] In exchange for their donations, the newspaper companies requested the Organizing Committee's permission to hold their own events featuring renowned physicists such as

[48] Masao Kotani to John A. Wheeler, March 12, 1952 [copy], "Kelly Correspondence, 1951–1952."

[49] Harry C. Kelly to John Slater [copy] [no date], "Kelly Correspondence, 1951–1952."

[50] John C. Slater to Chester I. Barnard [copy], March 17, 1952, "Kelly Correspondence, 1951–1952."

[51] Harry C. Kelly to John C. Slater [copy], March 26, 1952, "Kelly Correspondence, 1951–1952."

[52] 藤岡 (Fujioka), et al., "至るまで" (The Path), 459.

[53] Flora M. Rhind (Secretary, the Rockefeller Foundation), to Naoto Kameyama[copy], April 91,952, "Kelly Correspondence, 1951–1952."

[54] 藤岡 (Fujioka), et al., "至るまで" (The Path), 459.

[55] PQR, "始末記" (From the Beginning to the End).

[56] PQR, "始末記" (From the Beginning to the End), 78.

[57] 永田健 (Ken Nagata) and 伊藤憲二 (Kenji Ito), "国際地球観測年における南極観測事業と朝日新聞社: 日本における巨大科学の民間起源" ("Big Science" by a Newspaper Company: The Asahi Shimbun Company and Japan's Antarctic Expedition in the International Geophysical Year), 年報科学・技術・社会 (Nempō kagaku gijutsu shakai) 25 (2016): 25–47.

Bohr, Heisenberg, and Oppenheimer.[58] Despite their requests, none of these scientists visited Japan for the conference. Nonetheless, the newspaper companies did arrange their own public lectures and round table discussions, inviting conference participants.[59]

In addition to the media and the industrial sector, members of the general public and various groups, including Kaisei High School students and Tokyo Ryōyōjo Hospital patients, made contributions to the conference's funding. The media played an instrumental role in promoting the event and collecting small donations from the public. Even though the total amount donated by thirty-five individuals was a mere ¥33,920, and various groups donated ¥52,317, newspapers framed the donation as a touching story, which helped generate further public interest. For instance, a young girl who donated 200 yen from her summer vacation savings was invited to the conference's opening ceremony, where newspaper photographers captured a moment of her shaking hands with Nevil Mott, the President of IUPAP.[60]

Here again, however, the organizers may have been excessive in their efforts to raise funding, due to their relative inexperience in conference planning. With the ample fund, their hospitality became somewhat extravagant. All the transportation and meal costs of overseas participants were borne by the committee. Hayakawa Satio was taken aback by the food provided by the organizers. Food shortages still plagued Japan, and when he returned from the United States, hunger was his primary concern. On his train journey from Tokyo to Nagoya, he was served a sandwich and coffee prepared by the Imperial Hotel in the morning. Hayakawa thought it was brunch. Soon, he was taken to the dining car where he was served a kind of steak lunch that he had never eaten before, even during his stay in the United States.[61] Many of overseas participants might have enjoyed the luxury of the expensive hotel rooms and meals, but not entirely. Herbert Frölich said that he had never stayed at such a lavish hotel. Charles Coulson was concerned that they might have to do it in an equally sumptuous fashion when British physicists would organize a similar event. Moreover, to satisfy the patrons, various public lectures and banquets were organized. Conference participants were requested to attend these events. According to an anonymous author, Abraham Pais complained that they would have been freer in the Soviet Union.[62]

Expanding the Scale

Yokoyama Sumi, who worked as Nishina's long-time assistant, detailed in a letter to Kelly on December 6, 1952, how Kotani and Fujioka kept changing their plans "every week," increasing the budget from ¥2,000,000 to ¥12,000,000, which was met

[58] PQR, "始末記" (From the Beginning to the End), 78.
[59] "原子力時代と日本の将来" (Atomic Age and Japan's Future), *朝日新聞* (*Asahi* newspaper), (Morning, September 14, 1953): 4.
[60] PQR, "始末記" (From the Beginning to the End), 78.
[61] 早川幸男, "臭化銀中毒にかかった貧乏書生" (An Impoverished Student Who Contracted Bromism)," *日本物理学会誌* (Nihon Butsurigakkai shi) 32, no. 10 (1977): 763–4.
[62] PQR, "始末記" (From the Beginning to the End), 78.

with disapproval from Kameyama. Tomonaga also voiced concerns that Kotani and Fujioka were planning to invite too many scientists.[63]

With the influx of funding, the scale of the conference expanded significantly. Initially, Kotani envisioned a small meeting on elementary particle physics. However, Kramers and Ilya Prigogine, who were probably familiar with Kubo Ryōgo's work, suggested inclusion of statistical mechanics.[64] While the original plan was to hold the conference at the newly constructed Yukawa Memorial Hall in Kyoto, the need for three parallel sessions necessitated securing two additional lecture halls. Given that many key members of the Preparatory Committee, including Fujioka, Kotani, and Tomonaga, were located in Tokyo, along with the headquarters of the SCJ, it was the local Organizing Committee in Tokyo that eventually assumed the central role in planning the conference. As the overseas participants would arrive in Tokyo, it was logical to organize an event in the capital city. Consequently, it was decided that the opening ceremony of the conference would be held at the University of Tokyo on September 15, 1954.

The organizers' list of invitees continued to grow. They carefully selected speakers from both Japan and overseas through a process of invitation only. The selection of overseas speakers was based on their scientific merits and their alignment with research interests in Japan, to gain responses to developments in the field and to inspire young Japanese researchers.[65] The organizers consulted with prominent figures such as Mott and Slater to ensure a diverse and distinguished group of European and US participants.[66] However, some invitees were selected for reasons beyond their scientific research, such as I. I. Rabi and Harry C. Kelly, who were invited due to their contributions to the Japanese physics community (though both declined).[67] The IUPAP Executive Board members were also invited.

An initial list of planned invitees from overseas consisted of established physicists, included Enrico Fermi, Robert J. Oppenheimer, Julian S. Schwinger from the United States, Bohr, Werner Heisenberg, Max Born, Freeman Dyson, Wolfgang Pauli, Paul A. M. Dirac from Europe, Vladimir Fock and Lev Landau from the USSR, who were all unable to attend.[68] The majority of the overseas participants were less established but more active in their respective fields. At the time of the conference, the only Nobel laureate in attendance was Yukawa, but fourteen of the overseas participants were later awarded Nobel Prizes in either physics or chemistry, with John Bardeen receiving two.[69] From Japan, about seventeen speakers (including co-authors) were selected.[70]

As the number of participants increased, the program was also expanded. Topics related to solid state physics began to constitute a significant portion of the conference alongside statistical mechanics. Eventually, as mentioned, the program included three

[63] Sumi Yokoyama to Harry C. Kelly, December 6, 1952, "Kelly Correspondence 1953–1954."
[64] 藤岡 (Fujioka), et al., "至るまで" (The Path), 460.
[65] 早川, "臭化銀中毒にかかった貧乏書生." (A Poor Student Who Contracted Bromism).
[66] 藤岡 (Fujioka), et al., "至るまで" (The Path), 463.
[67] Harry C. Kelly to Sumi Yokoyama [copy], April 29, 1953, "Kelly Correspondence, 1953–1954."
[68] Masao Kotani to John A. Wheeler [copy], March 19, 1952, "Kelly Correspondence, 1951–1952."
[69] 山口嘉夫 (Yoshio Yamaguchi), "1953 年の理論物理学国際会議開催」と小谷先生" (The 1953 International Conference on Theoretical Physics and Kotani-sensei), *日本物理学会誌* (Nihon Butsurigakkai shi) 49, no. 6 (1994): 472–75.
[70] International Conference on Theoretical Physics, *Proceedings*, v–xiii.

parallel sessions, in addition to nine satellite symposia and two informal meetings. Moreover, numerous cultural events and several excursions were offered.[71]

One final significant addition to the conference was a memorial service in honor of Nishina. The suggestion for this service came from John A. Wheeler, who recommended to Mott that the overseas participants visit Nishina's laboratory to pay tribute by laying a wreath and contributing to the Nishina Memorial Fund. Mott found the idea "most interesting and welcome" and promptly wrote to Kotani on August 29, roughly two weeks before the conference, to request that appropriate arrangements be made if Kotani deemed the idea appropriate.[72] Given the late timing of the request, the organizers might find it difficult to include this new addition to the program. Nonetheless, probably due to their deep fondness for their departed leader, they quickly and eagerly approved the idea. At a meeting on August 31, they decided to incorporate the memorial service for Nishina into the conference, and the news of this change was soon reported by the media to the general public.[73]

The Japanese organizers devoted a great deal of effort to ensure the success of the conference. Kotani recollects working tirelessly until late into the night at the secretariat of the SCJ in Ueno, drafting letters, preparing documents, and organizing excursions, in collaboration with Yoshida Masao, who offered his expertise in refining Kotani's English prose.[74]

The meticulous efforts of the organizers did not escape the attention of the press. In August 1953, the *Asahi* newspaper featured an article on Fujioka, delineating his personality and the challenges he faced in organizing the ICTP. Besides getting along with persistently demanding senior physicists on his committee, he also had to deal with recalcitrant left-wing young physicists in the elementary particle theory group who were predisposed to regard Fujioka as "reactionary" and were swift to denounce his actions.[75] However, even his critics had to acknowledge the diligence of Fujioka and other organizers. One anonymous author with the pen name of PQR, who was most likely one of the left-wing young physicists, criticized the way the conference was envisioned but praised the enthusiasm of Fujioka and others in realizing their ideal vision for the conference. Even after September 10, 1954, when many overseas participants had already arrived, Fujioka was still raising funds. He sent telegrams to other members of the Organizing Committee, assuring them that he had requested donations from the Japan Business Federation and would receive the necessary funds to cover the expenses.[76]

The conference organizers were not alone in the preparations for the conference. Japanese physicists organized study groups to review the recent work of the visiting physicists, and more importantly, they endeavored to improve their English language

[71] International Conference on Theoretical Physics, *Proceedings*, xx–xxvi.

[72] Nevil F. Mott to Masao Kotani (August 29, 1953) [copy], "Kelly Correspondence, 1953–1954."

[73] "仁科博士の慰霊祭" (Memorial Service for Dr Nishina), *朝日新聞* (*Asahi* newspaper), (Evening, September 2, 1953): 3.

[74] 小谷 (Kotani), "1953 年国際理論物理学会議と IUPAP" (International Conference on Theoretical Physics in 1953 and IUPAP), 761. Yoshida was exceptionally fluent in English because of his extensive overseas experience as the second son of Yoshida Shigeru.

[75] "藤岡由夫" (Fujioka Yoshio), 朝日新聞 (*Asahi* newspaper), (Morning, August 2, 1953): 3.

[76] PQR, "始末記" (From the Beginning to the End).

skills to facilitate better communication with their foreign colleagues. Given that very few Japanese physicists had experience with international conferences or extended stays abroad, they awaited the event nervously, figuratively describing it as the arrival of Commodore Mathew Perry's "Black Ships."[77]

Conclusion and the Aftermath

The conference was a huge success. Fifty-three from overseas, and about 850 from Japan participated. Although there were some complaints and criticisms about this conference, participants both from outside and within Japan were generally satisfied, and the conference organizers were happy with the compliments they received.[78]

The conference was also well-received within Japanese society. Because of the visit of many famous physicists, several of whom were authors of textbooks well-known among Japanese students, the ICTP was a rare media event in science, comparable to the visits of Einstein (1922), and Bohr (1937), or Yukawa's Nobel Prize in 1949. Numerous related articles appeared on newspapers, which I do not discuss here.

Arguably the most notable outcome of this conference was the establishment or restoration of personal connections between Japanese physicists and their overseas counterparts. By forging connections during the conference, certain young physicists were afforded the opportunity to pursue studies abroad.[79] In organizing the conference, Japanese physicists, particularly those who assumed leadership positions following Nishina's passing, gained valuable insights into the intricacies of international academic politics and finance, particularly with regard to international organizations. In these ways, organizing the ICTP conference was a work of reconnecting the Japanese physicists' ties to the international physical community.

[77] 永宮健夫 (Takeo Nagamiya), "会議周辺の思い出" (Reminiscences Related to the Conference), 日本物理学会誌 (*Nihon Butsurigakkai shi*) 32, no. 10 (1977): 764–6; 山口 (Yamaguchi), "1953年の理論物理学国際会議開催|と小谷先生" (The 1953 International Conference on Theoretical Physics and Kotani-sensei); 西島和彦 (Kazuhiko Nishijima), "初めての国際会議" (My First International Conference), *日本物理学会誌* (Nihon Butsurigakkai shi) 32, no. 10 (1977): 762–3.

[78] International Conference on Theoretical Physics, *Proceedings*, xvi–xvii.

[79] International Conference on Theoretical Physics, *Proceedings*, xvii.

PART III
PHYSICS, DIPLOMACY, AND THE COLD WAR

9

Socialist Internationalism and Science Diplomacy Across the Iron Curtain

Geneva, Dubna, IUPAP

Climério Paulo da Silva Neto and Alexei Kojevnikov

After several years of Cold War isolation from Western peers, in the mid-1950s, Soviet scientists started redefining their role in their country's foreign relations. What began timidly as sporadic participation by a few scientists in international conferences soon acquired an official and strategic character. In 1955 a sizeable Soviet delegation of previously secret nuclear researchers participated in the First International Conference on the Peaceful Uses of Atomic Energy in Geneva. In 1956 they reorganized one of their classified nuclear laboratories into an open and international Joint Institute for Nuclear Research (JINR) in Dubna, the socialist analog of the European Organization for Nuclear Research (CERN). And in 1957, the USSR actively participated in the International Geophysical Year (IGY) and joined the International Union of Pure and Applied Physics (IUPAP).

Our chapter analyzes these developments by focusing on one of the key Soviet participants and promoters of science diplomacy, the physicist Dmitry Ivanovich Blokhintsev (1908–79). Known primarily for his works on quantum theory and the collectivist, "ensemble" interpretation of quantum mechanics, Blokhintsev relied on his political and scholarly connections to spread scientific internationalism within the socialist "second" world and beyond. In 1955 he created an international sensation with his report in Geneva on the construction and operation of the world's first nuclear power station. In 1956, Blokhintsev became the organizer and the first Director of the International Research Center in Dubna, and from 1966 to 1969, he served as the President of the International Union of Pure and Applied Physics (IUPAP). Using documents from the IUPAP archives, and several Russian archives, we investigate the Soviet (and generally, socialist) approach to scientific internationalism during the central period of the Cold War, from 1954 to 1970.

Ebbs and Flows of Soviet Scientific Internationalism

The intensity of scientific contacts between the Soviet Union and Western countries fluctuated considerably over the decades. In 1920, as the revolutionary regime emerged victorious from the devastating Russian Civil War, it lacked any international recognition and diplomatic contacts. Nevertheless, the Bolshevik government sent a representative scientific delegation to Europe, led by the physicist Abram

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Joffe, to acquire scientific literature, instruments, and restore academic connections interrupted since the start of World War I in 1914. By the end of the 1920s, along with the gradual establishment of official relations with other countries, contacts between scientists also intensified, especially between the USSR and Weimar Germany, another international pariah of that decade. A significant portion of papers published in the leading physics journals in Germany belonged to Soviet authors. The international openness of the USSR included bilateral visits, conferences, publications, and correspondence, peaking around 1930. By 1933 even the USA recognized the country diplomatically, but in that same year, the Soviet Union started isolating itself from the world, due largely to the establishment of hostile Nazi power in Germany. It rapidly became much harder for Soviet scientists to get permission to travel abroad, which aborted, for example, their cooperation with the program of International Rockefeller Fellowships for postdoctoral researchers.[1] By 1938, the looming threat of major war accompanied by vast political purges and spy-mania cut practically all channels of international contact for Soviet scientists, even personal correspondence. Only the official exchange of published scientific literature continued relatively uninterrupted.

Starting in 1941, the establishment of a wartime alliance between the USSR, the UK, and the USA reopened some scientific exchanges, primarily concerning military technology and medicine. As World War II was coming to its victorious end, Soviet scientists' hopes for a further revival of foreign contacts culminated during the Academy of Sciences' jubilee celebration in June 1945 with a major international conference attended by hundreds of allied and neutral scientists, even though some notable nuclear physicists could not accept the invitation to visit the USSR.[2] But already the following year, the development of Cold-War tensions started curtailing the internationalist trend. A high-profile political scandal erupted in 1947 following the Soviet medical delegation's visit to the USA, with publicized accusations of espionage and trading state secrets, resulting once again in the effective isolation of Soviet science.[3] Some proposals to send scientists to conferences abroad could still be submitted, but the bureaucratic procedures became so cautious and tedious that conference deadlines were almost always missed before any official permission could be granted. The USSR's participation in many international organizations also lapsed, but even at the nadir of scientific internationalism, 1951, it still retained membership in two international academic unions—astronomy and chemistry.

After its establishment in 1919, the International Research Council (IRC) boycotted World War I losers and excluded revolutionary Russia, "because of the mistrust of the new doctrines of Soviet government."[4] The downfall of the IRC and its replacement by the International Council of Scientific Unions (ICSU) in 1931 opened the way for Soviet membership. In 1930, the USSR joined the International Union of Pure

[1] Alexei B. Kozhevnikov, *Filantropiia Rokfellera i Sovetskaia Nauka* (St. Petersburg: MFIN, 1993).

[2] The Central Committee of the CPSU allowed the Academy to invite 155 foreign scientists and fifty-four scientific institutions. Russian State Archive of Socio-Political History (RGASPI). F. 17. Op. 3. D. 1052. L. 40.

[3] Nikolai Krementsov, *The Cure: A Story of Cancer and Politics from the Annals of the Cold War* (Chicago: University of Chicago Press, 2002).

[4] Frank Greenaway, *Science International: A History of the International Council of Scientific Unions* (Cambridge: Cambridge University Press, 1996), 57.

and Applied Chemistry (IUPAC) "and from 1933 to 1939 paid its annual membership fees of 675 golden dollars regularly but did not participate in the governing body of the Union."[5] On March 2, 1935, the Soviet government approved the country's participation in the International Astronomical Union (IAU).[6] IUPAP, however, since its creation in 1923, seemed too preoccupied with the German question to think about establishing ties with the Soviet Union.[7]

In the World War II aftermath ICSU wanted to avoid the exclusionist mistakes of the interwar period. The executive committees of the IAU and IUPAC tried to resume Soviet participation immediately after the war. In December 1945, IUPAC President Marston Bogert invited the Soviet Academy to nominate a Vice-President, and then repeated the invitation, emphasizing "that such nomination will give us great pleasure, meaning the cooperation of your great country and its outstanding chemists."[8] After positive endorsements from at least four lower levels of bureaucracy, on July 16, 1946, the Central Committee of the Communist Party resolved to "allow the Academy of Sciences of the USSR to take part in the work of the International Union of Chemistry" and to "approve Academician A[lexander] N. Nesmeyanov as a candidate for the post of Vice-President" of IUPAC.[9] The Central Committee also reacted positively to the IAU invitation, approving a delegation for the 1946 conference scheduled to meet in Copenhagen and the proposal to host the 1950 assembly in the USSR. The Soviet Academy was planning to demonstrate their astronomical observatories restored after wartime destruction, capable of competing with American observatories.[10]

IUPAP's attempts to bring Soviet physicists on board began early in 1947, by the Executive Committee led by the Dutch Hendrik Kramers and the French Pierre Fleury, who took office as President and Secretary General, respectively. They considered it essential to contact representatives of all nations with significant contributions to physics, especially England, the United States, and Russia. "The most difficult problem [was] contact with Russia,"[11] assessed one of the Vice-Presidents, the Dutch Cornelis Gorter. During a trip to New York, Kramers discussed the matter with the

[5] Shatalin, Pervukhin and Merkulov to Malenkov, April 5, 1946. Archive of the President of the Russian Federation (APRF), F. 3. Op. 33. D. 212. L. 12–14.

[6] RGASPI. F. 17. Op. 3. D. 968. L. 15. The USSR had participated in two meetings as observers. APRF, F. 3. Op. 33. D. 209. L. 4–5.

[7] Until 1931 IUPAP waited for the time when Germany could join and subsequently faced other challenges related to the anticipated German membership until most of the international activities became disrupted by World War II. See the chapters by Navarro, and Fauque and Fox in this volume. However, the Archives of the Russian Academy of Sciences contain a folder related to IUPAP ("Mezhdunarodnyi Soyuz chistoi i prikladnoi fiziki," ARAN, F.2, Op.1, D.595.) dated November 1937. This suggests that IUPAP invited Soviet physicists to the assembly scheduled for 1938.

[8] Bogert to Vavilov, April 8, and June 28, 1946, APRF F. 3, Op. 33, D. 212, L. 7.

[9] RGASPI. F. 17, Op. 3, D. 1059. L. 81. At the time, Nesmeyanov worked as the Dean of the Chemistry Department of Moscow State University. The Commissar of Chemical Industry characterized him as a prominent specialist and energetic researcher from the ranks of younger academicians, adding: "Nesmeyanov does not work in the military chemical industry and does not know its production secrets." Pervukhin to Molotov, January 17, 1946, APRF F. 3, Op. 33, D. 212, L. 20. Subsequently, Nesmeyanov would rise to the Secretary of the Academy of Sciences' Division of Chemistry, and in 1951 to the President of the entire academy.

[10] RGASPI. F. 17, Op. 117, D. 1056. L. 117–20.

[11] "Gorter to Fleury, January 27, 1947. IUPAP, Gothenburg secretariat, (hereafter IUPAP Gothenburg) Series E6 "Correspondence with Liaison Members," vol. 10, folder "34. Netherlands 1947–1999," Center for the History of Science, Royal Swedish Academy of Science.

physicist Dmitry Skobeltsyn, a Soviet scientific advisor to the UN Atomic Energy Commission and suggested writing to the President of the Soviet Academy, Sergei Vavilov.[12] In February 1947, Fleury had already tried to invite Vavilov to participate in IUPAP's Optics Commission but received no reply.[13]

The timing was certainly inopportune, as the political situation in the Soviet Union was then already turning away from internationalism. In 1947, Vavilov's public obligation as the academy's President was to warn his colleagues against excessive contacts with the West, which could result in revealing the country's military secrets.[14] With optics being a sensitive military technology, and as the head of Soviet research in optics, he personally was a carrier of many such secrets. The Central Committee still allowed some earlier commitments to continue: in June 1947 it approved the Soviet delegation to the International Congress of Physiologists, and in July permitted chemists to attend an IUPAC meeting in London.[15] In June 1948 it also authorized the Soviet Academy to participate in the 7th IAU General Assembly in Zurich, reconfirming support to host the next congress in Leningrad and Pulkovo.[16] Starting a major new international initiative would have been much harder, and as yet, we have found no record of Soviet considerations of IUPAP's 1947 openings. The matter would have to wait several more years for the dramatic post-Stalin shifts in the political climate.

International Atom

Immediately after Stalin's death in March 1953, a wave of remarkable changes started in both domestic and international policies of the Soviet Union, inaugurating a decade of reforms that would later become known as the "thaw" or "de-Stalinization." The country's Cold War posture also changed, at first quietly, then ever more openly, from beleaguered isolationism towards "peaceful coexistence," officially proclaimed by the first Secretary Nikita Khrushchev at the 20th Congress of the Communist Party in 1956. The new policy combined nuclear deterrence in the tense military standoff with an increasingly more open and active internationalist competition with the capitalist world in economic, social, diplomatic, and cultural spheres. In a few years, the faces of Soviet athletes, musicians, artists, and scientists became familiar

[12] J. van den Handel to Fleury, September 16, 1947, ibid. On Skobeltsyn and the UN Atomic Energy Commission, see RGASPI. F. 17. Op. 3. D. 1058. L. 8.

[13] Fleury to Vavilov, February 17, 1947, IUPAP Gothenburg, Series E6 "Correspondence with Liaison Members," vol. 12, folder "42. Russia 1947–1999."

[14] Alexei Kojevnikov, "President of Stalin's Academy: The Mask and Responsibility of Sergei Vavilov," *Isis* 87, no. 1 (1996): 18–50.

[15] RGASPI, F. 17, Op. 3. D. 1065, L. 46 and D. 1066, L. 8.

[16] RGASPI, F. 17, Op. 3, D. 1071, L. 23. The procedures for approving foreign trips were becoming increasingly stricter. The Soviet delegation for the IAU congress traveled with detailed "policy instructions," which included: "oppose any attempt to use the convention for reactionary political purposes"; "[s]eek recognition of the Russian language as an official language in plenary sessions of the Assembly" and "take all the necessary preliminary steps to [include the astronomical institutions of the other Soviet republics independently] at the next IAU congress in 1951." RGASPI, F. 17, Op. 3. D. 1072, L. 93. The 1951 assembly was postponed because of the Korean War. The Soviet delegation protested the decision and renewed the invitation for 1952, but the IAU Executive Committee accepted the proposal by Italy's National Research Council to hold the 1952 meeting in Rome.

fixtures at the most important international arenas and venues. Collectively, they made such a splash that Cold War mongers on the other side of the Iron Curtain started talking alarmingly about the "Soviet cultural offensive."[17] The pinnacles of this new cultural internationalism included the 1957 World Festival of Youth and Students in Moscow, Van Cliburn's victory in the International Tchaikovsky Competition, and, of course, the spectacular public triumph of Sputnik I.

In science, the similarly important case of the IGY (1957–58) reveals the dynamics of rapid changes. The first invitation to participate in the IGY was sent to the USSR in September 1952 and reiterated during subsequent months. At first, "senior figures at the Soviet Academy seem to have been reluctant to take a position for or against the IGY until after the death of Stalin in March 1953 and the first faint breaths of political change which followed it."[18] Then, in response to pressures from scientists for more international exchanges, the change was so swift that Nesmeyanov, by then President of the Academy of Sciences, indicated that the Soviet Union would join the IGY still in the week of Stalin's death, and a month later, the Foreign Minister Vyacheslav Molotov communicated to the Director of the United Nations Educational, Scientific and Cultural Organization (UNESCO) that the USSR was about to join the organization.

Perhaps counterintuitively, but some of the most successful openings towards scientific internationalism came from the field closest to top military secrets and state security concerns. After the success of the bomb project, Soviet nuclear physicists used their political capital and connections to powerful leaders to lobby for international exchanges in their discipline and science in general.[19] By the mid-1950s, the US government was also reconsidering its Cold War posturing and moving away from McCarthyist obsession with secrecy and spy paranoia. It became obvious that classifying all knowledge related to atomic energy had failed to prevent the USSR from developing nuclear weapons. Successful Soviet tests of fission and fusion devices convinced President Eisenhower to shift the American strategy from trying to guard the nuclear monopoly toward restricted international cooperation. His December 1953 "Atoms for Peace" initiative, based on the somewhat unverifiable assumption that it is possible to entirely separate military nuclear technologies and know-how from civilian ones, intended to keep nuclear weapons a state secret while declassifying, creating, monitoring, and profiting from the international market for uranium fuel and atomic energy production. Contrary to Eisenhower's fears that Soviet leaders would reject his challenge to open up their sources of uranium, the latter actually welcomed his Atoms for Peace proposal "with enthusiasm, corresponding to their interests in détente, international opening, and legitimizing their newly acquired status as a nuclear superpower"[20] (Figure 9.1).

[17] Frederick C. Barghoorn, *The Soviet Cultural Offensive: The Role of Cultural Diplomacy in Soviet Foreign Policy* (Princeton: Princeton University Press, 1960).

[18] Rip Bulkeley, "Aspects of the Soviet IGY," *Russian Journal of Earth Sciences* 10, no. 1 (2008): 1–17, on 2.

[19] Konstantin Ivanov, "Science after Stalin: Forging a New Image of Soviet Science," *Science in Context* 15, no. 2 (2002): 317–38.

[20] John Krige, "Atoms for Peace, Scientific Internationalism, and Scientific Intelligence," *Osiris* 21, no. 1 (2006): 161–81.

Figure 9.1 Soviet physicists visit Bevatron in the USA, December 16, 1957. Left to right: Lev Okun, Blokhintsev, Nikitin, Venedikt Dzhelepov, Luis Alvarez, Edwin McMillan, Herman (translator), Edward Lofgren, and Ernest Lawrence

Source: Available at https://nara.getarchive.net/media/visiting-russian-scientists-touring-the-bevatron-left-to-right-okun-blokhintsev-489c99. The US National Archives.

The major immediate consequence was the grandiose United Nations (UN) Conference on Peaceful Uses of Atomic Energy held in Geneva in August 1955. Under the presidency of the Indian physicist Homi Bhabha, scientists from many countries openly discussed their research on nuclear energy and reactors, significant parts of which had been extracted from formerly classified weapons programs. The USSR's huge delegation included some of the country's top nuclear physicists, who had just recently lived under the regime of strict secrecy but were happy to finally be able to travel, talk openly, and present their impressive accomplishments personally, for international recognition. Blokhintsev delivered the most sensational announcement and one of their crown results. Still relatively young and unknown, he described the operation of the world's first atomic power station built under his direction in 1954.[21]

Blokhintsev studied physics at Moscow University in 1926–30 and belonged to the first generation of post-revolutionary Russian students who learned quantum mechanics, and also Marxism, in seminars from their teachers, as part of the

[21] D. I. Blokhintsev and N. A. Nikolaev, "The First Atomic Power Station of the USSR and the Prospects of Atomic Power Development," in *Proceedings of the International Conference on the Peaceful Uses of Atomic Energy Held in Geneva, 8–20 August 1955. Vol. 3: Power Reactors* (New York: UN, 1955), 35–55.

Figure 9.2 Obninsk Power Station, 1954

Source: Available at https://rosatomnewsletter.com/wp-content/uploads/2019/08/65539892_2064734893822139_4651437967976431616_o-1548x1000.jpg.

regular curriculum. Inspired by both these novel fields, he interiorized and kept this combined intellectual commitment until the end of his life. The patriotic upsurge during the war encouraged many scientists, even those lacking proper proletarian backgrounds, to join the Communist Party, of which Blokhintsev became a member in 1943. Unlike most of his colleagues, he was also seriously inclined to use Marxist philosophy, more than just rhetorically, to interpret and popularize modern physical theories of relativity and quanta. His internationally acclaimed 1949 textbook on quantum mechanics presented in a developed form the so-called "ensemble interpretation" (also known as "collectivist" and "statistical") that challenged the then-prevailing Copenhagen philosophy from a materialist standpoint.[22]

As a party member, Blokhintsev was trusted with administrative responsibilities and positions beyond strictly academic ones. Starting in 1947, he supervised as the liaison officer one of the four research laboratories within the Soviet atomic bomb project which employed scientists from Germany. In a sense, he was already then involved in an international collaboration, albeit a peculiarly secret one. After the laboratory's reorganization into one staffed by Soviet researchers, he became its Director in 1950 tasked with developing a nuclear reactor suited for producing electrical energy. The world's first nuclear power station in Obninsk (Figure 9.2), some hundred kilometres south of Moscow, was launched officially in 1954, just in time to be

[22] Alexei Kojevnikov, "Probability, Maxism, and Quantum Ensembles," *Yearbook of the European Culture of Science 2011* 6 (2012): 211–36.

Figure 9.3 Ho Chi Minh visiting the Obninsk Atomic Power Station, with Blokhintsev, 1955

Source: Available at https://tiasang.com.vn/quan-ly-khoa-hoc/chuyen-tham-obsnink-cua-bac-ho-va-nganh-nang-luong-nguyen-tu-vn-20585/.

declassified and described to the conference in Geneva the following year.[23] Emboldened by the public success of their international debut, nuclear scientists pushed further, significantly beyond the confines of the Atoms for Peace convention. Igor Kurchatov, the Scientific Director of the entire Soviet atomic weapons project, was allowed to travel abroad and accompanied Khrushchev on an official state visit to the UK in 1956. For this unique occasion, he proposed and convinced the Politburo to authorize another major declassification of top-secret information. He presented to British peers at their main nuclear center in Harwell a sensational report on the advanced Soviet work on controlled thermonuclear fusion, thus successfully transforming this secret field of research into an academic one, open for international cooperation.

The USSR also started using its mastery of nuclear technology to strengthen international ties between socialist countries (Figure 9.3). During the 1955 Geneva Conference, members of the Soviet scientific team heard about plans to create CERN, and made an analogous proposal to Soviet authorities. Construction of what would become, for several years, the world's most powerful accelerator of elementary particles was then already on the way at one of the secret locations of the Soviet atomic project, a hundred kilometres north of Moscow. The laboratory started in 1946 with

[23] A. V. Zrodnikov and Yu. V. Frolov, "D. I. Blokhintsev–Pervyi Nauchnyi Director Laboratorii 'V,'" in *D. I. Blokhintsev. Izbrannye Trudy* (Moscow: Fizmatlit, 2009), 466–98; Hiroshi Ichikawa, "Obninsk, 1955: The World's First Nuclear Power Plant and "The Atomic Diplomacy" by Soviet Scientists," *Historia Scientiarum* 26, no. 1 (2016): 25–41.

the government's decision to authorize the building of a new type of cyclotron with the method of phase synchronization proposed by Vladimir Veksler two years earlier.[24] By 1955, the Dubna site had an operational synchrocyclotron, a six-metre accelerator of protons to the energy 680 MeV completed in 1949 and was finishing the construction of the synchrophasotron with the then unprecedented energy of 10 GeV.[25] The Soviet government approved the proposal by nuclear scientists to declassify these state-of-the-art devices and invite scientists from socialist countries to collaborate in their use for research in fundamental particle physics.

In March 1956, eleven socialist countries signed an agreement in Moscow to establish the JINR, although the name initially proposed was the "Eastern Institute for Nuclear Research." In addition to providing critical infrastructure, the USSR contributed 47% of its budget. 20% came from the People's Republic of China, whereas smaller countries contributed between 1 and 7% each. Dubna was incorporated as a town, administratively transferred to the Moscow region, and open to foreign visitors and researchers. Blokhintsev was elected the JINR's first Director, with Marian Danysz from Poland and Václav Votruba from Czechoslovakia as Vice-Directors, and he served in this position until 1965, leading the academic council that included representatives from other participating countries.[26] During the first decade of its existence, international teams of nuclear physicists in Dubna conducted pioneering investigations on strong interactions, strange particles and quarks, conservation laws in high-energy, and the creation of new trans-uranium chemical elements (Figure 9.4).[27]

In line with the strategy of peaceful coexistence, the USSR also proposed bilateral agreements for cultural exchanges with countries of the so-called first and third worlds. The first such agreements, with Syria and Norway, were signed in 1956, and new ones continued to be added at a pace of approximately six a year for the remainder of the decade, including the most well-studied one, the 1958 Lacy–Zarubin Agreement on cultural, educational, and scientific exchanges between the USSR and the USA.[28] The areas of East-West cooperation ranged from the arts and movie industry to scientific and industrial activities. Besides exchanges of scientific and technical knowledge and expertise, translation of scholarly publications, and some examples

[24] "Recollections" in M. G. Meshcheriakov. *K 100-Letiiu so dnia rozhdeniia* (Dubna, 2010), 47–50. For the history of the synchrocyclotron construction and many archival documents from the laboratory's secret period, see N. A. Rusakovich, ed., *Istoriia Sozdaniia Sinkhrotsiklotrona (v Dokumentakh i Vospominaniiakh)* (Dubna: OIIaI, 2014).

[25] N. N. Bogolyubov, ed., *Nauchnoe Sotrudnichestvo Sotsialisticheskikh Stran v Iadernoi Fizike* (Moscow: Energoatomizdat, 1986), 5.

[26] Roman Khandozhko, "Quantum Tunneling through the Iron Curtain the Soviet Nuclear City of Dubna as a Cold War Crossing Point," *Cahiers Du Monde Russe* 60, no. 2 (2019): 369–96. "Soglashenie ob Organizatsii OIIaI, 26.03.1956," available at http://www.jinr.ru/wp-content/uploads/Advisory_Bodies/Agreement_JINR_Russian.pdf

[27] D. I. Blokhintsev, "A Decade of Scientific Work at the Joint Institute for Nuclear Research," *Soviet Atomic Energy* 20, no. 4 (1966): 328–45; Jinyan Liu, Fang Wang, and Alexey Zhemchugov, "Chinese Scientists in Dubna (1956–1965)," *Chinese Annals of History of Science and Technology* 5, no. 2 (2021): 31–88.

[28] Benjamin Martin, "The Rise of the Cultural Treaty: Diplomatic Agreements and the International Politics of Culture in the Age of Three Worlds," *The International History Review* 44, no. 6 (2022): 1327–46; Gerson Sher, *From Pugwash to Putin: A Critical History of US-Soviet Scientific Cooperation* (Bloomington: Indiana University Press, 2019).

Figure 9.4 The first JINR Directorate, 1956: Danysz, Blokhintsev, Votruba
Source: The JINR Museum in Dubna.

of genuine collaboration in joint research projects, the agreement was also used for intelligence gathering, accessing the other country's scientific capacities, and related political objectives.[29]

Bringing the USSR to IUPAP

When the British physicist Nevill Mott was elected IUPAP's new President at the 7th General Assembly in 1951, the organization still had no official connection with the USSR, then at the lowest ebb of Cold War isolationism. Concerned about the lack of publications by Soviet physicists in other European languages and journals, IUPAP formed a Publication Commission in 1949 to consider translating works from Russian. One of the results was the publication of two special issues of *Il Nuovo*

[29] David Kaiser, "The Physics of Spin: Sputnik Politics and 1950s," *Social Research* 73, no. 4 (1995): 1225–52; Christopher D Hollings, *Scientific Communication Across the Iron Curtain* (Cham: Springer, 2016); Audra Wolfe, *Freedom's Laboratory: The Cold War Struggle for the Soul of Science* (Baltimore: Johns Hopkins University Press, 2018); Yale Richmond, *Cultural Exchange and the Cold War: Raising the Iron Curtain* (University Park: Penn State University Press, 2003); Brit Shields, "Mathematics, Peace, and the Cold War: Scientific Diplomacy and Richard Courant's Scientific Identity," *Historical Studies in the Natural Sciences* 46, no. 5 (2016): 556–91.

Cimento with reviews of papers on various branches of physics which had appeared in Slavic languages.[30] This would be followed, two years later, by the American Institute of Physics' much larger commitment to translating into English, cover-to-cover, several main physics journals published in the USSR. Towards the end of his presidency, Mott reflected self-critically:

> When I accepted the position as successor of Kramers, I thought the chief and most important job of the Union would be in re-establishing contacts with the Russians. But in the event, this took place through such occasions as the Geneva Conference, which had no connection with the Union and in view of the rather cumbrous organization of the latter, hardly could have had .... I think that in the next few years, the Union may acquire increasing importance in this respect. The Soviet Academy has very recently formally asked to join the Union and its representative will be at the next Executive Committee. If we can get Russians on our various committees and make them take a full part in organizing the conferences and other activities of the Union, I am sure this will be all to the good.[31]

Despite Mott's intentions, IUPAP's Executive Committee reacted slower than other international unions to the USSR's opening. The Central Committee of the CPSU approved requests from the Soviet Academy of Sciences to join the International Union of Crystallography in April 1954 and the International Union of Geophysics and Geodesy in January 1955. In May 1955 the umbrella International Council of Scientific Unions reached out to Yakov Malik, the Soviet Ambassador to the UK, who supported the proposal for the USSR to re-join the organization. One month later, the Politburo approved the academy's application for ICSU membership.[32]

It was, indeed, the 1955 Geneva Conference on the Peaceful Uses of Atomic Energy that provided the first major international encounter for Soviet physics during the Cold War and the inspiration for further exchanges both within the socialist block and across the Iron Curtain. In August 1955, the West German physicist H. Ebert wrote to Fleury inquiring whether IUPAP included Russian physicists and, if not, what would be the best way to invite them. Fleury replied in October that ICSU had written to the Soviet Academy of Sciences inviting Russian scholars to join its various unions.[33] This time, the answer arrived quickly. On November 2, Fleury wrote to Nesmeyanov that ICSU was happy to count the Soviet Academy among its members and was "delighted to foresee for the very near future the participation of physicists from your country."[34] The official invitation from Mott followed on February 7, 1956.

[30] The issues were published in 1953 and 1955. See Vieira's chapter in this volume.

[31] Mott to Amaldi, August 16, 1956, box 34, folder 1, subfolder 2 "IUPAP 1948–1959," Fondo Edoardo Amaldi, subfondo Archivio Dipartimento di Fisica, Physics Department Archives of Sapienza University of Rome (hereafter AEA).

[32] Malik to Nesmeyanov, May 24, 1955. Russian State Archive of Contemporary History (RGANI), F. 4, Op. 9, D. 1308, L. 35. For the Politburo's approval see, respectively, RGANI, F. 4, Op. 9, D. 1036, L. 116–7; RGANI, F. 3, Op. 10, D. 122, L. 154; and RGANI, F. 4, Op. 9, D. 171, L. 106.

[33] Ebert to Fleury, August 18, 1955; Fleury to Ebert, October 6, 1955. IUPAP Gothenburg, Series E6 "Correspondence with Liaison Members," vol. 6, folder "19. Fed. Republic Germany 1952–1998.

[34] Fleury to the President of the Academy of Sciences of the USSR, November 2, 1955, IUPAP Gothenburg, Series E6 "Correspondence with Liaison Members," vol. 12, folder "42. Russia 1947–1999."

He wrote that if the USSR joins IUPAP, the Executive Committee will wish to invite a representative of the USSR to this meeting as an observer, and that the General Assembly, which will meet in 1957 in Rome, will also consider it desirable that the Soviet Union be represented in the Executive Committee.[35] On February 22, 1956, the Academy signaled to Mott that it was proposing to join IUPAP, which the Soviet Politburo officially approved on July 7.[36] The Soviet rationale behind the decision clearly corresponded with the general policy towards "peaceful coexistence" as with joining other international unions and academic organizations. As summed up by the Director of the Central Committee's Department of Science, Universities, and Schools Vladimir Kirillin: "The participation of Soviet scientists in the Geneva Conference on the Peaceful Uses of Atomic Energy and the holding of a number of conferences on physics in the USSR with the participation of foreign scientists showed that the expansion of scientific ties between Soviet physicists and foreign scientists promotes the development of science and creates opportunities for obtaining broad information about achievements of foreign science."[37]

On July 13, 1956, the Soviet Academy informed Mott about its decision to join IUPAP and delegated the senior physicist Joffe as an observer to the Ottawa meeting of the Executive Committee. Officially and finally, the USSR became a member at the 9th General Assembly in Rome in 1957.[38] That same year the General Assembly created the Commission on High Energy Physics which would play a key role in promoting East-West contacts in physics. The stated functions of the commission were to organize international meetings to discuss scientific results and the construction of high-energy accelerators, promote international cooperation between laboratories, and enable the exchange of data, primarily between the USA, the USSR, and Western Europe. Its limited version of internationalism was reflected in the commission's membership, which included two physicists from each of its three geographical nodes. The Soviet side was represented by Igor Tamm and Veksler, and after 1960, Blokhintsev as Tamm's replacement. Later, the commission somewhat expanded its focus to include Japan and Eastern Europe.[39]

The commission assumed responsibility for authoritative "Rochester" conferences in particle physics, which had been previously meeting annually in Rochester, NY, but after 1957 started rotating internationally between different countries. The USSR hosted this event four times (Kiev 1959, Dubna 1964, Kiev 1970, Tbilisi 1976), and East Germany once (Leipzig 1984). Until the end of the Cold War, these conferences provided the most important platform for regular interactions between top high-energy physicists from the East and the West. Possibilities for long-term visits

[35] APRF, F. 3, Op. 33, D. 201, L. 128. The archive contains Mott's letter translated into Russian.

[36] RGASPI. F. 17. Op. 3. D. 1072. L. 3.

[37] APRF. F. 3. On. 33. D. 201. L. 124–5.

[38] Mott to Engelhardt, February 27, 1956; Sisakyan to Mott, July 13, 1956; Fleury to Sisakyan, July 27, 1956, IUPAP Gothenburg, Series E6 "Correspondence with Liaison Members," vol. 12, folder "42. Russia 1947–1999."

[39] HEP Commission, Minutes of the 1st and 4th meetings. IUPAP, Quebec secretariat, series E1, (hereafter IUPAP Quebec), vol. 4, folder "IUPAP Fleury's Correspondence 1957–1963, Commission on High Energy Physics, Minutes of Meetings," Center for the History of Science, Royal Swedish Academy of Sciences. Altogether, the USSR participated in six out of eight IUPAP's commissions. For a detailed analysis of the Commission on High Energy Physics, see Hof's chapter in this volume.

were occasionally discussed, but happened irregularly, outside of the commission's managerial purview.[40] According to Wolfgang Panofsky, and probably during one of the commission's meetings, Veksler made a joke about the amount of time and effort spent on sorting out diplomatic formalities instead of real scientific problems: "[t]here used to be two kinds of high-energy physics: experimental physics and theoretical physics. Now we have to add to that diplomatic physics."[41]

By 1959, the new President, Italian Edoardo Amaldi was thinking about changes to IUPAP's statutes to adapt to the increasingly more diverse, geographically polarized, and decolonizing world of physics. To him, it seemed a foregone conclusion that a representative from the USSR would also need someday to serve as the leader of IUPAP. From Amaldi's correspondence with past Presidents and Secretaries of various national committees, it is clear that the remaining disagreements were not about "whether" but "when."[42] As the Union prepared to gather in Ottawa in September 1960 for its 10th General Assembly, Mott was still "reluctant to put the presidency in the hands of a representative of a country where the government still exercises so close a control over scientific activities, and in which the western concept of 'an independent scientist' is only just beginning to find a place." Amaldi and chairmen of other European national committees shared this feeling. Mott preferred Bhabha from India as "the most eminent scientist in the most important uncommitted Eastern country" as the best candidate for the presidency.[43]

This proposal was opposed by the chairman of the American National Committee, Robert Brode, who insisted that in the wake of Presidents from England, the USA, the Netherlands, Sweden, and Italy, it would be appropriate to elect first a representative from France, and then from Russia. He proposed "to nominate Fleury for president, and subject to the concurrence of the Russians, Tamm for vice-president." In April 1960, he visited Moscow and discussed the matter with Joffe and other Russian physicists, who "confirmed a general feeling of enthusiasm for Tamm for this position." Brode had also considered Joffe and Veksler. Masao Kotani of Japan, who favored a Soviet President in 1960, had suggested Joffe, as internationally the most connected and recognized representative.[44] But the patriarch of Soviet physics was then already in frail health. Joffe died on October 14, 1960, aged seventy-nine. Further discussions in Moscow convinced Brode that Tamm was favored over Veksler. Thus, before the 1960 General Assembly, Brode believed Tamm to be the most likely candidate to represent the USSR as IUPAP's Vice-President.

The Assembly in Ottawa, in negotiations behind the doors, constructed a compromise between the two strategies. It elected Bhabha as the President and Louis E. F. Néel from France as the first Vice-President, even though Néel's candidacy had not appeared in previous discussions. Blokhintsev emerged as the main representative of

[40] HEP Commission, Minutes of the 2nd meeting, AEA, box 28, folder 1, subfolder 16.

[41] Interview with Panofsky by Elizabeth Paris and Jean Deken, April 8, 2004, Niels Bohr Library & Archives, American Institute of Physics, College Park, MD.

[42] Amaldi to Mott, July 28, 1959; Mott to Amaldi, August 1, 1959; Amaldi to Brode October 22, 1959, AEA, box 106, folder 1, subfolder 4. On Amaldi's presidency, see Cozzoli's chapter in this volume.

[43] Mott to Amaldi, March 9, 1960, De Boer to Amaldi, May 16, 1960; Staub to Amaldi, April 26, 1960, AEA, box 106, folder 1, subfolder 4.

[44] Brode to Amaldi, March 1, and July 25, 1960; Kotani to Amaldi, May 6, 1960, AEA, box 106, folder 1, subfolder 4.

the Soviet Union. He was formally appointed by the Academy of Sciences to replace Tamm in the Commission on High Energy Physics and to travel to the USA to participate in the Rochester Conference that year.[45] The Assembly chose him to replace Joffe as one of the Vice-Presidents and the Soviet member of the Executive Committee.[46] The assembly also approved a new version of the statute with provisions for ensuring some continuity after every leadership rotation. The first Vice-President did not have to automatically become the President's successor, but the Executive Committee hoped that such a scenario would continue as an unwritten traditional practice of the Union. Unwritten also remained the additional agreement for alternations between representatives from Eastern and Western countries, and that Néel was to be succeeded by a Soviet President, which indeed happened eventually, when Blokhintsev was elected in 1966. Although not exactly as envisioned by Amaldi, this result was still generally in line with his goal of a careful and gradual integration of the USSR into IUPAP, also supported by Mott and national representatives from Europe, who wanted to wait longer before handing the presidency to a Soviet physicist.[47]

Conclusion: Realities of Socialist Internationalism

During the 1960s, USSR representatives served as Presidents of several international academic unions: Viktor Ambartsumian at the IAU (1961–64), Blokhintsev at IUPAP (1966–69), Viktor Kondratiev at IUPAC (1967–69), and Ambartsumian at the entire ICSU (1968–72). For the international scientific establishment, these appointments reflected an important shift, generally, from Western predominance towards a more diverse geographical representation, somewhat wider inclusion of the second and third-world countries, and, in particular, a belated credit to Soviet scientific achievements, represented by the Sputnik, the IGY, nuclear physics, Nobel Prizes, etc.[48] Yet

[45] Minutes of the fourth HEP Commission Meeting—IUPAP Quebec, vol. 4, folder "IUPAP Fleury's Correspondence 1957–1963," Commission on High Energy Physics, Minutes of Meetings. Personal relations between Tamm and his former graduate student, Blokhintsev, were already very strained, victim to feuds within the Soviet academic community, but also to some scientific and political disagreements. The former represented the physics group of the Academy of Sciences, whereas the younger Blokhintsev had closer ties with a rival institution, Moscow State University. Blokhintsev felt very bitter about Tamm's ("my teacher and my enemy") critical rejection that prevented the publication of his earlier paper in 1938 with an important, Nobel-level calculation (the Lamb shift), and about Tamm's and other academy physicists' opposition to his election. In 1958, Blokhintsev was elected to the USSR Academy of Sciences as a corresponding member but was never promoted to full membership there. As a Nobel-Prize winner, Tamm was certainly much more famous internationally, and he also definitely had more support in the Academy of Sciences. The Soviet government bureaucracy, on the other hand, would have had more trust in Blokhintsev as a Communist Party member who had handled responsibly several highly important administrative and international obligations. D. I. Blokhintsev, *Dnevniki 1955–1975* (Dubna: OIIaI, 2022), 44.

[46] Report of the 19th General Assembly (1960), Larkin Kerwin fonds (P202), subseries P202/B4 IUPAP (hereafter IUPAP Kerwin), folder 18 "Procès-verbal. Assemblée générale (2 dossiers) 1923–1973," Division de la gestion des documents administratifs et des archives, Université Laval, Quebec, Canada.

[47] Report of the 10th General Assembly (1960), IUPAP Kerwin, folder 18 "Procès-verbal. Assemblée générale (2 dossiers) 1923–1973."

[48] See, in this volume, Lalli's broad discussion of IUPAP phases, especially the growth of membership and changes that took place after 1957. Also in this volume, Olšáková shows how the growing influence of the socialist bloc helped to reintegrate East German scientists into the international scientific community even before the GDR was officially accepted to ICSU in 1972. For IUPAC, see Elena Zaitseva-Baum,

it can also be argued that for Soviet science, this high level of official recognition also marked the beginning of a decline in real global influence. Previously, even if under-appreciated and excluded, it was seen as a serious alternative project of scientific development. With inclusion into international institutions, it blended in, adapted to the existing modus vivendi, and downplayed some of its visible distinctiveness. For example, in his role at IUPAP, Blokhintsev, like other Soviet representatives, did not push for radical changes but aimed to prove that IUPAP could continue to function normally and collegially, without serious perturbations, even when led by a scientist from a socialist country. Addressing the General Assembly, the newly elected President declared that he was "well aware of the traditions of the union and its problems" and "intended to maintain and strengthen these traditions, particularly those that contributed to understanding between countries." His goal was to extend the Union's activities and "work for peace in the world."[49]

He did this with remarkable diplomatic tact, leading the institution through some delicate diplomatic issues. One arose from the breakdown of diplomatic relations between the USSR and Israel after the latter's six-day war in 1967. The Israeli physicist Amos de-Shalit was not able to receive a Soviet visa to participate in a meeting of the Low Energy Nuclear Physics Commission in Dubna in 1968. The commission became aware of this problem too late and, despite Blokhintsev's efforts, could not remedy the situation. The invasion of Czechoslovakia by the Warsaw Pact countries later that year caused another, more serious political problem. Blokhintsev had to deal with both issues presiding at IUPAP's Executive Committee in London in September 1968. At the start of the meeting, the Swiss/American physicist Josef-Maria Jauch proposed a resolution "on the effects of certain political activity on science." Although Blokhintsev tried to avoid the discussion, arguing that "the Union traditionally avoided purely political subjects," the committee added the item to the agenda. The following day, however, Jauch withdrew his proposal, having been convinced by informal discussions that IUPAP was not an appropriate forum for it.[50]

It seems that in the end, even those IUPAP members who had concerns about electing a Soviet to presidency were ultimately satisfied that the Union managed to stay its course. After his tenure, when Blokhintsev was succeeded in a regular fashion by the American nuclear physicist Robert Bacher, Gerhard Herzberg of Canada praised the "outstanding work of President Blokhintsev during his term of office. He had accomplished his task with much tact, care, and imagination, and lent great dignity to his position." Blokhintsev himself believed he had succeeded in preserving the "good tradition of international collaboration" as "a small contribution to the efforts to reach a better understanding of the unity of the goals of all humanity." He advised the next President that "it would be extremely important for our Union, in this time,

"The First Russian President of IUPAC: Victor Kondratiev," *Chemistry International* 41, no. 3 (2019): 33–4; Danielle Fauque and Brigitte Van Tiggelen, "IUPAC Expansion from 1957 to 1975," *Chemistry International* 41, no. 3 (2019): 28–32.

[49] Report on the XIIth General Assembly (1966), 30, IUPAP Kerwin, folder 18 "Procès-verbal. Assemblée générale (2 dossiers) 1923–1973."

[50] See the Draft Resolution on the Invasion of Czechoslovakia and the Minutes of the committee meeting, London September 27–28, 1968, IUPAP Kerwin, folder 1,8 "Conseil exécutif (3 dossiers) 1963–1974."

to conserve its tradition which till now have been expressed in an explicit aspiration to support the spirit of internationalism among physicists."[51]

Yet behind this posture of official success for himself personally and for the country he represented, Blokhintsev's private diaries, which he kept through all those years, reveal a much more critical, increasingly alienated, and pessimistic thinker. As an up-and-coming scientist in the 1950s, he used to be a strong believer in the Soviet system, its progressive nature, and much more optimistic about the future of his own work, and of Soviet science in general. His experiences and expertise in the atomic project fully convinced him of the urgent necessity of "peaceful coexistence" and made him worry, intensively to the point of agonizing, of the irresponsibility of aggressive warmongering, especially apparent during his foreign trips. The looming danger of nuclear war and the possible death of millions constantly terrified him: "I now remembered a sleepless night at the hotel (The President) in Palo Alto and a foggy morning, when a deadly sorrow squeezed my heart and I cried, wept for people, for their fabulous, luminous cities. I wanted to throw myself at the window and shout, shout to the whole world: 'Stop the crazy people.'.... We need to wake up. But can we? Or is the horrible catastrophe inevitable?"[52] In an interview with an American correspondent, he then wanted to talk less about the topics of Cold War competitiveness, sputniks, and the space race, and more about scientific cooperation in areas, such as the fundamental laws of elementary particles physics, where it was possible for socialism and capitalism to work jointly towards goals common to all humanity. His preferred style of scientific internationalism thus went beyond peaceful coexistence, towards a collaborative merger that later would be called "convergence."[53]

In the 1960s, despite being at the peak of his administrative career, he grew increasingly disenchanted with Soviet bureaucratic ossification, otherwise known as the "really existing socialism." The socialist ideal was still dear to him, as in his revolutionary youth, but, as for many, his faith in the Soviet system as a realization of that ideal suffered from the series of shocking revelations about Stalinist purges, terrible losses, and mistakes during the War, dogmatism, and the suppression of a more open, reformist socialism of the Prague Spring.[54] The Soviet conflict with China especially alarmed him. Chinese scientists continued working in Dubna until 1965, but the rise of political tensions between the two communist parties was also damaging cooperation among scientists. Like many Russians, Blokhintsev felt that instead of learning from and avoiding some of the Stalinist mistakes, the Maoists succumbed even further to dangerous ideological extremes, particularly with their rejection of peaceful coexistence. Avoiding war remained his ultimate priority, and he believed that international contacts could help alleviate misunderstandings between peoples. He attributed the belligerent stance by the Chinese, at least in part, to "their total isolation from the

[51] Report on the XIIIth General Assembly (1969), 31–3, IUPAP Kerwin, folder 18 "Procès-verbal. Assemblée générale (2 dossiers) 1923–1973."

[52] Blokhintsev, *Dnevniki 1955–1975*, 43, entry of January 1, 1958.

[53] Lawrence E. Davies, "Russian Gives U.S. Pure Science Lead," *The New York Times*, 1957. For another case of Cold War convergence in science, see Climério Paulo da Silva Neto and Alexei Kojevnikov, "Convergence in Cold War Physics: Coinventing the Maser in the Postwar Soviet Union," *Berichte Zur Wissenschaftsgeschichte* 42, no. 4 (2019): 375–99.

[54] "...anticipation of the worst, the Death of the Great Idea." Blokhintsev, *Dnevniki 1955–1975*, 215, entry of November 13, 1970.

Western world. … They forget that in the West there are not only imperialists but also peoples; peoples who, in their ways, are seeking the way to happiness. There are people in the US and even in the FRG. The ultimate Chinese foolishness is [the idea] that an atomic war may accelerate the progress of humanity."[55]

Blokhintsev's peace activism provided the main context and motivation for his scientific internationalism, the promotion of East-West cooperation, and his work in Dubna and IUPAP. He retained strong and idealistic beliefs in the value of science and its capacity to solve the problems of humanity, but here, too, the realities of the 1960s world undermined his optimism. The social prestige of science was eroding, especially quickly in the West, albeit somewhat slower in the Soviet Union. International cooperation in fundamental particle physics continued, but the progress of research and new discoveries in the field were no longer as impressive as during earlier decades. Dubna's particle accelerator had been surpassed by larger machines elsewhere. Chinese physicists left, and the East Europeans often felt it was more prestigious for them to cooperate with Western colleagues at CERN. Blokhintsev understood that, especially after 1968, the Soviet official version of socialism stagnated and increasingly lost its international attractiveness—for many countries in the East, for East European allies, and also among leftist movements in the West. This also meant a decreased role for the Soviet version of scientific internationalism which he had so dutifully represented and served.[56]

[55] Blokhintsev, 97, entry of December 24, 1960. For Blokhintsev at the time, West Germany's government was still ruled by former Nazi collaborators and revanchists, who until 1970 refused to recognize officially the post-World War II western border of Poland (the Oder-Neisse line).

[56] Blokhintsev, 220, entry of May 10, 1971.

10

Particles, Purity, Politics

Expanding International Exchange in High-Energy Physics during the Cold War

Barbara Hof

The roots of particle physics lie in the study of atoms, physical forces, and gravity, alongside the formulation of quantum field theory in the early decades of the 20th century. Specialization in this emerging field of inquiry was bolstered by discoveries in the area of cosmic rays, and also developed through nuclear research projects during World War II, paving the way for physicists to have access to ample funds for accelerators with increasing electron volts.[1] The term high energy meant that particle physics became more associated with its experimental research tools than with its subject matter.[2] But beyond understanding the course of high-energy/particle physics as one of a field deploying expensive technology to study the fundamental properties of matter, two additional dimensions explain its powerful ascent in terms of both research activities and scientific prestige. For one, in the post-war period, particle physicists began working towards the ideal of a cosmopolitan collective producing pure knowledge believed to be independent of military considerations.[3] This in turn suggests the third dimension, which is that the significant rise of this field of inquiry cannot be understood in isolation from Cold War politics.

This chapter takes into account these three dimensions—particles, purity, politics—to analyze the course of particle physics as a result of contact with those on the other side of the Iron Curtain. Previous historical studies have shown how the Cold War catalyzed the increase in government support for physics.[4] These studies have largely focused on how the East and West competed against each other, but the ways in which they cooperated have been almost forgotten to history. This chapter

[1] Laurie M. Brown, Max Dresden, and Lillian Hoddeson, "Introduction," in *Pions to Quarks. Particle Physics in the 1950s*, ed. Laurie M. Brown et al. (Cambridge: Cambridge University Press, 1989), 3–39; Laurie M. Brown and Lillian Hoddeson, eds., *The Birth of Particle Physics* (Cambridge: Cambridge University Press, 1983); Helge Kragh, *Quantum Generations: A History of Physics in the Twentieth Century* (Princeton: Princeton University Press, 1999).

[2] Andrew Pickering, *The History of Particle Physics: A Sociological Analysis* (Dissertation, Edinburgh: University of Edinburgh, 1983): 2–3.

[3] Sharon Traweek, *Beamtimes and Lifetimes: The World of High Energy Physicists* (Cambridge and London: Harvard University Press, 1988).

[4] See for instance: Robert Seidel, "Accelerators and National Security. The Evolution of Science Policy for High-Energy Physics, 1947–1967," *History and Technology* 11, no. 3–4 (1994): 361–91; John Krige, "Maintaining America's Competitive Technological Advantage: Cold War Leadership and the Transnational Co-Production of Knowledge," *Humana* 16 (2011): 33–51; Naomi Oreskes, "Science in the Origins of the Cold War," in *Science and Technology in the Global Cold War*, ed. Naomi Oreskes and John Krige (Cambridge, MA: MIT Press, 2014), 11–29.

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shows that despite tense and sometimes hostile international relations, particle physicists established cross-border exchanges to discuss theories and share experimental results. Their context-sensitive interpretation of pure science, I argue, was what facilitated their collaboration.

Primary sources do not give a clear picture of what scientists understood by pure science. There were different usages in different contexts, which demonstrates that "purity" is a social construct. As discussed by Joseph Martin in this book, the distinction between pure and applied science is both strictly historical and national in character.[5] This distinction was particularly potent in US physics after 1945, where a commitment to purity signaled a move away from weapons research conducted in the service of national security at home and abroad.[6] US physicists typically conceived of purity as a condition for international collaboration. But in fact, government agencies took a strategic approach to the circulation of knowledge and the overseas visits of scientists. These travelers reported on progress abroad, thereby rendering scientific internationalism a servant of national interests.[7] Therefore, the approaches of physicists must be considered without losing sight of the fact that they remained subject to political settings and institutional rules. The concept of dual loyalty is relevant in this regard, since it describes physicists' attempts to strike a balance between their scientific aspirations and the expectations of their authorities. Physicists adapted to the codes of their bureaucracies to pursue their own goals.[8]

Drawing on publications, digitized records, and documents housed in a variety of archival collections, this chapter demonstrates that the supposed purity of particle physics was crucial for cooperation across national borders and ideological divides, while showing that the envisioned de-politicization was actually motivated by a strong political agenda. To make this case, the chapter explores the meaning of purity, and shows how closely this concept was connected to political considerations. It centers on a series of conferences, assuming that they were particularly relevant for the rekindling of the internationalist spirit among physicists. The first conference was held in 1950 at the University of Rochester in New York State, with participants from the United States only. This one-day conference was initiated by Robert Marshak, chair of the local department of physics, who deemed the exchange of expertise essential. This view was prompted by the recent construction of accelerators that surpassed cyclotrons in their capacity to create more powerful particle collisions, thereby allowing physicists to uncover more secrets about particles.[9] The conference proved successful in assembling accelerator experts, experimental researchers, and theoreticians to discuss results and ideas they considered important for the

[5] See Martin's chapter in this volume.

[6] Sarah Bridger, *Scientists at War. The Ethics of Cold War Weapons Research* (Cambridge, MA: Harvard University Press, 2015).

[7] Ronald E. Doel, "Scientists, Secrecy, and Scientific Intelligence: The Challenges of International Science in Cold War America," in *Cold War Science and the Transatlantic Circulation of Knowledge*, ed. Jeroen van Dongen, Friso Hoeneveld, and Abel Streefland (Leiden, Boston: Brill, 2015), 11–35; Audra J. Wolfe, *Competing with the Soviets: Science, Technology, and the State in Cold War America* (Baltimore: John Hopkins University Press, 2013).

[8] Jean-Philippe Martinez, "Trajectoires Internationales de Physiciens Soviétiques: La Diplomatie Comme Compromis Avec Leurs Autorités," *Cahiers Du Monde Russe* 63, no. 1 (2022): 81–102.

[9] Robert Marshak, "The Rochester Conferences: The Rise of International Cooperation in High Energy Physics," *Bulletin of the Atomic Scientists* 26, no. 6 (1970): 92–8.

advancement of their studies, so a similar conference was organized in Rochester in January 1952. By the time of the third conference in December 1952, the gathering had developed into an international event.[10]

In 1955, the 5th Rochester Conference received support from the International Union of Pure and Applied Physics (IUPAP), and two years later, IUPAP created a Commission on High Energy Physics. The latter still offers this conference series today, but in 1969 was renamed the Commission on Particles and Fields.[11] By describing the organizational process behind the conferences from 1955 to 1964—which, though they started in the United States, were subsequently also organized in Europe and the Soviet Union—and by focusing on the political implications that any reciprocal visit brought, this chapter considers purity and politics to be two important dimensions that explain the expansion of particle physics. By drawing attention to this, this chapter demystifies the social construct of purity. In doing so, it offers insights into some of the mechanisms of science diplomacy, while also revealing that cooperation between the East and West was prioritized over the inclusion of other world regions.

The Reawakened Spirit of Internationalism

In his introductory speech to the IUPAP General Assembly in 1947, the pro-tempore Secretary General Peter Paul Ewald outlined his vision of the organization as free from governmental influences. IUPAP's "strictly scientific" status would allow it to cooperate with former enemy countries after they had signed the post-war peace treaty.[12] Focusing on strictly scientific activities would facilitate the reconstruction of internationalism after World War II. This belief was also crucial to the United Nations Educational, Scientific and Cultural Organization (UNESCO), which began to provide financial means in service of cross-border scientific collaboration. In December 1946, UNESCO and the International Council of Scientific Unions (ICSU, the umbrella organization of IUPAP) signed an agreement outlining their mutual recognition, respective fields, and commitment to cooperation.[13] This enabled activities to be funded by UNESCO grants whose cost exceeded that which would have been possible using only contributions from IUPAP members. UNESCO grants were provided only to international conferences. Furthermore, a resolution signed in 1954 stipulated that IUPAP had to ensure the broadest possible international participation of speakers.[14]

[10] John Polkinghorne, *Rochester Roundabout: The Story of High Energy Physics* (New York: W.H. Freeman and Company, 1989).

[11] Report 13th General Assembly, 1969, folder 18, Larkin Kerwin fonds P202, subseries P202/B4 IUPAP (hereafter IUPAP Kerwin), Division de la gestion des documents administratifs et des archives, Université Laval, Quebec, Canada; C. C. Butler to L. van Hove, October 9, 1969; L. Kerwin to R. L. Walker, November 4, 1969, Léon van Hove Collection, CERN-ARCH-DGR-LVH-189 (hereafter LVH-189), CERN Archives, Geneva, Switzerland.

[12] 5ème assemblée générale, 1947, folder 18, IUPAP Kerwin.

[13] See chapter by Roberto Lalli in this volume for more details. ICSU has recently been re-named the International Council for Science.

[14] Enseignements et procès-verbal 8ème assemblée générale, 1954, folder 18, IUPAP Kerwin.

At the IUPAP General Assembly that year, representatives agreed to sponsor a conference on "High Energy Nuclear Physics" at the University of Rochester in 1955, with modest financial support from UNESCO.[15] The grant of $500 was approved to cover the travel costs of four invited foreign participants. This sum was in addition to $4500 from the National Science Foundation (NSF), financial commitments from local industry and the university, as well as funding from the Atomic Energy Commission (AEC) and the Office of Naval Research (ONR).[16] Recent successes had led to the discoveries of particles that had hitherto only been predicted. The head of the conference, Robert Marshak, felt that these discoveries were of such significance that it was imperative for the conference to have adequate representation of physicists from overseas so that they could discuss their implications and the course of future research. He even had the idea of bringing in people from behind the Iron Curtain, hoping to invite the Polish physicist Marian Danysz and the Soviet physicist Lev Landau. Marshak therefore sought the assistance of Isaak Rabi, who was involved in the organization of the forthcoming "Atoms for Peace" Conference in Geneva. Since Poland was a member of IUPAP, Marshak assumed that the invitation of Danysz would please the organization. He did not consider this to be the case for the Soviet Union, however, as it was not a member. In the end, neither invitation materialized. At the behest of the State Department, no invitations were issued to individuals from countries considered to be communist or under the influence of the Soviets.[17]

Eventually, in terms of geographic distribution, the 115 attendees of the "Fifth Annual Conference on High Energy Nuclear Physics" held in January 1955, sponsored by IUPAP, were from the United States, Canada, Mexico, Australia, India, Japan, Brazil, Sweden, Italy, France, Netherlands, West Germany, Switzerland, and Great Britain. A vast bureaucratic apparatus needed to be set up to coordinate between invitees, the US Immigration and Naturalization Service, embassies, the ONR, and the Air Force, which provided their Military Air Transportation Service (MATS) to fly in the participants.[18] Two weeks before the conference, George Kolstad, head of the physics and mathematics branch of the AEC, told Marshak that the AEC understood the Rochester Conference to be part of its commitment. He had informed the State Department of his strong interest in seeing the conference succeed, which helped speed up the administrative process.[19]

[15] P. Fleury to R. Marshak, July 22, 1954, box 1, folder 51, Robert E. Marshak Papers, Ms1988-060, series 1 (hereafter RMP Rochester), Special Collections and University Archives, Virginia Tech, Blacksburg, VA, United States. I thank archivist Marc Brodsky at Virginia Tech, who provided and scanned a wealth of important primary sources.

[16] R. Marshak to N. Mott, August 26, 1954; N. Mott to R. Marshak, August 31, 1954; A. Waterman to C. de Kiewiet, October 15, 1954; P. Fleury to R. Marshak, October 16, 1954; R. Marshak to N. Mott, November 4, 1954; R. Marshak to G. Kolstad, November 23, 1954; G. Kolstad to E. Fleury, December 13, 1954; F.W. Karas to R. Marshak, January 11, 1955, box 1, folder 51, RMP Rochester.

[17] R. Marshak to I. I. Rabi, November 16, 1954; R. Marshak to E. Jones, January 22, 1955, box 1, folder 60, RMP Rochester. Marian Danysz, later the first Vice-President of the JINR at Dubna, was known to Marshak because he had worked at University of Bristol, co-discovering the heavy unstable fragments. Marshak saw Landau as the leading theoretical physicist in the Soviet Union.

[18] J. B. Platt to R. Marshak, August 11, 1954; A. Roberts to Wm. J. Otting, Jr, December 9, 1955, box 1, folder 60, RMP Rochester.

[19] G. Kolstad to R. Marshak, January 14, 1955, box 1, folder 60, RMP Rochester.

However, due to the McCarran-Walter Act, the entry of foreigners into the United States for short cultural and scientific visits was treated on par with the admission of regular immigrants. Consequently, out of a total of forty foreign invitees, ten physicists expected or experienced difficulties in obtaining their visa due to the restrictions imposed by the law. Marshak saw the non-attendance and silent protest of five physicists who did not even try to get a visa (among them Patrick Blackett and Cecil Powell, two British cosmic ray physicists who had made discoveries seen as chiefly responsible for the rapid development of particle research, but who were known leftists) as a loss of quality in the conference content and damaging for the image of the United States.[20] This incident prompted Marshak to lobby for a revision of the McCarran-Walter Act. He briefed members of Congress on the visa issue, and agreed to speak to the media to give first-hand impressions of foreign reactions to US travel restrictions.[21]

Inviting Soviets with the Support of Intelligence Agencies

National security concerns had a pervasive influence on decisions about the freedom of physicists to meet with one another. However after 1955, the diplomatic framework was beginning to change, allowing exchange across the Iron Curtain to occur. Both the "Khrushchev thaw" and President Eisenhower's revision of the Atomic Energy Act in 1954 enabled policies to be adopted by the two nuclear superpowers in favor of internationalism. In this phase of the Cold War, the supposed purity of particle physics was of great importance in planning reciprocal visits. Yet the lobbying of US physicists vis-a-vis their authorities, and the intelligence operations they approved and supported, reveal their actual lack of political impartiality.

The 6th Rochester Conference was the first of three meetings in the spring of 1956 testifying to the launch of East-West cooperation. Preparations to invite Soviet physicists began two months after the conference in 1955, when Robert Marshak sought support from the AEC Commissioner John von Neumann, using the argument that the State Department would check whether the invitees were "particularly adept political propagandists."[22] As a result of the "Atoms for Peace" Conference in Geneva that year, which had offered the chance for physicists from both sides of the Iron Curtain to talk in person, the Rochester Conference organizers adjusted their list of potential speakers, thereby emphasizing that invitations would be based solely on individuals' contributions to science.[23]

As of late 1955, the AEC had not yet given the State Department the green light to send out the invitations. Therefore, leading physicists and science advisors attempted

[20] R. Marshak to W. Besterman, 16 February 1955, box 1, folder 60; R. Marshak to W. Besterman, March 7, 1955, box 2, folder 25, RMP Rochester. The three other physicists that did not apply for visa despite invitation were: Léon Rosenfeld, Bruno Ferretti, and Harrie Massey.

[21] R. Marshak to Hon. K. Keating, February 10, 1955; K. Keating to R. Marshak, February 18, 1955; R. Marshak to Hon. H. Lehman, April 19, 1955; R. Marshak to Hon. E. Celler, February 24, 1955; box 1, folder 60, RMP Rochester.

[22] R. Marshak to J. von Neumann, April 29, 1955, box 2, folder 26, RMP Rochester.

[23] A. Roberts to J. H. McMillen, December 8, 1955; A. Roberts to R. T. Owen, December 9, 1955; H. L. Anderson to W. Libby, December 23, 1955, box 2, folder 26, RMP Rochester.

to accelerate the decision-making: Edward Teller, Edwin McMillan, Jerome Wiesner, and Eugene Wigner sent recommendation letters to the authorities.[24] Another proponent was Robert Oppenheimer, who thought it best to "act as though professional intercourse with the Russians was a natural thing."[25] By claiming that the invitees would not represent the goals of the Soviet government, but merely wanted to advance science, US physicists allayed many concerns. In January 1956, the AEC Commissioner Willard Libby approached his colleagues and entreated them to reconsider their attitude. The AEC then declared it would not oppose the invitation of physicists from the Soviet Union.[26] Nevertheless, the State Department remained reluctant. Science administrators had been convinced of the benefits of inviting a delegation, but requests to issue visas were turned down.

It was Victor Weisskopf, member of the Conference Advisory Board, and Co-Chairman of the Committee on Visa Issues of the Federation of American Scientists, who stepped in. Weisskopf later recalled that he mobilized "strong representatives" on behalf of the invitation, namely the AEC Intelligence Division and the Central Intelligence Agency (CIA), both of whom were interested "in learning more about Russian affairs."[27] Thus, Soviet physicists were invited to Rochester not only for scientific reasons, but also because there was interest on the part of the intelligence agencies, who sought to gain knowledge about the technoscientific progress abroad through means of advocating, supporting, observing, and evaluating international exchange.[28] Weisskopf succeeded in leveraging the interest of intelligence agencies, and he further secured the support of the AEC by arguing that if the invitation failed, the negative propaganda effect for the United States would be devastating.[29] Thus, far from being apolitical, US physicists' tactical maneuvres served not only their community, but also their government.

Two months before the conference, officials at the State Department were persuaded to approve the visit, and the visa rejections were reversed.[30] Prior to this decision, any exchange with physicists in the East had been severely restricted. Now a reorientation occurred, which however, did not equally apply to Europeans. Patrick Blackett and Cecil Powell were still classified as "ineligible to receive visas."[31] This time Marshak tried to broaden the options for dialog by arguing to the State Department

[24] A. Roberts to Edwin McMillan on January 4, 1956; E. Teller to A. Roberts, February 16, 1956; A. Roberts to J. Wiesner, February 22, 1956; E. Wigner to V. Weisskopf, February 6, 1956, box 2, folder 26, RMP Rochester.

[25] R. Oppenheimer to A. Roberts, February 21, 1956, box 2, folder 26, RMP Rochester.

[26] Meeting no. 1160, January 4, 1956; Meeting no. 1163, January 11, 1956; AEC Office of the Secretary, Minutes of Meetings, 1946–1961, RG 326, Entry A119, box 9, vol. 17–18, National Archives and Records Administration, College Park, MD, United States.

[27] "Report on my efforts for the invitation of Soviet physicists" by V. Weisskopf, Appendix to a letter by V. Weisskopf to A. Roberts, February 17, 1956, box 2, folder 25, RMP Rochester.

[28] Memorandum for members, IAC ad hoc Committee on Exchanges, November 26, 1957, FOIA Electronic Reading Room, (FOIA)/ESDN(CREST), CIA-RDP62S00346A000100040010-2.

[29] V. Weisskopf to G. Kolstad, September 30, 1955, box 2, folder 26, RMP Rochester.

[30] W. J. Stossel, Jr to A. Roberts, February 20, 1956, box 2, folder 26, RMP Rochester.

[31] T. Valenza to R. Marshak, July 1, 1955; R. Marshak to T. Valenza, July 6, 1955; W. M. Rudolph to R. Marshak, July 19, 1955, box 2, folder 25, RMP Rochester.

that the impossibility of inviting these two appeared “a little absurd” when Soviet scientists were admitted to the same conference.[32] The interest in interactions with the latter was obviously of more strategic importance.

Shortly after the State Department agreed to the participation of Soviet physicists, invitations were sent to six individuals. In the end, Vladimir Veksler, Moisey Markov, and A. P. Silin came to the Rochester Conference in April 1956. The organizers sought as little publicity as possible, taking the view that the invitation was only based on the special competences of the three guests, and their contribution to the objectives of the conference.[33] Consequently, the discussions focused on scientific results, machine designs, and experimental techniques, whereas in the background there was certainly lively interest in obtaining relevant information about yet unknown advances in the Soviet Union. Apparently, the Federal Bureau of Investigation (FBI) was not involved, but the CIA had a representative at the meeting acting as a freelance press writer. The interpreter recommended by Weisskopf, John Turkevich, had been approved by the State Department. Both agencies were willing to supply more interpreters.[34]

At the conclusion of the conference, the three foreign visitors, together with Vasily S. Emilyanov, Soviet delegate to the United Nations (UN), and their interpreter Turkevich, traveled to the American West Coast. Edwin McMillan, Associate Director of the Radiation Laboratory at Berkeley, provided a report on the visit to his security manager. McMillan described that his guests had shown particular interest in two matters: seeing the Golden Gate Bridge, a well-known symbol of modern architecture, and visiting a machine presented by the US delegation at the Geneva Conference in 1955. He dismissed the latter idea by pointing out that it was in a remote location; namely Livermore, which had restricted access due to its high level of involvement in weapons research.[35] Seeing parts of the Radiation Laboratory at Berkeley, on the other hand, had been possible since 1954, when it was integrated into the campus,[36] so the visitors were taken there. A distinction was made between areas that were considered strategically sensitive and those that were accessible after previous security checks, illustrating another interpretation of purity.

[32] R. Marshak to T. Valenza, April 17, 1956, box 2, folder 25, RMP Rochester.

[33] L. A. Embrey to C. F. Cole, February 27, 1956, box 2, folder 26, RMP Rochester.

[34] A. Roberts to C. W. de Kiewiet, April 19, 1956, box 2, folder 25; V. Weisskopf to A. Roberts, March 13, 1956; A. Roberts to V. Weisskopf, March 16, 1956, box 2, folder 26 RMP Rochester. The organizers had permission to invite six participants from the Soviet Union, which needed approvement by the Soviet Academy of Sciences: M. F. Mescheriakov, L. D, Landau, V. I. Veksler, I. E. Tamm, D. Skobeltzyn, M. A. Markov, and A. P. Silin substituted for Tamm, and several invitees could not attend for unknown reasons.

[35] E. McMillan to P. L. Schiedermayer, April 30, 1956, subseries 2, box 10, folder visitors correspondence, 1954-, Laboratory and Scientific Conference Papers of Edwin McMillan, 1948–1974, RG 326, Entry 326-0004 (hereafter McMillan NASF), National Archives and Records Administration, San Francisco, CA, United States.

[36] Edwin McMillan to E. C. Shute, December 16, 1958, subseries 2, box 12, folder Visitors USSR 1957–1959, McMillan NASF.

Towards more International Cooperation

The invitation of the Soviet delegation came shortly after several US physicists had received a telegram from Alexander Nesmeyanov, President of the Academy of Sciences of the Soviet Union, inviting them to a Conference on "Physics Of High Energy Particles" in Moscow in May 1956. The AEC raised no objections, and the State Department issued the passports for fourteen physicists.[37] The NSF funded their trip, even though there were no established policies supporting such exchanges, which demonstrates how important the visit was deemed to be (President Eisenhower would adopt a National Security Council recommendation to introduce bilateral measures to exchange information and people with the Soviet Union one month later).[38]

The trip of the fourteen physicists to the Soviet Union was covered by the US media, which gave them the opportunity to present themselves as participants in a diplomatic mission that helped to smooth out tensions between two hostile camps. Among the conference speakers was Luis Alvarez, who explained his work with bubble chambers to the attendees. Later, in two issues of *Physics Today*, Alvarez described his stay in Moscow in detail, including his impressions of Russian urban life. He concluded his remarks with the conviction that the US physicists had been "good ambassadors of good will from the Western world."[39] Similarly, Marshak (see Figure 10.1) described his experience in the university periodical *Rochester Review*. He lauded the city tours, the visit to the new Joint Institute for Nuclear Research (JINR) laboratories in Dubna, as well as the many informal dinner conversations and invitations to private house parties.[40] Soviet physicists had the opportunity to show the best sides of their private life, while leaving potential ideological disagreements aside. The fact that US physicists found their stay in Moscow unrestricted, enjoying the availability of limousines and free admission to theatres,[41] suggests that the governments of both sides acted similarly, ostensibly advocating scientific exchanges and cultural activities, but closely monitoring what was happening and assigning individuals to gather information.

Before returning home, the US delegates attended a symposium at the European Organization for Nuclear Research (CERN) in Geneva in June 1956, the invitation to which suggests that this organization was attempting to take a third position in the emerging constellation of exchanges between the East and the West. Fifty US and fifty

[37] A. N. Nesmeyanov to L. Alvarez, undated; L. Alvarez to A. N. Nesmayanov, April 23, 1956, box 4, folder Russian trip, Records of Luis Alvarez related to the Lawrence Radiation Laboratory research and projects, 1936–1980, RG 434, Entry SB-2610, National Archives and Records Administration, San Francisco, CA, United States.

[38] "US-Soviet Exchanges Urged," *Physics Today* 9, no. 8 (1956): 16–7.

[39] Luis Alvarez, "Excerpts from a Russian Diary," *Physics Today* 10, no. 5 (1957): 24–32; Luis Alvarez, "Further Excerpts from a Russian Diary," *Physics Today* 10, no. 6 (1957): 22–32.

[40] Robert Marshak, "Sixteen Days in the USSR. Rochester Scientist's Intimate Report of an Epochal Visit," *Rochester Review* XVII, no. 1 (1956): 10–7 & 33–5; Harrison Salisbury, "Curtains are Parted on Science in Soviet," *New York Times*, June 3 (1956): 1 and 78.

[41] E. P. Rosenbaum, "Physics in the U.S.S.R.," *Scientific American* 195, no. 2 (1956): 29–35.

Figure 10.1 Robert Marshak, center, at the Moscow Conference on Physics of High Energy Particles in 1956.

Source: Emilio Segrè Visual Archives, Marshak Collection.

Soviet delegates were among the three to four hundred participants.[42] According to US accelerator expert Hildred Blewett, the symposium offered the change for a group to form, which decided to organize another accelerator meeting at CERN in 1958, and also suggested holding it in conjunction with a high-energy physics conference, like those held annually in Rochester and the one held in Moscow.[43]

The events in spring 1956 illustrate the first attempts to enable East-West exchange between particle physicists who, together with government agencies, had been working towards such opportunities. As their efforts proved successful, physicists sought to consolidate their cooperation. In his position as Vice-President of IUPAP, Robert Brode was willing to agree to a co-sponsorship of the next Rochester Conference for 1958, especially if it were to take place outside of the United States. Convinced that internationalizing the conference series would require the formation of a new commission within IUPAP, he consulted the US National Committee, of which he was the Chairman.[44] In response, Marshak not only pointed out the decision to hold the 1958 conference at CERN (as reported by Blewett), he also took up the idea of international monitoring, seeing the content of the three 1956 conferences as essentially identical,

[42] "High-Energy Physics," *Physics Today* 9, no. 4 (1956): 10; Hildred Blewett, "High Energy Accelerators: Vol. 1 of Proceedings of the CERN Symposium on High Energy Accelerators and Pion Physics (Geneva, June 1956)," *Physics Today* 10, no. 4 (1957): 34.

[43] Hildred Blewett, "CERN Symposium on High-Energy Accelerators and Pion Physics," *Physics Today* 9, no. 11 (1956): 18.

[44] R. Brode to J. S. Coleman, May 3, 1956, box 2, folder 26 RMP Rochester.

and having heard rumors that the Soviets were planning another one.[45] Subsequently, at a meeting of the US National Committee of IUPAP, Marshak proposed a motion to set up a specialized commission and to cut the number of meetings back to reasonable proportions. Members agreed to propose a discussion of the desirability of such a commission at the next IUPAP General Assembly.[46]

Yet the Hungarian crisis in autumn 1956, which prompted the State Department to announce the suspension of cultural exchanges with the Soviet Union, briefly threated future East-West cooperation. This crisis necessitated the reaffirmation of the invitation of the Soviet physicists to the 1957 Rochester Conference, which Weisskopf saw as a good opportunity to espouse the US position of encouraging meetings that were purely scientific in nature, and distinct from the tense political climate.[47] Ultimately, international tensions did not have the feared negative impact on preparations for expanding exchange programs in physics. 1957 proved to be an important year: the Soviet Union joined IUPAP,[48] and IUPAP established a commission to continue the organization of conferences on high energies, accelerators, and instrumentation.

A Balance of Powers? The Commission on High Energy Physics

In the initial proposal, submitted to the IUPAP General Assembly by Marshak, the name of the Commission was High Energy *Nuclear* Physics, reflecting the fact that research reaching high energies was still considered “in the field of nuclear physics.”[49] Elementary particles and forces are studied with accelerators, and in the 1950s, those that run at more than 100 MeV were considered as enabling high-energy experiments. During this time, this field of inquiry began to separate from nuclear physics. This development resulted in the creation of an IUPAP commission, which served to promote the latter field as an independent one. More precisely, when Marshak proposed the creation of a Commission on High Energy Physics and had it approved by IUPAP, French physicist Georges-Albert Boutry asked why there was “no commission on nuclear physics (excluding high-energy physics).”[50] Consequently, IUPAP appointed an ad hoc committee to study the establishment of a Commission on Low Energy Nuclear Physics, which was created in 1960.[51] Thereafter, there were two commissions, reflecting two different albeit overlapping research areas.

In addition to these technical and scientific considerations, the Commission on High Energy Physics soon made a concerted effort in their public relations to separate their research from all things nuclear. There is anecdotal evidence that the term

[45] R. Marshak to R. Brode, August 24, 1956, box 2, folder 26, RMP Rochester.
[46] USA National Committee of the International Union of Pure and Applied Physics, January 30, 1957, box 4, folder 38, RMP Rochester.
[47] C. T. MacLeod to E. K. Hyde, March 7, 1957, box 2, folder 26; V. Weisskopf to W. Libby, January 16, 1957, box 44, folder 30, RMP Rochester.
[48] See chapter by Silva Neto and Kojevnikov in this volume.
[49] Robert Marshak, “The Khrushchev Détente and Emerging Internationalism in Particle Physics,” *Physics Today* 43, no. 1 (1990): 34–42.
[50] Report of the 9th General Assembly, 1957, folder 18, IUPAP Kerwin.
[51] See chapters by Fauque and Van Tiggelen and by Cozzoli in this volume.

"nuclear" was dropped from external communications after the CERN Conference in 1958.[52] This decision may have been due to external circumstances, for in the same week, another conference took place in Geneva, which was attended by experts from the East and the West, working on an agreement to detect violations of atomic weapons test suspension. In his Conference Report, the British physicist John Polkinghorne claimed that in Geneva that week "[s]cience was showing its twin faces: applied science, with its inevitable political significance, and pure science, which advances through combining the work of men of many nations."[53] Thus, the association of particle physics with pure science, and the notion of purity as a prerequisite for international peaceful cooperation had become commonplace among proponents of this field of inquiry.

The year before, in the autumn of 1957, the individuals approved by the IUPAP General Assembly to serve the Commission on High Energy Physics held a first informal meeting, with Cornelis Bakker serving as Chair, Robert Marshak as Secretary, and four other members: Rudolf Peierls, Wolfgang Panofsky, Igor Tamm, and Vladimir Veksler.[54] Commissioners were appointed for three years, which was usually extended to six years. Hence Marshak acted as Secretary until 1963.[55] With its six seats equally divided between Europe, the United States, and the Soviet Union, and the two representatives from each region ideally consisting of an experimentalist and a theoretician, the commission was symbolic of the emergent exchange relations along the East-West axis. In other words, the commission was designed to facilitate and promote contact between physicists, but with unequal priority: scientific exchange between East and West was to be restored, while the opportunities for exchange between North and South, or South and South were disregarded—reflecting that high-energy physics was pursued in world regions where the most powerful accelerators were already operating, planned, or under construction. The imbalance between the potential interests represented in the commission is also evident in the distinction made between the United States, the Soviet Union, and Europe, and what was called the "rest of the world." In October 1960, Japanese physicist Hideki Yukawa, Nobel Laurate for his prediction of mesons, and attendee of the Rochester Conferences since at least 1956, was elected as a seventh member of the commission to represent this category.[56]

At their first formal meeting following the CERN Conference in 1958, the Commission on High Energy Physics decided to organize international conferences under the sponsorship of IUPAP which would thematize scientific results in experimental

[52] Brown, Dresden, and Hoddeson, "Introduction," in Polkinghorne, *Rochester Roundabout: The Story of High Energy Physics*, 70; 9.

[53] John Polkinghorne, "CERN Conference on High-Energy Nuclear Physics, 1958," *Physics Today* 11, no. 11 (1958): 22–3. For the expert meeting in parallel see: Donald A. Strickland, "Scientists as Negotiators: The 1958 Geneva Conference of Experts," *Midwest Journal of Political Science* 8, no. 4 (1964): 372–84.

[54] "File under Commission on High Energy Physics," October 17, 1957, box 4, folder 38, RMP Rochester.

[55] Minutes of meeting of the Commission on High Energy Physics of IUPAP, signed August 22, 1963, vol. 4, folder IUPAP Fleury's correspondence 1957–1963, IUPAP, Quebec secretariat, series E1 (hereafter IUPAP Quebec), Center for the History of science, Royal Swedish Academy of Sciences.

[56] P. Fleury to H. Yukawa, October 1, 1960; H. Yukawa to P. Fleury, December 16, 1960, vol. 4, folder IUPAP Fleury's correspondence 1957–1963, IUPAP Quebec.

and theoretical physics as well as accelerator designs.[57] Since visual detection methods and counting techniques were also seen as relevant,[58] conferences on instrumentation were included in the commissioners' agenda, with the first to take place in Geneva in 1959. Soviet physicist Igor Tamm proposed that the next Conference on High Energy Physics be held in Moscow, also in 1959.[59]

Yet cooperation did not go smoothly after the initial meetings. The Soviet organizers learned from their authorities at short notice that the conference in 1959 would not take place in Moscow but in Kiev, and they had to drastically reduce the number of invitees.[60] The reasons for this decision remain unclear, but in the West, this change in plans was seen as a vote of no confidence. The choice of Kiev, and the reduction in the number displeased Marshak, who found that the US physicists were much more willing to cooperate.[61] Only in a later publication did he concede that the Soviet commissioners had suffered from bureaucratic obstacles.[62] And again, the Kiev Conference was not free of strategic information gathering on progress on the other side of the Iron Curtain. The CIA was interested in learning more about the planned accelerators in the Soviet Union, and thus asked the AEC to be provided with reports.[63] The Office of Special Investigations (OSI) also intended to have one of their consultants in Kiev to give a lecture on atomic energy, even if the OSI was aware that the conference was to cover this subject matter "on a more purely scientific plane."[64]

In Pursuit of Reciprocity

After the organizational problems plaguing the Kiev Conference, US commitment was put to the test again the following year. Soviet attendance at the 1960 conference, which once again was organized in Rochester, was permitted under the Lacy-Zarubin Agreement on cultural exchange signed two years earlier, but the allies of the Soviet Union had not established equivalent diplomatic ties with the United States. Commission member Veksler, and the Director of the JINR at Dubna, Dmitry Blokhintsev,

[57] Report of first meeting of the IUPAP High Energy Commission, July 8, 1958, subseries 4, box 20, folder IUPAP 8th High Energy Physics Conference, McMillan NASF. The aims of the commission are described in: Report of the 10th General Assembly 1960, IUPAP Kerwin, folder 18.

[58] Peter Galison, *Image and Logic. A Material Culture of Microphysics.* (Chicago and London: University of Chicago Press, 1997).

[59] Robert Marshak, "The Rochester Conferences," 96.

[60] Russian State Archive of Contemporary History (RGANI. F. 3. Op. 14. D. 273. L. 13-14). I thank Climério P. da Silva Neto for this reference.

[61] I. Tamm to C. Bakker, November 26, 1958; C. Bakker to S. Y. Nikitin, March 11, 1959; R. Marshak to Brode, Haworth, McMillan, Williams, and Wright, March 20, 1959, subseries 4, box 18, folder IUPAP commission conference 1958–1960, McMillan NASF.

[62] Robert E. Marshak, "Scientific and Sociological Contributions of the First Decade of the 'Rochester' Conferences to the Restructuring of Particle Physics (1950–1960)," in *The Restructuring of Physical Sciences in Europe and the United States, 1945–1960*, ed. Michelangelo DeMaria, Mario Grilli, and Fabio Sebastiana (Singapore, New Jersey, London, Hong Kong: World Scientific, 1989), 759f.

[63] D. H. Morgret to Elizabeth Fisher, September 18, 1959, box 1, folder accelerators general 1959–1963, Correspondence Relating to High Energy Physics, 1957–1964, RG 326, Entry A139 (hereafter HEP NACP), National Archives and Records Administration, College Park, MD, United States.

[64] Chief materials division to deputy chief economic research, October 19, 1958, FOIA Electronic Reading Room, (FOIA)/ESDN(CREST), CIA-RDP62S00346A000100110009-6.

were responsible for selecting the physicists. Marshak subsequently submitted this list to the State Department to be approved "on scientific grounds."[65] In addition to his own nationals, however, Blokhintsev proposed thirty physicists from non-Soviet member countries of the JINR. The Soviets were informed that the participation of these nationals (mostly East Germans and Chinese) would be approved if they came as private citizens and not as representatives of their state regimes.[66] In this way, it was communicated that physics was to be separated from the political sphere. Moreover, this decision shows that the US visa policy had to be adjusted again to broaden exchange opportunities.

This development also resonated in Europe, where physicists received invitations for the 1960 Rochester Conference. Here, some individuals who needed to apply for visas would not have received them due to the restrictions imposed by the McCarran-Walter Act. However, US physicists saw the recent relaxation of visa policy as an opportunity to renegotiate the inclusion of these Europeans in the conference, so they lobbied for their entry to the United States. Accordingly, the embassy in Rome received a telegram from the State Department stating that any "refusal of entry to a purely scientific meeting" would undermine the US government's goal of encouraging international collaboration. The embassy was asked that the possible security risks posed by Marcello Cini, an Italian physicist and communist party member, be weighed against Soviet bloc conference participation and that his visa application be reconsidered. Eventually, entry requirements for Europeans were relaxed under the waiver program. Waivers granted admission to the United States to foreigners who would otherwise be barred by the McCarran-Walter Act so that they, including Cini, could participate in the Rochester Conference.[67]

However, several physicists from the Soviet Union cancelled their trips.[68] Their absence may have been due to a degradation in international relations after the Soviets shot down an unauthorized US reconnaissance plane flying over their territory in the spring of 1960. But as Marshak recalled, the fact that the conference was held under the auspices of IUPAP and the international recognition of the US efforts to promote cooperation in physics meant that the Soviet delegation was well represented at the conference after all.[69] To affirm his nation's goodwill, Blokhintsev asserted at the opening ceremony that the people of the Soviet Union believed strongly in the necessity of "fair friendship."[70] Similar to the way Luis Alvarez presented himself as a diplomatic player after the Moscow trip in 1956, Blokhintsev used the opportunity to point out the positive intentions of his regime.

[65] V. Veksler to R. Marshak, undated; R. Marshak to Members of the Organizing Committee, August 5, 1960, box 1, folder Conference Rochester 1960, HEP NACP.

[66] R. Marshak to A. N. Nesmeyanov, October 23, 1959; D. Blokhintsev to R. Marshak, 14 January 1960; R. Marshak to G. Kolstad, February 5, 1960, box 1, folder Conference Rochester 1960, HEP NACP.

[67] Telegram to embassy in Rome N. 01850, approved by W. R. Brode, undated, box 1, folder conference Rochester 1960, HEP NACP; Marcello Cini, *Dialoghi di un cattivo maestro* (Torino: Bollati Boringhieri, 2001).

[68] Michael Moravcsik, "High-Energy Physics: An Informal Account of the Rochester Conference," *Physics Today* 13, no. 12 (1960): 20–5.

[69] Robert Marshak, "The Khrushchev Détente and Emerging Internationalism in Particle Physics," *Physics Today* 43, no. 1 (1990): 34–42.

[70] B. Sullivan to J. A. McCone, undated addendum; H. S. Traynor to J. C. Clark, August 4, 1960, box 1, folder conference Rochester 1960, HEP NACP.

The High Energy Physics Conference was followed by a week-long tour, which was completed with a conference on instrumentation.[71] Again, a distinction was made between areas that could be visited and those where access was restricted. In a letter to the congressional Joint Committee on Atomic Energy (JCAE), the General Manager of the AEC, Alvin Luedecke, clarified that "high energy physics programs at the AEC laboratories to be visited are unclassified and discussions at the conferences and in the laboratories are to be limited to unclassified topics."[72] The US authorities allowed foreigners to see several laboratories, but their hosts were advised to take special precautions, and all facilities had to implement security plans beforehand.[73]

The US hosts gleaned from their visitors that the Soviet high-energy program was advancing rapidly.[74] Based on the legacy of a lack of reciprocity in the flow of knowledge after World War II, and on considerations that knowledge accumulation by the United States was what helped it maintain its technoscientific lead,[75] the AEC had to be convinced of the net benefit and reciprocity of IUPAP conferences in order for them to be expanded and their future secured.[76] Accordingly, Edwin McMillan, in his role as a member of the IUPAP Commission on High Energy Physics, was asked to insist that one of the next conferences be held in the Soviet Union. Vladimir Veksler agreed to propose to the Soviet Academy of Sciences that the Accelerator Conference in 1963 be organized in Dubna. In line with these suggestions to foster reciprocity, the commission adopted a resolution to establish symmetry regarding where meetings would take place, starting after 1964, so that the sequence United States, Europe, Soviet Union would continue.[77]

Before this rotation system was introduced, and due to heightened international tensions, the Soviet invitees were absent from the Accelerator Conference at the US Brookhaven National Laboratory in 1961. The decision not to attend was communicated late, as Hildred Blewett reported in *Physics Today* that "a telegram was received during the first [conference] day stating that none of the expected delegates from the Soviet Union would be present."[78] In 1962, a year after the erection of the Berlin Wall, the conferences sponsored by IUPAP—one on high-energy physics and one on instrumentation—were both held at CERN (in a neutral country), instead of that on instrumentation being held in Hamburg, as originally planned. This was done to the

[71] I. Tamm to R. Marshak, March 20, 1959; E. C. Shute to E. McMillan, March 9, 1959, subseries 4, box 20, folder IUPAP 9th High Energy Physics Conf, McMillan NASF.

[72] General Manger AEC to Hon C. P. Anderson, July 1960, box 1, folder conference Rochester 1960, HEP NACP.

[73] J. C. Clarke to H. S. Traynor, August 4, 1960; "Program Post-Conference Tour August 25 to September 1, 1960," General Manager AEC to Chairman McCone, July 13, 1960, box 1, folder conference Rochester 1960, HEP NACP.

[74] "Report of visit of Russian physicists to UCRL," Edwin McMillan, December 1957, subseries 2, box 12, folder Visitors USSR 1957–1959, McMillan NASF.

[75] Mario Daniels and John Krige, *Knowledge Regulation and National Security in Postwar America* (Chicago: University of Chicago Press, 2022), 57–64.

[76] E. C. Shute to D. Cooksey, February 2, 1959, subseries 2, box 10, folder visitors correspondence, McMillan NASF.

[77] Minutes of meeting of the Commission on High Energy Physics of IUPAP, August 26, 1960, vol. 4, folder IUPAP Fleury's correspondence 1957–1963, IUPAP Quebec; "Summary of conclusions of IUPAP Commission during meeting at Rochester 1960," subseries 4, box 18, McMillan NASF.

[78] Hildred Blewett, "The Brookhaven International Conference on High-Energy Accelerators," *Physics Today* 14, no. 12 (1961): 31.

displeasure of the local organizers, who faced more work, but allowed participation from both sides of the Iron Curtain.[79]

At their meeting held during the Accelerator Conference in Dubna in 1963, the members of the IUPAP Commission decided to also organize the next High Energy Physics Conference there.[80] The AEC, sponsor of the US delegates, saw their participation as an opportunity to acquire information on the progress of the foreign laboratories, and the AEC divisions of security, intelligence, and international affairs did not object.[81] Following the 1964 High Energy Physics Conference in Dubna, attended by 450 participants, the AEC headquarters received reports that foregrounded the spectacular dinner parties and theatre programs rather than the content of the talks, while the laboratory tours had provided access only to declassified sectors.[82] By sticking to entertainment and scientific discussions, the hosts were carefully steering activities in the direction of the cultural exchange programs that had been agreed on by the Soviet Union with the United States, illustrating how diplomatic understanding was practiced on the ground.

Conclusion

From 1955 to 1964, the Conferences on Instrumentation, Accelerators, and High Energies supported by IUPAP with funding from UNESCO grants offered an important arena for developing particle physics. While cosmic ray studies were deemed ever less important, debates focused more and more on accelerators and instruments for data analysis. In terms of content, attention shifted from subjects such as mesons, the interactions of pions and nucleons, or the physics of muons to strange particles, weak interactions, neutrinos, the composition of hadrons, and field theory.[83] Nevertheless, at the 1964 Dubna Conference, participants sensed a scientific crisis after the numerous discoveries in the previous decade.[84] Theories failed to explain certain phenomena, which soon underpinned demands for accelerators with higher intensities,

[79] R. Marshak to P. Fleury, March 23, 1962; V. Weisskopf to D. Blokhintsev, March 26, 1962, CERN Directors-General, CERN-ARCH-DG-FILES-339, CERN Archives, Geneva, Switzerland; V. Weisskopf to R. Marshak, November 28, 1961; V. Weisskopf to R. Marshak, December 13, 1961, subseries 4, box 18, folder IUPAP Commission Conference (1961), McMillan NASF.

[80] R. Marshak to V. Veksler, G. Bernardini, D. I. Blokhintsev, L. Leprince-Ringuet, E. M. McMillan, H. Yukawa, and M. L. Goldberger, March 18, 1963, box 2, folder DUBNA (USSR) Conference August 1963, HEP NACP.

[81] P. W. McDaniel to A. R. Luedecke, April 17, 1964, box 2, folder 1964 International Conference on HEP at Dubna, HEP NACP.

[82] N.P. Samios, "High-Energy Physics: The 1964 Conference at Dubna," *Physics Today* 17, no. 12 (1964): 38–40; P. J. Reardon to W. A. Wallenmeyer, November 23, 1964, box 2, folder DUBNA (USSR) Conference August 1963; W. A. Wallenmeyer to files, August 24, 1964, folder 1964 International Conference on HEP at Dubna, HEP NACP.

[83] The conference proceedings contain extensive details. For a summary see: Laurie M. Brown, Max Dresden, and Lillian Hoddeson, "Pions to Quarks: Particle Physics in the 1950s," *Physics Today* 41, no. 11 (1988): 56–64.

[84] "Trip report" by Robert Bacher, October 26, 1964, box 2, folder 1964 International Conference on HEP at Dubna, HEP NACP.

and preceded the introduction of quarks, which gave new impetus for research into the development of the Standard Model.[85]

Apart from its relevance in advancing particle physics, the IUPAP Conference series was important for establishing a system of East-West cooperation during the Cold War. Restrictions by both sides that limited exchange to "pure" science matters enabled mutual participation in conferences from 1956 onwards. This exchange resulted from efforts on the part of physicists as they sought to enable international discussion of their findings. To this end, they were loyal to both their governments and their research community. Scientific collaboration would thus never have come about without politics: The most obvious politicized aspect of the conferences is the way in which physicists helped intelligence operations (although it is difficult to determine to what extent). Because they served the interests of their administrations, physicists were unable to truly escape the hold of politics.

The selection of the participants, content, and location of the conferences was an exclusive process: although the IUPAP Commission discussed in this chapter institutionalized cooperation, allowing for more contact and intensifying communication across borders, many nations were relegated to "the rest of the world" category. Thus, while reciprocity and symmetry were sought between the East and the West, there was an imbalance between them and other world regions. Several attempts were made to change this situation. In 1961, commission members discussed the preferential treatment of other countries in the selection of the conference venue, but without result.[86] A year later, when Yukawa's term was to expire, consideration was given to electing an Asian representative who was not from Japan, but to no effect, as he returned for another term.[87] In 1966, commissioners agreed that one person should be replaced by a member from a region other than the United States, the Soviet Union, or Europe. Giving the place to India was suggested, but without consequence.[88] In 1969, Shigeki Suwa, who had succeeded Yukawa in 1966, expressed his view that it was easy to find a Japanese replacement for him, but "practically impossible to discuss on this matter [on] an international scale as your 'other countries' category." In response to this implicit criticism of the categories different countries were grouped under, commission Secretary Léon van Hove noted that it was "very natural" that Japan was represented, as it was the most active player along with the United States, the Soviet Union, and Europe.[89] Particle physics programs were emerging around the world, but it was not until 1978 that the high-energy conferences broke the strong East-West axis by choosing their venue to be Tokyo.

The post-war vision of being a "strictly scientific" organization involved IUPAP becoming a diplomatic actor in the reconstruction of international exchange. But as

[85] Hildred Blewett, "Future Prospects for High-Energy Accelerators," *Invited paper to be published in the Proceedings of the Lund International Conference on Elementary Particles*, June 17, 1969; Murray Gell-Mann, "Progress in Elementary Particle Theory, 1950–1964," in *Pions to Quarks. Particle Physics in the 1950s*, ed. Laurie M. Brown et al. (Cambridge: Cambridge University Press, 1989), 695.

[86] IUPAP Commission on High Energy Physics, addition to agenda, September 9, 1961, subseries 4, box 18, folder IUPAP Commission Conference Correspondence 1961, McMillan NASF.

[87] Minutes of meeting of the Commission on High Energy Physics of IUPAP, July 7, 1962, vol. 4, folder IUPAP Fleury's correspondence 1957–1963, IUPAP Quebec.

[88] Minutes of meeting of the Commission on High Energy Physics of IUPAP in 1966, LVH-189.

[89] S. Suwa to L. van Hove, February 13, 1969, L. van Hove to S. Suwa, March 26, 1969, LVH-189.

has been shown, the discourse around pure science was highly political. It marked out a rhetorically powerful line between the pursuit of knowledge in particle physics and concerns about national security. But the concept of purity remained part of political considerations and strategies, and it included aspects that extended beyond strictly scientific exchange.

11
China's Tortuous Path to IUPAP
An Enlightening Case of Chinese Science Diplomacy during the Cold War

Danian Hu, Jinyan Liu, and Xiaodong Yin

China's Early IUPAP Membership, 1933–1954

Modern Chinese physicists first appeared at the beginning of the 20th century. As this physics community continued to grow in China during the following three decades, the need to form a professional society of their own to promote the physical sciences and advance their study became more obvious. Hence, following the suggestion of Paul Langevin, the French physicist who visited China late in 1931, some physicists established the Chinese Physical Society (CPS) in Beijing on August 22–24, 1932. At its first General Assembly, the CPS adopted the resolution to join the International Union of Pure and Applied Physics (IUPAP) to "stay updated with the international physics community." On December 1, the CPS formally applied for IUPAP membership and Henry Abraham, its Secretary General, replied on January 7, 1933, accepting the CPS into the Union.[1] Soon after paying the membership dues of 1600 francs to IUPAP, the CPS assigned two Chinese representatives working in the United States at that time to take part in the Chicago meeting of the IUPAP Committee on Symbols, Units, and Nomenclature, which convened in June.[2] In October 1934, the fourth IUPAP General Assembly in London ratified China as its nineteenth member.[3] Unfortunately, IUPAP was not very active and thus had little influence in China during the following decade.[4]

Due to World War II and other international turbulences, IUPAP suspended its General Assemblies from 1935 to 1946. During this period, the CPS was also unable to carry out its normal agenda and had to convene its annual meetings in collaboration with other domestic scientific societies or merely hold regional instead of national conferences. In 1946, the International Council of Scientific Unions (ICSU)

[1] Writing Group of the Chinese Physical Society, ed. 中国物理学会编写组编. *Eighty years of Chinese Physical Society* 中国物理学会八十年. (Beijing: China Science and Technology Press 北京: 中国科学技术出版社, 2012), 5.

[2] Chinese Physical Society, ed., 中国物理学会编. *Report of the Second Annual Meeting of the Chinese Physical Society* 中国物理学会第二次年会报告. 1933: 34. The two Chinese participants were Yuen Ren Zhao (赵元任) and Ta-You Wu (吴大猷).

[3] Report of the 4th General Assembly, 1934, series B2aa, vol. 1 "1923–1966," IUPAP, Gothenburg Secretariat (hereafter IUPAP Gothenburg), Center for the History of Science, Royal Swedish Academy of Sciences.

[4] For the Union's development during this period, see the chapter by Fauque and Fox as well as that by Jaume Navarro in this volume.

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reached an agreement with the United Nations Economic Scientific and Cultural Organization (UNESCO) which enabled IUPAP to receive special grants through ICSU supporting specific international conferences. In January 1947, four Chinese physicists attended the fifth IUPAP General Assembly in Paris, the meeting that called on IUPAP members to assemble national committees.[5] Thus, the CPS joined hands with other well-known Chinese research institutions and universities and elected the Chinese Committee of IUPAP in March 1948. This committee intended to send delegates to the 6th IUPAP General Assembly to be held in Amsterdam in July that year, but eventually failed to dispatch any, likely due to domestic difficulties during the civil war.[6] That June, the CPS paid the 1947 dues of forty pounds ($160) to IUPAP. In the following six years, however, the Chinese Committee stopped paying its membership fees, and did not answer any inquiries from the Union, apparently due to the domestic and international upheavals.[7] The Chinese silence led the Union's Executive Committee to recommend at the eighth General Assembly in 1954 that the membership of the Chinese Committee "be left in abeyance."[8]

Returning to IUPAP and Walking out Again

Joffe's Advocacy

The exchanges between IUPAP and physicists in the People's Republic of China (PRC) began in the mid-1950s, thanks to the advocacy of Abram F. Joffe, the famed "father of Soviet physics."[9] The Soviet influence in the PRC continued to grow since the latter's foundation in October 1949, culminating in the early years of the post-Stalin era.[10] As a result, Soviet scientists were widely admired in the PRC during the 1950s and Joffe, in particular, had been elected an honorary member of the CPS in 1951, citing his "outstanding contributions to physics" and "enthusiastic care and support" for physics development in China.[11] By the fall of 1953, the CPS had even declared that "learning from the USSR is the core of our present mission and this

[5] The four Chinese physicists were Li Shuhua (李书华), Qian Sanqiang (钱三强), Wang Dezhao (汪德昭), and Cai Bailing (蔡柏龄) Report of the fifth General Assembly, 1947, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

[6] "The Chinese Committee of the International Physical Association was established 国际物理协会中国委会成立," Shen Bao 申报, March 16, 1948, 6th edn 1948 年 3 月 16 日, 第 6 版.

[7] The relevant revolutionary changes during this period could include the Chinese Civil War (1946–1949), the foundation of the People's Republic of China (PRC), the Korean War, and the US-led sanctions and blockade against the PRC.

[8] Report of the eighth General Assembly, 1954, series B2aa, vol. 1, "1923–1966," IUPAP Gothenburg. The General Assembly of the IUPAP is held every three years, while the Executive Committee usually meets once a year.

[9] For a biography of Joffe, see Horst Kant, *Abram Fedorovič Ioffe: Vater der sowjetischen Physik*, 1. Aufl. ed., Biographien hervorragender Naturwissenschaftler, Techniker, und Mediziner, (Leipzig: B. G. Teubner, 1989).

[10] Zhang, Baichun 张柏春, Yao Fang 姚芳, et al. *Technology Transfer from the Soviet Union to the P. R. China: 1949–1966* 苏联技术向中国的转移: 1949–1966. (Jinan: Shandong Education Press 济南: 山东教育出版社, 2004).

[11] "Writing Group of the Chinese Physical Society," ed. 中国物理学会编. *The sixty years of the Chinese Physical Society.* 中国物理学会六十年. (Changsha: Hunan Education Press 长沙:湖南教育出版社,

principle should be carried out in each and every piece of work." It called on its members to "learn from the USSR earnestly and sincerely," claiming that "[t]he USSR is simply the best role model for us."[12] After Stalin's death in March 1953, the new Soviet leaders abandoned his scientific isolationism and endeavored to internationalize Soviet sciences.[13] In July 1956, the Soviet Academy of Science (SAS) formally applied for IUPAP membership, which was unanimously approved at the Union's Executive Committee Meeting in Ottawa, Canada, in September 12–13. Joffe, who represented the USSR at the Ottawa meeting, proposed to invite the PRC to join the Union. The committee unanimously supported Joffe's proposal and entrusted him to inform the Chinese.[14] While still in Ottawa, Joffe telegramed the Soviet Academy, asking the latter to inform the Chinese Academy of Sciences (CAS) about IUPAP's invitation through the Chinese Embassy in Moscow.[15]

It took weeks for the CAS to receive and ponder the unexpected and sketchy message from the Chinese Embassy. The delay was partly due to the ignorance of the contemporary CAS leaders about IUPAP: even Zhou Peiyuan, the CPS President, claimed that he was not familiar with the Union.[16] The CAS replied on November 1, requesting the embassy to investigate if the SAS was a IUPAP member, if it would attend the IUPAP General Assembly in 1957, if the SAS could help acquire a copy of IUPAP's charter, and, most importantly, if institutions in Taiwan had anything to do with IUPAP.[17] Here, it is important to note that from the very beginning, the issue of Taiwan was a major concern for the CAS to make a decision on joining an international organization like IUPAP. Since Joffe had not received the CAS's reply by mid-November, he wrote directly to Guo Moruo (郭沫若), the CAS President, reiterating IUPAP's invitation and explaining that the SAS was now a member in the

1992), 53; Wang Shouwu 王守武, "In Memory of Academician A. F. Joffe 纪念 A.Ф. 约飞院士," *Acta Physica Sinica* 物理学报, 17, no. 6 (1961): 254.

12 "The CPS Executive Council," (*an announcement to physicists at large on the mission and working direction of the CPS in the future* 关于中国物理学会今后的任务和工作方向告广大的物理学工作者), in *The sixty years of the Chinese Physical Society* 中国物理学会六十年 (Changsha: Hunan Education Press 长沙:湖南教育出版社, 1992), 71–2.

13 For a detailed discussion on the development of the USSR's policy concerning international scientific exchanges, see the chapter by Silva Neto and Kojevnikov in this volume.

14 Because of his unique credibility and connections with Chinese physicists, Joffe was an ideal messenger. In addition to his honorary membership in the CPS and his new role in IUPAP, Joffe was also a member of the Presidium of the SAS and the Secretary of the Academy's Physical Mathematical Division. (See "Obituaries: Abram F. Joffe," *Physics Today* 14, no. 1 (1961): 99.) About Joffe's request at the Ottawa Meeting, see The CAS to the Office of Foreign Affairs, The PRC State Council, March 20, 1958. 为请示申请加入国际纯粹及应用物理协会事 [A request for instructions about applying for the IUPAP membership], Archives of the Chinese Academy of Sciences (hereafter CAS Archives), 1958-04-052-11-066, Beijing.

15 F. Joffe to Guo Moruo, December 20, 1956, CAS Archives, 1958-04-052-03. The CAS to the Chinese Embassy in the USSR, October 29, 1956, CAS Archives, 1958-04-052-06. On Joffe's academic status within the Soviet Academy, see "Obituaries: Abram F. Joffe."

16 The CAS to the Chinese Embassy in the USSR, October 29, 1956, CAS Archives, 1958-04-052-01-003. It is not completely clear why Zhou made such claim then because as one of the founding members of the CPS in 1932, he should have learned of the CPS's membership in IUPAP. It is possible that Zhou was not familiar with the full title of IUPAP because the Union used to be called "International Union of Physics" in Chinese documents and even in the correspondence from the Union's administrators.

17 The CAS to Embassy of the People's Republic of China in the USSR, October 28, 1956. 请了解国际纯粹及应用物理学会议组织情况 [Please investigate the organization of IUPAP], CAS Archives: 1958-04-052-01.

Union.[18] Having not received Joffe's letter nor any reply from the Chinese Embassy, the CAS sent an airmail to the embassy on December 6, repeating the previous requests and urging the embassy to reply as soon as possible.[19]

Eight days after sending out its second letter, the CAS finally received Joffe's November letter together with a copy of IUPAP's bylaws.[20] Having studied the information from Joffe, Pei Lisheng (裴丽生), the CAS Academic Secretary General, replied to him directly on January 19, 1957, informing that "the Chinese physics circle would be very happy to be able to join IUPAP." However, Pei stressed, "in order to avoid the two-China situation in an international organization, we very much wish to know if there is any institution from Taiwan joining IUPAP. Hence, we hope that you—dear Academician A. Joffe—could inquire IUPAP on our behalf so as to decide if a Chinese physics institution should join the Union."[21]

It is necessary to introduce some historical background of the One-China Principle and the crucial issue of Taiwan in the PRC's foreign policy, which is essential for readers to understand the central theme of this paper. Taiwan had been officially integrated into China's administrative system since 1683. In 1895, Japan occupied Taiwan by forcing Qing China to sign the Treaty of Shimonoseki which was abrogated in December 1941 by the Nationalist Government led by Chiang Kai-shek after Japan launched an all-out war of aggression against China.[22] In December 1943, the Cairo Declaration issued by the Chinese, US, and British Governments stipulated that "all the territories Japan has stolen from the Chinese, such as Manchuria, Formosa [Taiwan], and the Pescadores, shall be restored to the Republic of China."[23] The Potsdam Proclamation signed by China, the United States, and Britain in 1945 also stressed that "[t]he terms of the Cairo Declaration shall be carried out."[24] After the Japanese surrender in August that year, the Chinese Government recovered Taiwan and the Penghu Archipelago, resuming the exercise of sovereignty over Taiwan on October 25, 1945.[25] Between 1945 and 1949, the US Government and its allies "recognized China's exercise of sovereignty over Taiwan Island." Afterwards, the US Government, out of its geopolitical concerns during the Cold War, first advocated an idea that "the status of Taiwan has yet to be determined" and then pushed forward "dual recognition" among the international community in order to create "two Chinas," especially during the Eisenhower-Dulles administration. In response, the PRC insisted on the

[18] A. F. Joffe to Guo Moruo, November 19, 1956, CAS Archives: 1958-04-052-03. Because Joffe did not address, in his letter, the questions concerning Taiwan and the Soviet participation in the 1957 Rome Assembly, he apparently had not received the earlier reply from the CAS.

[19] Chinese Academy of Sciences to the PRC embassy in the USSR], December 6, 1956. 再催请了解国际纯粹及应用物理会议组织情况 [Repeated request for investigating the situations concerning the IUPAP]. CAS Archives, 1958-04-052-04.

[20] A. F. Joffe to Guo Moruo, November 19, 1956, CAS Archives: 1958-04-052-03.

[21] Pei Lisheng to A. F. Joffe, January 19, 1957. 请了解国际纯粹及应用物理协会有无台湾参加 [Please inquire if there is any institution from Taiwan participating in the IUPAP], CAS Archives, 1958-04-052-04. In this paper, all English translations of the original Chinese texts are done by the authors.

[22] "PRC White Paper, 'The One China Principle and the Taiwan Issue,' 21 February 2000," *Asian Affairs: An American Review* vol. 27, no. 1 (Spring 2000): 39.

[23] The Cairo Declaration, available at https://history.state.gov/historicaldocuments/frus1943CairoTehran/d343, accessed on July 6, 2023.

[24] The Potsdam Proclamation, available at https://history.state.gov/historicaldocuments/frus1945Berlinv02/d1382, clause 8, accessed on July 6, 2023.

[25] PRC White Paper, "The One China Principle and the Taiwan Issue," 40.

One-China Principle, that is, "[t]here is only one China in the world, Taiwan is a part of China and the Government of the PRC is the sole legal government representing the whole of China." It is also important to note that, despite the American pressure, Taiwan authorities also insisted that Taiwan was a part of China and that there was only one China, thus opposing the idea of "two Chinas" or "Taiwan independence" during the three or four decades after 1949, even though they did not recognize the legitimacy of the Government of the PRC as the representative of the whole of China.[26]

Joffe's brief reply arrived at the CAS before March 26, 1957, reporting that "Taiwan was not among the IUPAP members according to the list sent to you before," that "only the CAS in Beijing was discussed" at the executive meeting on September 12, 1956, and that "all participants at the meeting unanimously welcomed the CAS to join the Union." In concluding his note, Joffe offered "to make a formal inquiry with Professor Mott," the IUPAP President then, in case "the above-mentioned facts were still not satisfactory."[27] Afterwards, Joffe did inquire Fleury, Secretary General of IUPAP, which prompted a reply from Mott. On June 10, 1957, Mott wrote Joffe to clarify specifically that "[t]he International Union of Physics *has not had any relationship* with the Government of the island of Formosa [Taiwan]." He added in his letter, "[a]s president, I may say that I hope very much that the Chinese Academy will see its way to participate in the Union and that it will be able to send a delegation to the meeting of the General Assembly of the Union which will take place in Rome from 17th to 20th September."[28] Upon receiving Mott's letter, Joffe wrote to Guo Moruo immediately, enclosing a copy of Mott's letter and urging the CAS "to join IUPAP as the Soviet Academy of Sciences has done."[29] It is important to note here that Mott's statement concerning Taiwan merely declared the Union's policy so far but made no promise of excluding any Taiwanese institution in this Union in the future. In fact, three months before Mott wrote Joffe, an official from the Ministry of Education in Taipei, Taiwan, had contacted IUPAP, expressing their interest in and seeking detailed information about the Union's 9th Assembly in Rome, Italy, in the following September.[30] The Union, however, did not seem to have answered the request from Taiwan, and thus Mott's statement was technically true.

[26] PRC White Paper, "The One China Principle and the Taiwan Issue, February 21, 2000," 39. For detailed American-archive-based discussions about the US Government's policy toward Taiwan and the PRC, see Shuang Jinghua 双惊华 and Xin Hua 忻华, eds., *Taiwan Wenti 台湾问题 [The Issue of Taiwan]*, 8 vols., vol. 4, Meiguo dui Hua qing bao jie mi dang an, 1948–1976 美国对华情报解密档案 [Declassified US Intelligence Documents on China]: 1948–1976 (Shanghai: Dong fang chu ban zhong xin 上海:东方出版中心, 2009), 9–15.

[27] A. F. Joffe to Pei Lisheng, undated, CAS Archives: 1958-04-052-05.

[28] N. F. Mott to A. F. Joffe, June 10, 1957, CAS Archives: 1958-04-052-06, emphasis added by the authors.

[29] A. F. Joffe to Guo Moruo, June 21, 1957, CAS Archives, 1958-04-052. Joffe's original letter in Russian is not in the archival collection we found, but its Chinese translations are. The English quote that appears here is translated by the authors based on the Chinese translation.

[30] Chang Naiwei to P. Fleury, March 5, 1957, series E6 "Fleury's correspondence with Liaison Members," vol. 4, folder "11 China, one China," IUPAP Gothenburg (given the fact many documents are from this folder, we use hereafter IUPAP Gothenburg China, one China). Chang was the Director for Bureau of International Cultural and Educational Relations in Ministry of Education, Taipei, Taiwan, China.

Although the CAS received Joffe's last letter before July 12,[31] it did not answer the Soviet academician until September 2. As early as July 30, Xie Xinhe (谢鑫鹤), a deputy Secretary General of the CAS, commented on Joffe's letter, proposing that China should "not attend the Assembly this year, nor join the Union for now."[32] Another CAS official seemed to be more prudent and consulted Professor Zhou Peiyuan, the CPS President, who did not support Xie but recommended instead that the CAS should reply to Joffe with the President's opinion.[33] Eventually Guo wrote to Joffe: "[w]e are currently considering the matter of joining IUPAP. [Please] allow us to inform you later by mail." Nevertheless, Guo declined to send a Chinese delegation to Rome, citing insufficient time for preparation and the absence of a formal and direct invitation from the union.[34]

A fortnight after Guo penned his letter, Zhou Peiyuan telegraphed Joffe through the Soviet Embassy in Italy on September 17, the opening day of IUPAP's Rome Assembly, announcing that "[t]he Chinese Physical Society wishes to join the International Union of Pure and Applied Physics."[35] One week later, Mott, in his capacity as President, wrote to Zhou to express his "pleasure" at receiving via Joffe "the desire of the Chinese Physical Society to join the Union" and to request the CPS "to send a formal application, which will be put before the next meeting of the Executive Committee of the Union."[36] The CPS, however, did not send out its application until more than six months later.

The CPS's Formal Application and Sudden Withdrawal

Beginning in early June 1957 the anti-rightist campaign swept mainland China.[37] By mid-July, the CAS had also been drawn into this political whirlpool, which seriously hindered the academy's operation in the following months. This helps explain why the CAS did not send a delegation to Rome and why the formal application for IUPAP membership was not ready until February 1958 when the campaign in the CAS wound down.

[31] The earliest handwritten remarks on one of the Chinese translations of Joffe's letter is dated July 12, 1957.

[32] 今年不参加大会 也不参加协会 [Do not attend the General Assembly and do not join the union this year]. August 5, 1958, CAS Archives: 1958-04-052-10-063.

[33] Untitled. CAS Archives: 1958-04-052-10-063 and 1958-04-052-10-064.

[34] Guo Moruo to A. F. Joffe, September 2, 1957, CAS Archives: 1958-04-052-07. Joffe's letter reached President Guo's desk likely after July 12.

[35] Zhou Peiyuan's telegram to A. F. Joffe, September 17, 1957, CAS Archives: 1958-04-052-10-061 and 1958-04-052-10-062.

[36] N. F. Mott to Zhou Peiyuan, September 24, 1957, CAS Archives: 1958-04-052-08-052.

[37] The "anti-rightist campaign" was launched to counter the attacks and criticism against the CCP, which were outpoured during the Rectification Campaign initiated by Mao Zedong in 1956 to encourage intellectuals "to speak out against abuses within the party." As a result of the "anti-rightist campaign," hundreds of thousands Chinese intellectuals were branded as "rightist" and their careers in China were ruined. See Jonathan D. Spence, *The search for modern China*, third edn (New York: W.W. Norton & Company, 2013), 509–13.

Zhou Peiyuan drafted the official application addressed to Fleury as well as a reply to Mott.[38] Early in March, the CAS prepared a report to request for the permission to join IUPAP in the name of the CPS, arguing this was important to "learn about international developments in physics and advance physics in [China]."[39] It was not until March 20, however, that the CAS submitted its report along with the draft application and other supporting documents to the Office of Foreign Affairs in the PRC State Council.[40] Eight days later, the CAS received official approval.[41]

On April 1, 1958, Zhou Peiyuan submitted the CPS's formal application to join IUPAP, in which he stated specifically that the CPS "is *the **only** national learned society of Chinese physicists in the whole country*."[42] IUPAP officials must have noted this statement because it was underlined by pencil on Zhou's original letter deposited in the IUPAP's archives, either immediately or later, when the "crisis" arose due to the "Two-Chinas" controversy. Early in July, the CPS's application was unanimously approved at the IUPAP Executive Committee meeting in Grenoble, France. On July 30, Pierre Fleury wrote Zhou to announce this approval.[43]

What Fleury did not tell Zhou is that merely two days earlier, he had just replied Yuin-Kwei Tai (戴运轨), the President of "[t]he Chinese Physical Society" located in "Taipei, Taiwan (Formosa), China" (hereafter CPS-Taipei). Besides the isolated letter from the Nationalist Government in Taiwan in early March 1957 already mentioned, there was no further exchange between Taipei and IUPAP until fifteen months later. On June 30, 1958, Tai suddenly wrote a letter to Fleury, expressing CPS-Taipei's "desire to join the International Union of Pure and Applied Physics." He also eagerly declared that the society was "ready to send some delegates to participate in the meetings to be held in the future" despite it had not yet received any information about "the necessary requirements and procedures" for IUPAP membership.[44]

Several pieces of evidence support the speculation that this application was part of a strategy in which Taiwan was applying to several scientific unions around the same time, and that "the original application from Taiwan must have been originated by the US State Department."[45]

[38] Zhou Peiyuan to N. F. Mott, undated, CAS Archives: 1958-04-052-08-055-057; Zhou Peiyuan to P. Fleury, undated, CAS Archives: 1958-04-052-08-058-060.

[39] The party leadership Group of the CAS to the Steering Committee of International Activities of the Central Committee of the Communist Party of China, March 20, 1958. 为请示加入国际纯粹及应用物理协会事 [For requesting to join IUPAP], CAS Archives: 1958-04-052-08-080-082.

[40] The party leadership Group of the CAS to the Steering Committee of International Activities of the Central Committee of the Communist Party of China, March 20, 1958. 为请示加入国际纯粹及应用物理协会事 [For requesting to join IUPAP], CAS Archives: 1958-04-052-08-080-082. The supporting documents include IUPAP's charter, previous correspondence with Joffe and Mott, and the CPS's draft application and a reply to Mott.

[41] 同意申请加入国际纯粹及应用物理协会为会员 [Agree to apply for membership in IUPAP], March 27, 1958, CAS Archives: 1958-04-052-12-083.

[42] Zhou Peiyuan to P. Fleury, April 1, 1958, series E6 "Fleury's correspondence with Liaison Members," vol. 4, folder "10. China," IUPAP Gothenburg (given the fact many documents are from this folder, we use acronym hereafter IUPAP Gothenburg China). The italics are added by the authors, the bold is by a reader.

[43] P. Fleury to Zhou Peiyuan, June 30, 1958, IUPAP Gothenburg China, one China.

[44] Yuin-kwei Tai to P. Fleury, June 30, 1958, IUPAP Gothenburg China, one China.

[45] Thierry Montmerle and Yi Zhou, *China and the International Astronomical Union: Divorce, Separation and Reconciliation (1958–1982)* (Cham: Springer, 2022), 26.

Together with the application or in some previous date, Fleury received a letter of endorsement in an official envelope of the CPS-Taipei dated June 19 and signed by Han-sheng Chuan (全汉昇), a historian of modern Chinese economy and the acting Director General of Academia Sinica. The fact that Chuan's letter was dated almost two weeks before Tai's indicates that it was the Nationalist Government in Taiwan that initiated Taiwan's application for IUPAP. Comparing with previous letters from Taiwan to IUPAP, Chuan's letter was unusually stiff and assertive, which indicates that the authorities in Taiwan had suddenly received certain unprecedented outside support and encouragement and thus felt entitled to press on the Union:[46]

> Dear Sir:
>
> Reference is made to the letter of June 12, 1958, sent to you by the Chinese Physical Society, the Republic of China, requesting for adherence to the International Union of Pure and Applied Physics. As a member of the International Council of Scientific Unions, the Academia Sinica desires to indicate that it has endorsed this Physical Society and officially supports its adherence [to IUPAP]. We hope that necessary action to formalize its adherence be taken as soon as possible so that this Physical Society would be able to make preparations to attend the Meetings of the International Union of Pure and Applied Physics to be held in the future.

Academia Sinica (in Taiwan) had just become a member of ICSU in 1958 and this seemed to have given Chuan some kind of right to demand IUPAP to immediately admit the CPS-Taipei based on the academia's endorsement.[47]

What then aroused Taiwan's sudden interest and "desire" in joining IUPAP in 1958? Archival records in the Union's archives demonstrate that the US Department of State was the driving force behind Taiwan's moves, which led to a "China crisis" in IUPAP for the next twenty-five years. This was a pattern similar to China's experience in the other unions, most notably the International Astronomical Union (IAU).[48]

As soon as Fleury received Tai's application letter, he copied it to Robert Brode. When Fleury replied to Tai on July 28, informing him about IUPAP's "normal procedure for the adhesion of a country" and wishing Tai's "effort for this membership come to fruition soon," he again copied Brode in.[49]

Robert Brode (1900–86), a distinguished American physicist at UC Berkeley who was appointed to the US National Committee in IUPAP in 1950,[50] served as a member of the IUPAP Executive Council from 1954 to 1960, as one of its Vice-Presidents. In the same period, he was also the Chairman of the US National Committee in

[46] Hansheng Chuan to P. Fleury, June 19, 1958, IUPAP Gothenburg China, one China. The letter by the CPS-Taipei on June 12, which mentioned by Chuan, does not exist in IUPAP's archives. Both Chang and Tai addressed Fleury "Dear Professor Fleury" in their letter. Chuan's biographical information can be found at https://www1.ihp.sinica.edu.tw/Fellows/Han-sheng_Chuan (last accessed on 16 April 2023).

[47] Thierry Montmerle, "When China Left the IAU: A Reappraisal," in *Astronomers as Diplomats: When the IAU Builds Bridges Between Nations*, ed. Thierry Montmerle and Danielle Fauque (Cham: Springer International Publishing, 2022), 169–98, on 182.

[48] For a detailed study of the IAU case, see Thierry Montmerle and Yi Zhou.

[49] P. Fleury to Yuin-kwei Tai, July 28, 1958, IUPAP Gothenburg China, one China.

[50] R. C. Gibbs to Robert B. Brode, June 23, 1950, R. Brode Papers, The Bancroft Library, BANC MSS 98/71C, carton 5.

the Union.[51] As Roberto Lalli points out in his chapter in this volume, Brode had a particularly strong role in the small circle debating IUPAP decisions.[52]

Robert Brode's triplet brother, Wallace Brode, was a famous and influential American chemist who created the scientific branch at CIA, and later acted as President of the American Chemical Society, science advisor to Secretary of State John Foster Dulles from 1958, President of the American Association for the Advancement of Science, a member of the board of governors of the American Institute of Physics, and a member of the President's Committee on Scientists and Engineers.[53] As advisor to the US Government, Wallace Brode publicly advocated that "science should be an integral and interdependent part of our national policy promotion," insisting that "[a]ny individual listed as officially representing the United States, whether he is a scientist or not, has a responsibility to support his government's policies on *all* issues which may arise at the forum where he has official status."[54] It was Wallace Brode who pressured IAU in early 1958, through Leo Goldberg, the chair of the US National Committee in IAU, and "demanded that Taiwan be invited to the IAU."[55] As shown in Table 11.1, Taiwan suddenly applied for membership in several scientific unions in that very same year: the IAU in April, the International Mathematical Union (IMU) in May, IUPAP in June, and the International Union of Biochemistry (IUB) in August, which demonstrates that it was an orchestrated move instead of a simple coincidence. It has been argued that the US State Department and Wallace Brode were behind that move to further isolate the PRC at the height of the Cold War and especially in the aftermath of the second Taiwan Straits Crises of 1958.[56] Since the two Brode brothers "had great affection for each other and met often in Washington and Berkeley,"[57] it appears quite reasonable to infer that Robert Brode was willingly implementing the decision made by his brother at the US Department of State in 1958, to push IUPAP to accept the CPS-Taipei as its member.[58] So far, however, we have not found direct evidence.

Without knowing IUPAP's burgeoning association with Taiwan, scientists in the PRC were eager to acquire updated scientific information through the Union. Probably even before receiving Fleury's announcement of the Executive Committee's

[51] D. W. Bronk to Robert Brode, August 12, 1957. R, Brode Papers, The Bancroft Library, BANC MSS 98/71C, carton 1; Report of the 9th General Assembly, 1957, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

[52] See the chapter by Lalli in this volume. Robert Brode's portrait and biographical information are drawn from William B. Fretter and David L. Judd, "Robert Bigham Brode, 1900–1986;"William B. Fretter and David L. Judd, "Robert Bigham Brode, 1900–1986," in *Biographical Memoir of National Academy of Sciences* (Washington DC: National Academy of Sciences, 1992).

[53] Donald S. McClure, "Wallace Reed Brode, 1900–1974," *Biographical Memoir of National Academy of Science* (Washington DC: National Academy of Sciences 2002).

[54] Wallace R. Brode. "National and International Science." *Chemical and Engineering News* 38, no. 16 (1960): 142. Italics by the authors.

[55] Montmerle and Zhou, *China and the International Astronomical Union*, 29.

[56] Liu Xiaowei, "The China Crisis," in *Astronomers as Diplomats: When the IAU Builds Bridges Between Nations*, ed. Thierry Montmerle and Danielle Fauque (Cham: Springer International Publishing, 2022), 161–8.

[57] McClure, "Wallace Reed Brode, 1900–1974," 9.

[58] Robert Brode was clearly informed by his brother Wallace about situations in IUPAC and ICSU, which apparently inspired and motivated the former's initiatives to make changes in IUPAP. See Robert Brode to Henry D. Smyth, July 16, 1957, R. Brode Papers, The Bancroft Library, BANC MSS 98/71C, carton 1.

Table 11.1 A comparative timeline for Chinese Memberships in International Organizations 1950s–1980s

	IUB		IMU		IUPAC		IUPAP		IAU[a]		IOC		ICSU		IUGS[b]	
	PRC[c]	Taiwan	PRC[d]	Taiwan[e]	PRC	Taiwan	PRC	Taiwan	PRC	Taiwan	PRC	Taiwan	PRC	Taiwan	PRC	Taiwan
Pre-1949 Membership							1934–1954		1935–		1924 or 1931[f]		1937–			
Initial Contact	1954		1951				1956	1957	1949							
First Application		1958[g]	1957	1958			1958	1958		1958						
Admission by EC	1956	1963		1958		1959	1958	1959		1959		1954		1958		1952
Withdrawal	1965						1960		1960		1958[h]					1976
Rejoining/ Joining	1979		1986		1979[i]		1984		1979		1979		1982		1976[j]	expelled

IAU: International Astronomical Union; **IUB**: International Union of Biochemistry; **IMU**: International Mathematical Union; **IUPAC**: International Union of Pure and Applied Chemistry; **IUPAP**: International Union of Pure and Applied Physics; **IOC:** International Olympic Committee; **ICSU:** International Council of Scientific Unions; **IUGS**: International Union of Geological Sciences.

[a] Montmerle, "When China Left the IAU."

[b] Wu Fengming 吴凤鸣, *An Overview of the International Geological Conference (1878–1980)* 国际地质会议概况 (1878–1980), (Beijing: Geological Publishing House 北京: 地质出版社, 1980), 91–105.

[c] Slater E. C. and W. J. Whelan, "China to rejoin the IUB," *Trends in Biochemical Sciences* 5, no. 2 (1980): III–V.

[d] Olli Lehto, *Mathematics Without Borders: A History of the International Mathematical Union* (New York: Springer, 1998), see 126–7.

[e] Olli Lehto, *Mathematics Without Borders*, 129.

[f] Lu Xiangjun 陆向军, *Sports and Health* (The first volume), 体育与健康 上, (Hefei: Hefei University of Technology Press.合肥: 合肥工业大学出版社, 2016), 81–3

[g] Xiong Weimin 熊卫民, "China's Participation in International Science—The Case of Biochemistry, 1949–1982 中西科学社团的交流 (1949—1982): 以中国生物化学(委员)会为例," 10, no. 2 (2013): 50–72.

[h] Montmerle and Zhou, *China and the International Astronomical Union*, 31.

[i] Liu Dagang 柳大纲, "The 20th General Assembly Report of the Chinese Chemistry Society 中国化学会第二十届理事会工作报告," In 政协仪征市委员会学习、文史资料研究委员会 Zhengxie Yizhengshi Weiyuanhui Xuexi, and Wenshi Ziliao Yanjiu Weiyuanhui, ed. 仪征文史资料 第11辑 柳大纲纪念文集 Yizheng Wenshi Ziliao 11th Jinian Liu Dagang Wenji.

[j] Olli Lehto, *Mathematics Without Borders*, 243.

approval, the Institute of Scientific Information of China wrote Fleury to request "complimentary copies of the papers, proceedings, reports and any other relevant literature of the Colloquium on Thermal Properties or Mechanics of Non Metallic Solids."[59] By late January 1959, they had made another request for "the proceedings and any other relevant literature" of the international conferences on nuclear reactions, theoretical physics, and high-energy physics respectively.[60] We do not have any record about Fleury's reply to the first Chinese request, but we found his answer to the second, in which, to the disappointment of his correspondents in Beijing, he only informed them of relevant contacts in the Netherlands and the United States, asking them to acquire materials directly from three Western institutions respectively.[61]

It is not clear when the CPS learned of the previously mentioned exchanges between IUPAP and the CPS-Taipei, but records show that the CPS did not respond to Fleury's letter of July 30, 1958 for nearly a year. When the IUPAP Executive Committee met again in Moscow in mid-July 1959, they tentatively set the CPS membership dues at four shares ($100 per share).[62] At this meeting, the same committee also approved the application of the CPS-Taipei for membership in IUPAP.[63] Either being ignorant of the sensitivity of the Taiwan issue or doing this on purpose, Fleury wrote to Zhou Peiyuan on July 30, inviting a CPS delegation to the tenth IUPAP General Assembly in Ottawa, Canada, in September 1960.

Zhou did not respond to Fleury's invitation at once. It was not until three months later that Zhou sent a letter to the IUPAP President. Apparently not knowing that the Union had elected in 1957 its new President, Italian physicist Edoardo Amaldi, Zhou wrote to Mott on November 12, 1959 to "solemnly lodge [the CPS's] strong protest" against the Union's acceptance of the CPS-Taipei as its member, a decision "unreasonable and utterly mistaken." The letter declared,

> as the people of the whole world know, there is only one China in the world, namely, the People's Republic of China. Therefore, it is only the Physical Society of the People's Republic of China that has the prerogative to join international organizations on behalf of the Chinese physicists. Taiwan is a province of China; it is an inseparable part of Chinese territory. The United States Government has not only occupied our Taiwan with armed forces, thus rudely preventing us from liberating Taiwan and completing our righteous cause of unification of our fatherland, but—it is also playing the dirty politics in creating "two Chinas" at every occasion, intends to occupy our Taiwan forever, and takes the hostile attitude toward the Chinese people.

[59] Institute of Scientific Information of China to P. Fleury, August 4, 1958, series E6 "Fleury's correspondence with Liaison Members," vol. 4, folder "10. China," IUPAP Gothenburg China.

[60] Institute of Scientific Information of China (Assistant Director Le Shoeh) to P. Fleury, January 20, 1959, IUPAP Gothenburg China. Whereas the first request concerns a colloquium held in Leningrad, the second request dealt with the conferences held in Amsterdam, Seattle, and New York. It is curious that the CAS asked IUPAP instead of the Soviets for the materials concerning the colloquium in Leningrad, for the latter was would have been much easier.

[61] P. Fleury to Le Shoeh, February 3, 1959, IUPAP Gothenburg China. Considering the US-led Western sanctions and blockade against the PRC in the 1950s, there was probably little chance for the CAS to obtain their requested materials in the way Fleury suggested. As a result, the CAS gained little from the union in this matter.

[62] P. Fleury to Zhou Peiyuan, July 30, 1959, IUPAP Gothenburg China.

[63] P. Fleury to the President of CPS-Taipei, July 30, 1959, IUPAP Gothenburg China, one China.

> Furthermore, even in international scientific organizations it wants to realize its "two Chinas" political hoax. This is firmly opposed by the Chinese people.[64]

Suspecting that Mott did not tell the full truth about Taiwan in 1957, Zhou reminded Mott that before applying to IUPAP, the CPS had expressed the previously mentioned position and learned from Mott himself, via Joffe, that the Union "has not had any relationship with the government of the island of Formosa."[65] Zhou pronounced it a "wrong decision" to accept "the application of the so-called 'Chinese Physical Society' in Taiwan" after admitting "the Physical Society of the People's Republic of China as an adhering organization" in the Union, which "not only trespass[ed] upon the right of the Chinese people," but also "damage[d] the credit of international scientific organisation, and seriously obstruct[ed] normal developments of international scientific cooperation."[66] "Therefore," Zhou concluded his letter:

> ... I state formally to you, Mr. President, that only under the condition that the Executive Council of IUPAP abolish the decision for accepting the so-called "Chinese Physical Society" in Taiwan as an adhering organisation and sever all relationship with it, will the Physical Society of the People's Republic of China agree to participate in the IUPAP as an adhering organisation.

Five days after penning this letter to Mott, Zhou also corresponded with Fleury. Zhou wrote that "Chinese physicists are greatly disturbed by the wrong decision adopted by the Executive Council of the International Union of Pure and Applied Physics."[67]

Mott replied Zhou on November 19, apparently soon after receiving Zhou's letter. Mott told Zhou only two things: first, that IUPAP indeed "had no relationship with the government of the Island of Formosa [Taiwan]" when he wrote Joffe on June 10, 1957; and second, that Professor Amaldi had succeeded him as the Union's current President, to whom he was forwarding Zhou's protest.[68]

Within five days, Amaldi received Mott's letter together with Zhou's. The Italian physicist immediately wrote back on November 24 to seek Mott's advice on what to do with the CPS's protest. Amaldi felt "extremely difficult to accept the principle that a country [i.e., the PRC]—which is not yet a Member of IUPAP—has the right of 'veto.'"[69] He originally intended to wait for a letter directly from Zhou before writing to him but, at Mott's suggestion, Amaldi changed his mind and decided to initiate his exchanges with Zhou before circulating Zhou's protest in the Executive Committee.

While Amaldi was pondering his planned letter to Zhou, the Union's Secretary General received another letter from Y. K. Tai, the President of the CPS-Taipei. On November 30, Tai wrote Fleury to thank IUPAP for admitting the CPS-Taipei as a member of the Union and to "beg to be registered" in IUPAP as "The Physical Society of the Republic of China" instead of "Chinese Physical Society." Tai stressed that he

[64] Zhou Peiyuan to N. F. Mott, November 12, 1959, IUPAP Gothenburg China.
[65] N. F. Mott to A. F. Joffe, June 10, 1957, CAS Archives: 1958-04-052-06.
[66] Zhou Peiyuan to N. F. Mott, November 12, 1959, IUPAP Gothenburg China.
[67] Zhou Peiyuan to P. Fleury, November 17, 1959, IUPAP Gothenburg China, one China.
[68] N. F. Mott to Zhou Peiyuan, November 19, 1959, IUPAP Gothenburg China, one China.
[69] E. Amaldi to N. F. Mott, November 24, 1959, IUPAP Gothenburg China, one China.

was "instructed" by the Government in Taiwan to make this title change, a move clearly intending to show that the CPS-Taipei represented all physicists throughout China, including not only Taiwan but also the mainland.[70] Amaldi, however, did not permit the change right away. On December 17, he instructed Fleury "to find a way to postpone this decision" until the Ottawa General Assembly in the next September, where the Union could discuss the problems concerning "two Chinas."[71]

In preparing his letter to Zhou, Amaldi assumed that the problem about mainland China and Taiwan was similar to that with East and West Germanies. Late in January 1960, Fleury also sought advice from D. H. Sadler, the Secretary of the IAU, because the IAU was currently facing exactly the same predicament. On January 29, 1960, Sadler shared with Fleury some "confidential" information about the IAU's status quo.[72] The detailed history about China and the IAU can be found in the excellent studies by Thierry Montmerle, Yi Zhou, and Liu Xiaowei[73] and we do not want to repeat the full story here. It suffices to summarize the IAU situation based on Sadler's letter.

The IAU Executive Committee voted to admit Taiwan as a member of the Union in early September 1959. Meanwhile, the committee adopted a resolution whose text was claimed to be "designed to facilitate the position of the People's Republic of China in this matter." However, the resolution enlisted "the two Republics of China," calling them "the two countries," as adhering members of the Union: "The People's Republic of China" ("China" in short) and "The Republic of China" ("Taiwan" in short). In due course, the IAU "received a letter from the President of the Astronomical Society of the People's Republic of China in Peking requesting confirmation of the Executive Committee's decision to admit Taiwan to membership of the Union, and stating their irrevocable decision to withdraw from the Union if this be confirmed." Meanwhile, the IAU also received a letter from "the Acting Director General of the Academia Sinica in Taiwan" protesting against the terms of the same resolution and implying that "the Astronomical Society of the Republic of China in Taiwan represented astronomers throughout China."[74] As a result, the President of the IAU and Sadler communicated with the people in Beijing, "personally expressing the hope that China would not withdraw," or at least deferring "any decision regarding the withdrawal of China pending the clarification of the decision of Taiwan." Sadler admitted to Fleury that "the position is extremely difficult and I have no means of knowing whether we can achieve our aim of keeping both China and Taiwan as members of the Union" because according to the IAU statutes and mission, "the Executive Committee had in fact no alternative but to accept Taiwan's request for adherence, once the application had been made in a proper form."[75]

One week after Sadler wrote his letter to Fleury, the PRC formally withdrew from the IAU on February 5, 1960, a decision that was immediately announced over the

[70] Yuin Kwei Tai to P. Fleury, November 30, 1959, IUPAP Gothenburg China, one China.
[71] E. Amaldi to P. Fleury, December 17, 1959, IUPAP Gothenburg China, one China.
[72] D. H. Sadler to P. Fleury, January 29, 1960, IUPAP Gothenburg China, one China.
[73] See Montmerle and Zhou, *China and the International Astronomical Union*; Montmerle, "When China Left the IAU;" and Xiaowei, "The China Crisis."
[74] D. H. Sadler to P. Fleury, January 29, 1960, IUPAP Gothenburg China, one China.
[75] D. H. Sadler to P. Fleury, January 29, 1960, IUPAP Gothenburg China, one China.

radio in mainland China the next day.[76] Sadler, however, did not inform Fleury of the PRC's withdrawal until March 8. By then, Amaldi had already put his letter to Zhou in the mail. Amaldi drafted his letter on February 24, 1960, to address the CPS's protest three months earlier. It appears, however, that he did not send out this letter until March 7.[77] In this letter, Amaldi first reaffirmed the IUPAP Executive Committee's unanimous decision to accept the CPS as its member and then acknowledged the CPS's opposition to the committee's decision to extend the Union's membership "also to the Academia Sinica of Taipei, to represent the Republic of China, Taipei."[78] He endeavored to persuade Zhou to accept the aforementioned decision based on the IUPAP regulations[79] and the fact that both the Federal Republic of Germany and the German Democratic Republic were members in the Union. Amaldi asserted that "the union's Executive Committee has taken the decisions mentioned previously with a view to avoiding [*sic*] that an important political issue arise within the union which, on the other hand, is endeavoring to secure the collaboration of all physicists, irrespective of the political divergences prevailing in the world." He also attempted to assure Zhou that the decision to accept Taiwan "is based in the present situation and does not in any way reflect any judgement on the political situation."[80]

At the end of his letter, Amaldi asked Zhou and his colleagues "to kindly reconsider the problem of the participation in the Union of the People's Republic of China, in the light of the above, and also taking into account the sincere desire of the great majority of the physicists belonging to member-countries of the IUPAP to collaborate with their Chinese colleagues." He hoped that his clarifications could convince the CPS to agree "to become a member of the IUPAP before next summer, so that the People's Republic of China may be in position to send its delegates to the Union's General Assembly, which is to be held in Ottawa at the beginning of September 1960."[81]

Before hearing from Zhou, IUPAP received a copy of the memo from Dr Joseph Needham, a former Director of UNESCO's Department of Natural Sciences, to Sir Rudolph Peters, the President of ICSU in late May 1960. Needham was a biochemist-turned-historian of Chinese science and technology, who served as the Director of the Sino-British Science Co-operation Office in Chongqing, the wartime Chinese capital, from 1942 to 1946. During the years working in China, he acquainted himself with a large number of Chinese scientists as well as leaders of Chinese scientific

[76] D. H. Sadler to P. Fleury, March 8, 1960, IUPAP Gothenburg China, one China. The news was announced over the radio in mainland China on February 6, 1960, but Sadler did not receive China's official notice of withdrawal until March 8, 1960.

[77] E. Amaldi to Zhou Peiyuan, February 24, 1959, IUPAP Gothenburg China, one China. Although there is not a copy of Amaldi's letter on March 7, Zhou Pei-yuan's reply revealed the date of Amaldi's letter to Zhou.

[78] E. Amaldi to Zhou Peiyuan, February 24, 1959, IUPAP Gothenburg China, one China. Because both the PRC and the ROC proclaimed that each of them represented the entire China, the phrase of "the Republic of China, Taipei" in Amaldi's letter must have offended both sides of the Taiwan strait, which Amaldi and his colleagues probably did not realize.

[79] According to IUPAP's regulations, "even two bodies belonging to the same country (in a political sense) may become members of the IUPAP provided they represent physicists who are conducting their activities in two different geographical areas." E. Amaldi to Zhou Peiyuan, February 24, 1969, IUPAP Gothenburg China, one China.

[80] E. Amaldi to Zhou Peiyuan, February 24, 1959, IUPAP Gothenburg China, one China.

[81] E. Amaldi to Zhou Peiyuan, February 24. 1959, IUPAP Gothenburg China, one China.

organizations, and got along well with many officials in Chiang Kai-shek's Nationalist Government. Meanwhile, Needham also got to know Zhou Enlai, a legendary leader of the Chinese Communist Party and later the Premier of the PRC from 1949 to 1976. He was among the small number of Westerners who were able to visit the PRC in the 1950s.[82] When Needham learned of the "serious problem" resulted from Taiwan's applications to ICSU and other individual scientific unions such as IUPAP, he volunteered to offer his insight and propose his solution based on his rich knowledge and deep understanding of both sides of the Taiwan Strait.

In his memo, Needham carefully analyzed the statutes of ICSU, the IAU, and several other scientific unions and concluded that "[n]one of the definitions in these Union statutes, I must emphatically say, covers the case of Formosa [Taiwan]." Having consulted "legal opinion of the highest possible competence," Needham was convinced that:

> the only title which Formosa has to acceptance as an adhering territory by the International Council of Scientific Unions or by any of the international scientific unions is the claim that it represents "China" as such. The Government of Formosa in fact makes this claim. But since no adhering country can have two votes in the Council or the Unions it seems quite clear that they must decide whether they wish to accept the government or the national academy of China at Peking, or those of Formosa at Taipei, as the real and sovereign "China." It should be pointed out here that this argument is quite independent of the undoubted fact that if Formosa is admitted to any of our organisations[,] China proper will withdraw. The Council and the Unions would thus give up the substance in exchange for the shadow.

To be "faithful to their true aims and interests," Needham argued,

> On all grounds—scientific man-power and contributions, number and size of scientific institutes, immensity of land area available for geophysical, meteorological and astronomical observations, and potential as well as actual achievements, the Council and the Unions should retain the main body and decline to accept the secession fraction. The opposite course would be to sacrifice their great aim of international scientific co-operation, so splendidly pursued and attained through the years for a legal fiction created in a passing phase of international politics.

At the end, he advised, "if either the Council or any one of the Unions has already admitted Formosa, then in my opinion a grave mistake has been made, and the decision should be rescinded at the earliest possible opportunity."[83] ICSU and other relevant international scientific unions apparently did not heed Needham's advice and the memo certainly came too late for Amaldi's correspondence with Zhou.

[82] For information about Needham's life, see Simon Winchester, *The man who loved China: the fantastic story of the eccentric scientist who unlocked the mysteries of the Middle Kingdom* (New York: Harper, 2008).

[83] Joseph Needham to Rudolph Peters, May 20, 1960, IUPAP Gothenburg China, one China.

Zhou Peiyuan replied Amaldi restating first the "firm stand of the Chinese people against the creating of the so-called 'two Chinas' plotted by the American imperialists," Zhou was greatly disappointed that IUPAP disregarded "the stand of the Chinese people" and refused "to rescind the illegal decision."[84] He asserted that:

> Taiwan has been an inseparable part of Chinese territory since ancient times. It is a province of China. It is neither a "country," nor an "autonomous region," or a "single territory." Therefore, neither the reason that both the German Democratic Republic and the German Federal Republic are members of IUPAP, nor any regulation on the membership contained in the Constitution of IUPAP can be used as arguments to defend the illegal decision of the Executive Committee of IUPAP to accept the so-called Chiang Kai-Shek clique as member of IUPAP.

At the end, just as Needham had predicted in his memo, Zhou pronounced: "I, on behalf of the Physical Society of the People's Republic of China, once more declare to you: If IUPAP does not rescind the illegal decision of accepting the so-called 'Physical Society of the Republic of China' as member of IUPAP, the Physical Society of the People's Republic of China will not participate in the IUPAP."[85] Upon receiving Zhou's letter on June 9, Amaldi directed Fleury on the same day to distribute it, along with Zhou's letter to Mott and Amaldi's response, to all members of the Executive Committee, intending to have this very important matter thoroughly discussed at the forthcoming General Assembly in Ottawa.[86] Ultimately, IUPAP did not agree to Zhou's aforementioned demand, leading to the CPS's eventual withdrawal from the Union, despite the Ottawa Assembly officially approving its membership.[87]

Prior to the PRC withdrawing from IUPAP, its physicists actively participated in international conferences organized by the Union. In July 1959, notable events such as the International Conference on Cosmic-ray in Moscow and the Ninth International Conference on High Energy Physics in Kiev witnessed the presence of PRC physicists. Their involvement was made possible through their membership in the Joint Institute for Nuclear Research (JINR) in Dubna, USSR.[88] During the Kiev Conference, fifteen physicists from mainland China had a unique opportunity to engage with their Western colleagues, exchanging fresh discoveries and knowledge.[89] This fruitful interaction underscored the significant benefits derived from the active participation of the CPS in IUPAP. Unfortunately, archival records reveal a complete absence of communication between the Union and the CPS since 1961. It was not until the early

[84] Zhou Peiyuan to E. Amaldi, June 1, 1960, IUPAP Gothenburg China, one China.

[85] Ibid. The "two German states formula" proposed by Amaldi was not acceptable because in the Chinese Government's view, "[t]he division of Germany after the war and the temporary division between the two sides of the strait are questions of a different nature." For details, see PRC White Paper, "The One China Principle and the Taiwan Issue, 21 February 2000," *Asian Affairs: An American Review* 27, no. 1 (2000): 49. For the issues of German participation in IUPAP see, Olšáková's chapter in this volume. For the analysis of Amaldi's perspectives on these issues see Cozzoli's chapter in this volume.

[86] E. Amaldi to P. Fleury, June 9, 1960, IUPAP Gothenburg China.

[87] Report of the tenth General Assembly, 1960, 23, series B2aa, vol. 1 "1923–1966," IUPAP Gothenburg.

[88] Liu Jinyan, Wang Fang and Alexey Zhemchugov, "Chinese Scientists in Dubna (1956–1965)," *Chinese Annals of History of Science and Technology* 5 (2021): 31–88.

[89] 参加第九届国际高能物理会议的报告 [The Report of attending the Ninth International Conference on High Energy Physics], CAS Archives: 1959-04-060-04.

1970s, owing to a series of pivotal geopolitical changes, that their correspondence finally resumed.

The Renewed Recruiting Effort, 1972–1973

On October 25, 1971, the 26th session of the United Nations General Assembly decided "to restore all its rights to the People's Republic of China and to recognize the representatives of its Government as the only legitimate representative of China to the United Nations, and to expel forthwith the representatives of Chiang Kai-shek from the place which they unlawfully occupy at the United Nations and in all the organizations related to it."[90] Meanwhile, the Sino-American relation also began to thaw after 1971. In February 1972, the US President Richard Nixon visited China and issued a "joint communiqué" in Shanghai, which "acknowledge[d] that all Chinese on either side of the Taiwan Strait maintain there is but one China and that Taiwan is a part of China," and declared that "[t]he United States Government does not challenge that position." Afterwards, China was able to send several delegations of its elite scientists to visit West Europe, Canada, and the USA to resume scientific exchanges with the West.[91]

In light of contemporary geopolitical considerations and the increasing importance of Chinese science and technology,[92] many international scientific organizations proactively reached out to China, extending enthusiastic invitations for her representatives to join their associations. IUPAP was keenly aware of the major membership gaps and the poor representation of developing countries within the Union, which hindered it from "being truly international." Celebrating IUPAP's 50th anniversary at its 14th General Assembly in Washington, DC in September 1972, the outgoing Union President, Robert Bacher, urged his successors "to pursue every opportunity to fill the major gaps in our membership and to make efforts to have an active participation by the physicists from important and influential nations whose role in IUPAP has been small or completely absent."[93]

During the 1972 Assembly, H. Maier-Leibnitz, L. Kerwin, and Jan S. Nilsson were elected President, Secretary General, and Associate Secretary General, respectively. The General Assembly also passed a resolution, aiming to employ all measures within the framework of IUPAP statutes to invite the PRC for membership.[94] Despite this

[90] UN Resolution 2758, available at https://digitallibrary.un.org/record/192054?ln=en#record-files-collapse-header, accessed on June 23, 2023.

[91] From October to December 1972, Bei Shizhang (Pei Shih-chang 贝时璋) led a scientific delegation on a significant visit to the UK, Sweden, Canada, and the USA. It was the first delegation of its kind since 1966. In May 1973, Zhang Wenyu (Wen-yu Chang, 张文裕), the Director of the Institute of High Energy Physics, CAS, also led a delegation on a tour of the USA to survey the construction of accelerators.

[92] Despite its isolation from international scientific community, China had accomplished some extraordinary progress in mathematics, biochemistry, nuclear weapons programs, space technology, and so on, by the early 1970s.

[93] Robert Bacher, "Looking to the Future," in *Physics 50 Years Later: [Papers] as Presented to the XIV General Assembly of the International Union of Pure and Applied Physics on the Occasion of the Union's Fiftieth Anniversary*, September 1972 (Washington, DC: The National Academies Press, 1973), 393–401, on 400.

[94] Report of the 14th General Assembly, 1972, 33, series B2aa, vol. 2, IUPAP Gothenburg.

resolution, it took months for Maier-Leibnitz to contemplate his letter of invitation to Beijing, during which he consulted with his confidant, Henriette Mathieu-Faraggi, the then Chairwoman of the IUPAP Commission on Nuclear Physics and the President of the French Physical Society.[95] Before sending out his invitation to China, he admitted to Faraggi in a letter on January 2, 1973 that he was "somewhat frightened." He pointed out that the PRC was "the only country" conducting significant physics research but had not yet become a member of IUPAP. He sincerely wanted that mainland Chinese physicists could, through a national committee of the Union, "participate freely in international conference[s] and especially in those [sponsored] by IUPAP." He doubted that representatives from Taiwan could legitimately claim to represent mainland China. However, he told her, "I, as President of the Union, cannot write a letter [violating] our statutes," that is, to exclude Taiwan, especially because IUPAP and its sponsored conferences had "no political aims or activities." He "aim[ed] at creating de facto situations which avoid confrontations between the two sides." He informed Faraggi that no invitations had been sent to Taiwan for "the Nuclear Physics Conference" and he even envisioned that the next General Assembly be held "in the absence of Taiwan representatives."[96]

Maier-Leibnitz completed his letter on January 11, 1973 and promptly sent it to Wu Youxun (吴有训), a Vice-President of the CAS and a former pupil of A. H. Compton. In it, he formally conveyed the General Assembly resolution from the previous September to Wu and extended a sincere invitation from the Union, emphasizing the significance of having the PRC as a member. He hoped that Beijing would give the invitation "serious consideration in view of its importance for international science."[97] Subsequently, Kerwin forwarded some essential IUPAP documents to Wu. Having recently received a delegation of Chinese scientists led by Bei Shizhang, Kerwin enthusiastically expected that China's participation in IUPAP would significantly bolster international scientific exchanges.[98]

In her letter to Maier-Leibnitz on January 23, Faraggi wholeheartedly endorsed his invitation letter and shared her observation: what the mainland Chinese truly desired was to be recognized as the sole official representatives of China. In her opinion, PRC physicists would not necessarily object to meeting with those from Taiwan, as long as the latter refrained from claiming to represent the "Republic of China."[99] On February 5, when thanking Faraggi for her endorsement, Maier-Leibnitz remarked, "if the Chinese also agree, there should be no serious difficulty." He would be disappointed two months later.

On April 6, Pan Chun (潘纯), the Director of the CAS's Bureau of Foreign Affairs, responded to Maier-Leibnitz's invitation letter. Pan agreed with Maier-Leibnitz on "the importance for the work of IUPAP of having as national member the People's

[95] Faraggi is a French experimental physicist. In 1946, she entered the French Radium Institute to do research under the guidance of Irène Joliot-Curie, and worked together with eminent Chinese physicists Qian Sanqiang and He Zehui (何泽慧).
[96] H. Maier-Leibnitz to Henriette Mathieu-Faraggi, January 2, 1973, IUPAP Gothenburg China.
[97] H. Maier-Leibnitz to WU Youxun, January 11, 1973, IUPAP Gothenburg China.
[98] Larkin Kerwin to WU Youxun, February 1, 1973, IUPAP Gothenburg China.
[99] H. Faraggi to H. Maier-Leibnitz, January 23, 1973, IUPAP Gothenburg China.

Republic of China" but firmly declined to join the Union and its activities because IUPAP had so far permitted "the Chiang Kai-shek cliques to seize illegally the seat of China in the organization." He hoped that Maier-Leibnitz would support the PRC's "solemn stand."[100]

Besides Faraggi, Aage Bohr, a renowned Danish physicist and imminent Nobel Laureate, and Olli V. Lounasmaa, chairman of the IUPAP Commission on Very Low Temperature Physics, also actively assisted the Union in engaging with China. Shortly after Bohr's return from his visit to China, on June 8, he wrote to inform Maier-Leibnitz that he had personally discussed with Pan Chun and other representatives of the CAS regarding "the Chinese participation in IUPAP and international scientific conferences." In accordance with Faraggi, Bohr reported that "the main point in the Chinese position is that the People's Republic must be recognized as the only Government that can represent China," and that "[t]hey do not seem to insist on exclusion of Taiwanese scientists from conferences or IUPAP." During the meetings, he also explained to his Chinese hosts that "the statutes of IUPAP interprets 'nation' as including territories which have an independent scientific community." It was on this ground that IUPAP claimed that they had to accept Taiwan's membership application and were unable to revoke it now. Bohr told Maier-Leibnitz that the Chinese did not reject his interpretation of the statutes but would further study the legal content. In Bohr's view, China would seriously consider an invitation to a conference if they could be assured that there would be no other participants representing China. In this situation, Bohr recommended that the Union further explore the stance of the Taiwanese representatives.[101]

In June, Kerwin sent all Secretaries of the IUPAP international commissions a memorandum concerning delegates to conferences from the PRC. Because both ICSU and IUPAP were "making serious efforts" to have the PRC join IUPAP and various other unions, the memo encouraged the commissions to recommend that international conference organizers "invite participants from China." Having received this memo, Lounasmaa informed Kerwin of his forthcoming visit to China in September 1973 at the invitation of the CAS. Lounasmaa intended to follow the Union's recommendation to discuss with Chinese scientists their participation in the 14th International Conference on Low Temperature Physics in Helsinki in August 1975. On his return, however, Lounasmaa offered an impression different from that of Faraggi and Bohr. In his letter to Kerwin on October 24, Lounasmaa reported that Chinese scientists would not attend any conference which also enlisted people representing Taiwan or the Nationalist China. He thus keenly looked forward to IUPAP's assistance to "find a way out of the impasse."[102] Replying Lounasmaa on November 8, Kerwin appreciated the "interesting and valuable" information provided but rendered no solution. He was forced to admit that this question would "obviously occupy us for some time."[103]

[100] Pan Chun to H. Maier-Leibnitz, April 6, 1973, IUPAP Gothenburg China.
[101] Auge Bohr to H. Maier-Leibnitz, June 8, 1973, IUPAP Gothenburg China.
[102] Olli V. Lounasmaa to L. Kerwin, October 24, 1973, IUPAP Gothenburg China.
[103] L. Kerwin to Olli V. Lounasmaa, November 8, 1973, IUPAP Gothenburg China.

The CPS's Official Adherence to IUPAP (1977–1984)

After the tumultuous period of the Cultural Revolution, the scientific and technological community in China gradually regained its footing, resuming academic conferences and journal publications, and actively seeking to strengthen exchanges and collaborations with international academic organizations. In March 1978, the unprecedented National Congress of Science convened in Beijing, marking a renaissance in China's development of science and technology. During this congress, Zhou Peiyuan, the President of Peking University and Chairman of the China Association for Science and Technology (CAST), passionately called upon his country's professional societies to take the initiative in fostering greater international academic exchanges.[104]

Challenges and Reconciliation

The UN 1971 resolution had far-reaching consequences, which, through UNESCO and ICSU, extended to individual scientific unions affiliated with ICSU. In November 1974, UNESCO's general conference passed a resolution reiterating that the PRC Government was the sole legitimate representative of China within UNESCO. It called upon all international non-governmental organizations maintaining relations with UNESCO, to exclude any elements associated with Chiang Kai-shek's Government in Taiwan and sever all ties with them. Subsequently, in January 1975, ICSU's Executive Secretary informed all unions of a letter received from UNESCO's Director General, urging them to take note of UNESCO's resolution and submit a report on the matter.[105]

Unlike UNESCO, ICSU and its unions are apolitical and non-governmental entities. Since its establishment in 1931, ICSU has emphasized its inclusiveness towards scientists worldwide, striving to avoid political entanglements. For instance, it defined the term "country" in its statutes to encompass territories with independent scientific activity, making it apolitical and not linked to the recognition of any government or political status. In 1958, the ICSU General Assembly further clarified this stance, emphasizing the term's apolitical nature. Consequently, severing all scientific relations with Taiwan would contradict ICSU's fundamental policy. Despite their autonomy, ICSU and its unions faced intervention and pressure from UNESCO, given that ICSU received an annual subvention from UNESCO, and the unions also received UNESCO's support through ICSU.[106]

Each individual scientific union responded differently to UNESCO's 1974 resolution and the Director General's reminder. On August 19, 1976, the International Union of Geological Sciences (IUGS) admitted the Geological Society of China as

[104] Zhou Peiyuan 周培源, "*Collected papers of Zhou Peiyuan* 周培源文集," (Beijing: Beijing University Press 北京: 北京大学出版社, 2002), 216.
[105] Olli Lehto, *Mathematics Without Borders*, 242–3.
[106] Ibid.

its member and terminated Taiwan's membership. One year later, the International Union of Geodesy and Geophysics took a similar action. However, ICSU added complexity to this matter with a new resolution passed at its 16th Congress in Washington, DC in October 1976. While the resolution welcomed the main scientific communities of the PRC to join ICSU and individual unions as national members, it also advocated the admission of scientific communities representing particular regions (not countries). The resolution emphasized that the PRC's membership should not compromise Taiwan's position, as doing so would contradict ICSU's original intention to foster global scientific development and its principle of universality.

In response to this resolution, CAST issued a statement on November 27, protesting against the creation of "two Chinas" and "one China, one Taiwan" by ICSU and condemning some ICSU officials for demanding the reinstatement of Taiwan's membership. Nevertheless, the United States supported ICSU's position. On March 6, 1977, the council of the US National Academy of Sciences reaffirmed the "Resolution on Political Non-Discrimination in International Scientific Activities" that had been passed by the Council in February 1960. This created more obstacles for China's membership in IUPAP.

Kerwin, however, never gave up. In August 1978, representatives from mainland China attended the International Conference on Luminescence, which took place at UNESCO's office buildings in Paris. The Chinese delegation drew significant attention during the conference.[107] Recognizing this positive signal, Kerwin wrote to the Director of the Bureau of Foreign Affairs, CAS, extending an invitation to China to rejoin IUPAP to facilitate academic exchanges during this "dynamic period" in physics.[108] He hoped to receive a prompt positive reply so that the PRC delegation could participate in the 1981 General Assembly. Kerwin also discussed China's membership with the PRC delegation during the United Nations' Conference on Science and Technology for Development in Vienna in August 1979. Both China and the IUPAP Executive Committee reached a mutual agreement to handle the membership issue in a manner similar to how China joined the IUB.[109] The IUB's path to successfully resolving the membership issues of mainland China and Chinese Taiwan was also complex and challenging.[110] In late 1954, the IUB invited the PRC to participate in its third General Assembly, and mainland Chinese scientists attended after confirming that Taiwan was not involved in IUB activities in 1955. During the conference, the PRC received an invitation to join the IUB. Subsequently, the Chinese Biochemical Committee, which was swiftly established in 1956, submitted an official application for IUB membership. The IUB Executive Committee approved the Chinese application in 1956.

[107] Xu Xurong 徐叙瑢, Yu Jiaqi 虞家琪, et al, "The overview of the 1978 International Conference on Luminescence 1978 年国际发光学学术会议概况," *Foreign luminescence and electro-optics* 国外发光与电光, 6 (1978): 1–14.

[108] L. Kerwin to the Director of the Bureau of Foreign Affairs, CAS, April 10, 1979, IUPAP Gothenburg China.

[109] L. Kerwin to Zhou Peiyuan, November 16, 1979, IUPAP Gothenburg China.

[110] Wang Yinglai 王应睐, "China rejoined the International Union of Biochemistry 我国重新加入国际生化联合会," *Biochemistry Communication* 生化通讯 1 (1980): 1–4.

The turning point also appeared at the end of the 1950s. Upon learning of the IUB's intention to admit Taiwan as a member in 1959, the PRC sent a letter of protest to the IUB and also dispatched representatives to attend the 4th IUB General Assembly held in Moscow in 1961. As a result, the discussion on Taiwan's membership application was removed from the agenda. However, in 1964, the IUB formally accepted the Academia Sinica in Taipei as a member. In response, the PRC declared to sever all relations with the IUB in 1965. All the IUB's subsequent efforts to reestablish contact with mainland China made no significant progress.

In 1979, the PRC and the United States officially established diplomatic relations and relations between the two sides the Taiwan Strait also began to improve. It was in this context that the IUB, the PRC and the authorities in Taiwan reached an agreement in July. On October 8, 1979, Wang Yinglai (王应睐), the President of the Chinese Biochemical Society, formally applied to join the IUB in a letter to W. J. Whelan, the Secretary of the IUB. Eventually, the Chinese mainland, Chinese Taiwan, and the IUB all agreed that both "The Chinese Biochemical Society" and "The Biochemical Society located in Taipei, China" joined the IUB under the designation of "China."[111]

The Chinese Biochemical Society's successful adherence to the IUB was the first case since the founding of the PRC that a mainland science society joined an international scientific union including Taiwan. This IUB formula served as a precedent and set a useful model for ICSU and other unions to address similar challenges.[112] Encouraged by this progress, two other unions—IUPAC and the IAU—also negotiated similar agreements with Beijing and Taipei in 1979. Inspired by the previous model, Kerwin sent an IUPAP draft agreement[113] to Zhou Peiyuan and Edward Yen (阎爱德) (the President of the Physical Society in Taipei) on November 16, 1979, with hopes that representatives from both sides would sign the agreement.[114]

Precarious Relations between IUPAP and China

To strengthen its ties with the Chinese physics community, IUPAP made concerted efforts to provide opportunities for Chinese physicists to participate in some activities sponsored by the Union. In early December 1979, Edwin L. Goldwasser, the President of the IUPAP Commission on Particles and Fields (formerly the Commission on High Energy Nuclear Physics), proposed to Nilsson that they invite Chinese physicists to attend their annual meeting in 1980 as observers or official members, given China's rapid advancements in high-energy physics.[115] Goldwasser sought to

[111] Slater and Whelan, "China to rejoin the IUB."

[112] E. C. Rowan to William J. Whelan, November 9, 1979, IUPAP Gothenburg China.

[113] L. Kerwin to Zhou Peiyuan and Edward Yen, respectively, November 16, 1979, IUPAP Gothenburg China.

[114] According to the draft, the Chinese Physical Society and the Physical Society located in Taipei, China both could join IUPAP under the heading of "China."

[115] Chinese high-energy physics was active in the 1970s as China planned to construct a high-energy accelerator after it withdrew from the JINR since 1965, as well as that, China and the United States closely collaborated in this field in the late 1970s. Besides, the construction of the Straton model of hadrons in the

contact Zhang Wenyu (张文裕) and requested information and advice from Nilsson.[116] Meanwhile, Kerwin received a positive response from Zhou Peiyuan, stating that the CPS was eager to join IUPAP at the earliest opportunity and requested details about the Union's statutes, membership list, duties, and fees.[117] On December 18, Kerwin sent Zhou Peiyuan the IUPAP General Report of 1976 and arranged for the Deputy Secretary to send the newly printed General Report of 1979. He also informed Zhou that IUPAP planned to nominate Chinese physicists as observers or correspondents of the Commission on Particles and Fields. By sharing the progress of China's potential membership in IUPAP with Goldwasser, Kerwin encouraged direct communication between him and Chinese high-energy physicists.[118]

To Kerwin's bewilderment, the CPS did not respond promptly. Kerwin requested C. Hilsum, from the Royal Signals and Radar Establishment, and who visited China in the early 1980s to figure out the reason. Hilsum provided Jie Per,[119] the Secretary General of the CAS, a copy of the letter Kerwin sent to Zhou Peiyuan. From Huang Kun (黄昆), a former student of Mott and the current Director of the Institute of Semiconductors of the CAS, Hilsum learned that the CPS had not reached a formal agreement. On April 29, 1980, Hilsum reported the situation to Kerwin and suggested adding Chinese representatives to the IUPAP Committee, as well as inviting Chinese physicists to preside over the IUPAP-sponsored conference on the Physics of Semiconductors, scheduled to be held in Kyoto in September of that year.[120] On May 12, Kerwin replied to Hilsum, stating that he had just heard from the CPS, and they hoped to receive the latest general report as soon as possible. Kerwin found all these developments "very promising for the future," including the participation of Chinese physicists in the Conference on the Physics of Semiconductors in Kyoto and the invitation of high-energy physicist Fang Shouxian (方守贤) to speak at the Conference on High Energy Physics in Geneva.[121] On June 17, Kerwin sent Zhou Peiyuan the latest IUPAP general report he had just received, expressing his hope that China would agree to the tentative agreement of the Union. He also looked forward to further exchanges with China as the newly appointed President of the National Research Council of Canada.[122]

On October 7, 1980, Goldwasser formally extended an invitation to Chinese scientists to participate in the activities organized by the IUPAP Commission on Particles and Fields. However, the Vice-President of the CAS, Qian Sanqiang, responded stating that Chinese scientists were not yet ready to join IUPAP and its affiliated groups, given that IUPAP still recognized a regional organization from Taiwan as a national

middle of the 1960s also made high-level Chinese leaders pay attention to this field. As for the history of the Chinese physicists' construction of the Straton Model, see more details in Liu Jinyan. "Chinese physicists' construction of the Straton Model in social context," *Chinese Annals of History of Science and Technology* 2, no. 1 (2018): 85–122.

[116] Edwin L. Goldwasser to Jan S. Nilsson, December 5, 1979, IUPAP Gothenburg China.
[117] Zhou Peiyuan to L. Kerwin, December 10, 1979, IUPAP Gothenburg China.
[118] L. Kerwin to Zhou Peiyuan, December 18, 1979, IUPAP Gothenburg China.
[119] The authors haven't identified this name.
[120] C. Hilsum to L. Kerwin, April 19, 1980, IUPAP Gothenburg China.
[121] L. Kerwin to C. Hilsum, May 12, 1980, IUPAP Gothenburg China.
[122] L. Kerwin to Zhou Peiyuan, June 17, 1980, IUPAP Gothenburg China.

member.[123] Goldwasser felt disappointed, as their efforts seemed unlikely to yield immediate results. He believed that IUPAP's tentative agreement resembled other unions' agreements and hoped that Qian Sanqiang could clarify China's standpoint and the minimum conditions required for joining IUPAP.[124] Goldwasser conveyed Qian's perspective to Kerwin and urged him to continue advancing the relationship with China. However, on January 12, 1981, Kerwin informed Goldwasser that they would have to patiently rebuild the connection with China. The situation had changed, and China's attitude seemed to have shifted, as evidenced by the cancellation of the scheduled talks with ICSU at the last minute.[125]

The sudden change in attitude on the part of the PRC in 1980 likely resulted from political developments. While China and the United States established diplomatic relations in 1979, the US Congress passed the "Taiwan Relations Act" nearly at the same time, which further solidified the United States' commitment to Taiwan and resumed arms sales to the island. This action prompted strong protests from Beijing. As a consequence, the scientific community also witnessed a stiffening of the PRC's position. Despite being on the verge of joining ICSU, China suddenly withdrew its candidacy, which was a clear setback disappointing everyone wishing to enhance international scientific collaboration. The political tensions had repercussions on the scientific landscape, impacting China's stance towards international scientific organizations like ICSU and IUPAP.

Re-Applying for IUPAP Membership and its Expedient Approval

In the summer of 1981, China agreed to join IUPAP as previously discussed in Kerwin's letter of November 16, 1979. Based on this promising development, Kerwin telegraphed Zhou Peiyuan on July 31 to invite a Chinese delegation to the IUPAP General Assembly scheduled in Paris from September 1 to 3, emphasizing that the assembly was poised to approve China's membership.[126] To the Union's disappointment, no delegate from the PRC attended the assembly, marking another Chinese protest against the "Taiwan Relations Act."

Kai Siegbahn, the newly elected IUPAP President, made it one of his major goals during his tenure to "do my outermost (utmost) to have China become a member of the IUPAP."[127] In the meeting, the IUPAP Executive Committee worked to amend the statutes, removing the term "national" and introducing the concept of a liaison committees representing "identified physics communities."[128] This change removed

[123] Tsien San-tsiang to E. L. Goldwasser, November 27, 1980, IUPAP Gothenburg China.
[124] E. L. Goldwasser to Tsien San-tsiang, January 8, 1981, IUPAP Gothenburg China.
[125] L. Kerwin to E. L. Goldwasser, January 12, 1981, IUPAP Gothenburg China.
[126] L. Kerwin's telegram to Zhou Peiyuan, July 31, 1981, IUPAP Gothenburg China.
[127] Kai Siegbahn to J. W. T. Dabbs, July 31, 1981, IUPAP Gothenburg China.
[128] IUPAP General Report 1982, 8, series B2aa, vol. 2, IUPAP Gothenburg. So far, we have not discovered the reasons for the Union making these amendments. The IUPAP statutes originally interpreted the word "nation" including dominions, diplomatic protectorates, or other territories which have an independent scientific community. While the new statutes read: "A member should effectively represent independent scientific activity in physics in a definite territory and be listed under a name that avoids any misunderstanding about the territory represented. The word 'territory' does not imply any political position on the

the major obstacle to the PRC's membership. Additionally, Siegbahn found a "new way" to engage with Chinese physicists. He invited Chinese physicists to serve on the editorial board of *Nuclear Instruments & Methods in Physics Research* (*NIM*), of which he was the editor-in-chief, and planned to republish English versions of articles published in Chinese journals in the *NIM*.

In May 1982, the Executive Board of ICSU released a draft resolution for its upcoming General Assembly in the autumn. The resolution acknowledged that there is only one China, and Taiwan is considered a province of China. It also accepted the application of CAST as a national member. However, the status of the academy located in Taipei was to be further examined by an ad hoc commission. This commission would be tasked with recommending an appropriate membership arrangement for the academy and proposing any necessary amendments to the ICSU statutes to accommodate this change. During this process, the academy located in Taipei would retain its current membership in ICSU, along with its existing voting rights, until a revised version of the Statutes was officially adopted.

The third National Congress of the CPS was held in Beijing from December 20 to 25, 1982, during which Qian Sanqiang was elected as the new CPS President. The new CPS leadership stressed on the importance of "advancing international academic exchanges."[129]

On December 30, after learning that the obstacles for the CPS's admission to IUPAP had been resolved, Yang Fujia (杨福家), the Chairman of the Department of Nuclear Science of Fudan University expressed his gratitude to Siegbahn for his efforts.[130] Seeing this as a positive sign of success, Siegbahn forwarded Yang's letter to Kerwin and suggested that he respond promptly and comprehensively once the CPS made a clearer declaration about joining IUPAP on January 12, 1983.[131] Fifteen days later, Kerwin replied to Siegbahn, stating his intention to write to Zhou Peiyuan to reiterate IUPAP's invitation and express his hope to address the issue in Ottawa.[132] In addition, Zhou Guangzhao (周光召), the newly elected Vice-President of the CPS, from the Institute of Theoretical Physics, CAS, received the 1982 general report and responded to Nilsson on December 25, 1982, indicating that there were no major obstacles for the CPS to join IUPAP since the revision of the IUPAP statutes. Both Zhou Peiyuan and Qian Sanqiang actively supported this and were willing to take necessary measures to facilitate the process.[133] Around one month later, Nilsson replied to Zhou Guangzhao, expressing his delight in receiving the news and informing him that he had already shared the information with Siegbahn. Nilsson also mentioned that either Siegbahn, Kerwin, or himself intended to visit China to finalize the details and solidify the agreement.[134]

part of the Union which seeks to assist physicists everywhere in the world to cooperate on an international level."

[129] Writing Group of the Chinese Physical Society, ed. 中国物理学会编写组编, *Eighty years of Chinese Physical Society* 中国物理学会八十年," (Beijing: China Science and Technology Press 北京:中国科学技术出版社, 2012), 32.

[130] Yang Fujia to Kai Siegbahn, December 30, 1982, IUPAP Gothenburg China.

[131] Kai Siegbahn to L. Kerwin, January 13, 1983, IUPAP Gothenburg China.

[132] L. Kerwin to Kai Siegbahn, January 28, 1983, IUPAP Gothenburg China.

[133] Zhou Guangzhao to Jan S. Nilsson, December 25, 1982, IUPAP Gothenburg China.

[134] Jan S. Nilsson to Zhou Guangzhao, January 20 1983, IUPAP Gothenburg China.

On January 28, 1983, Kerwin wrote to Zhou Peiyuan, expressing IUPAP's willingness to consider any special conditions that would facilitate the CPS's admission. He mentioned that this would be discussed during the Executive Committee meeting in Ottawa, scheduled for September 1983, and hoped that China would send a delegation to the IUPAP General Assembly in Trieste, set for September 1984.[135] Zhou Peiyuan forwarded the letter and attached documents to Qian Sanqiang. On March 18, Qian telegraphed Nilsson to express gratitude for his efforts in dealing with China's admission issue and extended an invitation to Nilsson, Siegbahn, and Kerwin to visit China in May or July for detailed discussions.[136] Soon afterwards, Qian wrote to Kerwin, clearly stating China's position on the matter. Firstly, they appreciated the Executive Committee of IUPAP's efforts to modify the statutes and address the obstacle that prevented the CPS from joining IUPAP. Secondly, before the CPS's adherence, both sides needed to sign an agreement similar to the one they did with the IUB in 1979, acknowledging Taiwan as a province of China and the academy located there as a local organization of China. Thirdly, after admission, the terms "Republic of China" and "Taiwan" should be deleted from all IUPAP documents and publications. Both the CPS and the academy located in Taipei should be listed under "China" to avoid any territorial misunderstanding. Finally, China agreed to hold eight shares.[137] By addressing these points, China made clear its conditions for joining IUPAP, paving the way for further progress in their membership discussions.

Considering that the situation had once again deteriorated, Kerwin communicated with Siegbahn, expressing concern that a political statement declaring "Taiwan as a Province of China" would violate the IUPAP statutes. Consequently, they would need to approach China's admission issue with patience and further discussions.[138]

In August 1983, Fang Jun (方均) and other CAST representatives had planned to meet with IUPAP representatives during the ICSU meeting in Warsaw, but the gathering did not materialize. On August 22, Fang Jun telegraphed Kerwin, informing him that CAST would not be attending the meeting in Ottawa. He proposed submitting to the executive council "only a document guaranteeing under one heading of China two adhering bodies: the Chinese Physical Society and the Society located in Taipei." He also asserted that China did not necessarily require a political statement.[139] Amidst the ongoing complexities, Kerwin and IUPAP continued their efforts to find a suitable resolution that would enable China's admission while adhering to the principles set forth in the IUPAP statutes.

During the Ottawa meeting, the IUPAP Executive Committee reached a consensus to accept the CPS membership with 8 shares. On September 30, 1983, Kerwin conveyed this decision to Qian Sanqiang and expressed his hope that the CPS delegation would attend the IUPAP General Assembly in Trieste in October 1984.[140] On December 6, Qian replied to Kerwin, confirming China's agreement to join IUPAP in

[135] L. Kerwin to Zhou Peiyuan, January 28, 1983, IUPAP Gothenburg China.
[136] Qian Sanqiang telegrammed L. Kerwin and Jan S. Nilsson respectively, March 18, 1983, IUPAP Gothenburg China.
[137] Qian Sanqiang to L. Kerwin, March 29, 1983, IUPAP Gothenburg China.
[138] L. Kerwin to Kai Siegbahn, June 3, 1983, IUPAP Gothenburg China.
[139] Fang Jun telegrammed L. Kerwin, August 22, 1983, IUPAP Gothenburg China.
[140] L. Kerwin to Qian Sanqiang, September 30, 1983, IUPAP Gothenburg China.

the manner described by Fang Jun. He recommended that the IUPAP official documents refer to the two organizations as "China": "The Chinese Physical Society" and "The Society of Physics located at Taipei, China." If IUPAP agreed to this arrangement, China would send a delegation to Trieste and submit a name list for members in the international commissions and Executive Council.[141]

However, Kerwin and Siegbahn discovered that the names Qian proposed were not in line with the formula used for the IUB. Despite the setbacks and uncertainties, Kerwin expressed his hope that they "were not leaded for a negative cycle in the sine curve!" Both he and Siegbahn agreed that inviting China to Trieste would provide an opportunity to iron out the details and decide on names that would better align with the preferences of both sides.[142]

From March to April 1984, Nilsson paid a visit to China with the aim of resolving the remaining obstacles for China's adherence to IUPAP.[143] During his visit, he engaged in informal discussions with representatives from CAST, Zhou Guangzhao (the Deputy President of the CAS), and the CPS regarding the issue of naming. Nilsson found China's attitude to be "very encouraging."[144] The Chinese mainland expressed a willingness to reconsider the description of the two societies representing China, but suggested dropping the prefix "Chinese" for the Taipei organization. Although Nilsson acknowledged the political nature of the proposal, he agreed to convey it to IUPAP for further consideration.[145]

On April 14, 1984, Zhou Guangzhao wrote to Nilsson to make sure that the IUPAP General Assembly would not encounter any political problems related to the "two Chinas" or "one China, one Taiwan" issue. He demanded that terms such as "Republic of China" or "Taiwan" not appear in the bulletins, abstracts, proceedings, or other publications. Zhou also proposed that in the next issue of the IUPAP General Report, the list of liaison committees under the heading of China would include "Chinese Physical Society, Beijing" and "Physical Association, Taipei."[146]

In a letter to Kerwin on May 10, Nilsson provided a summary of his visit to China and emphasized that China would soon join IUPAP if an agreement could be reached with Taiwan. He suggested that Tsung-Dao Lee (李政道) serve as an intermediary, given his upcoming visit to both Beijing and Taipei and his esteemed reputation in both places.[147]

Knowing Tsung-Dao Lee's special relation with Ta-You Wu, the President of Academia Sinica in Taiwan,[148] Zhou Guangzhao made a request to Lee while he was visiting China in spring 1984. Lee readily accepted Zhou's request to facilitate

[141] Qian Sanqiang to L. Kerwin, December 6, 1983, IUPAP Gothenburg China.
[142] Kerwin suggested the names as CHINA: The Chinese Physical Society, Beijing and The Chinese Physical Society, Taipei.
[143] Nilsson's visit to China was arranged through an exchange program between the CAS and the Royal Engineering Academy of Sweden. So he went to Beijing not as an official IUPAP representative and with no mandate to negotiate, but clearly in a position to discuss the matter and he could convey in person his interpretation of the position of the Union.
[144] Jan S. Nilsson to L. Kerwin, May 10, 1984, IUPAP Gothenburg China.
[145] Jan S. Nilsson to L. Kerwin, May 10, 1984, IUPAP Gothenburg China.
[146] Zhou Guangzhao to Jan S. Nilsson, April 24, 1984, IUPAP Gothenburg China.
[147] Jan S. Nilsson to L. Kerwin, May 10, 1984, IUPAP Gothenburg China.
[148] Ta-You Wu was appointed as the President of Academia Sinica in Taiwan in 1983. Tsung-Dao Lee was Wu's protégé when he studied at National Southwestern Associated University in Kunming during

the negotiation with Wu on the naming of the two physical societies located in Beijing and Taipei, both to be listed under the same heading of China. Because Lee did not expect to meet Wu in person until December, he opted to conduct this mediation through written correspondence. Upon returning to New York from China, Lee promptly wrote to Nilsson, inquiring "the preferred wording" for the names of the two organizations, as he believed that such information would greatly aid in resolving this delicate issue.[149] In his response, Nilsson informed Lee that China accepted IUPAP's strict political neutrality but expressed the desire to remove the word "Chinese" from the name of the Taipei organization. He believed that a solution could be found due to the close positions of both sides, but acknowledged that it might not be possible without Tsung-Dao Lee's mediation. Nilsson urgently hoped to address the matter before the Trieste meeting, enabling the PRC delegation to attend the meeting officially and facilitating the CPS's acceptance in IUPAP committees and other groups.[150]

On July 18, 1984, Siegbahn formally invited the CPS to send delegations to the Trieste meeting and recommended Zhou Guangzhao as the leader.[151] ICSU showed concerns about the progress of the negotiations between China and IUPAP. On August 2, 1982, F. W. G. Baker, the Executive Secretary of ICSU, wrote to Nilsson to inquire about the status. During the 20th General Assembly of ICSU (September 23–28, 1984, Ottawa), official representatives from IUPAP negotiated with Chinese mainland and Chinese Taiwan on the names of the two organizations.[152]

At the beginning of October 1984, Tsung-Dao Lee wrote to Deng Xiaoping, the supreme Chinese leader whom Lee had met multiple times. Lee made a suggestion to resolve the issue of the membership of the CPS and Taiwan in IUPAP. Deng immediately approved Lee's proposal on October 3. Just two days later, Zhou Guangzhao and Lee signed a memorandum regarding the CPS and the Physical Society located in Taipei's membership in IUPAP.[153] Then Qian Sanqiang promptly informed Siegbahn that, thanks to the mediation of Tsung-Dao Lee, the Chinese mainland and Taiwan had reached a consensus.[154] Both sides agreed that there is only one China in the world, and both Chinese mainland and Taiwan are parts of China. They also reached an agreement in naming the two Chinese organizations to be listed in IUPAP.

World War II. It was Wu who made the pivotal decision to bring Lee, then merely an undergraduate student, to the United States in 1946, a move that set the stage for his subsequent extraordinary scientific accomplishments.

[149] T. D. Lee to Jan S. Nilsson, May 29, 1984, IUPAP Gothenburg China.

[150] Jan S. Nilsson to T. D. Lee, June 20, 1984, IUPAP Gothenburg China.

[151] K. Siegbahn to Zhou Guangzhao, July 18, 1984, IUPAP Gothenburg China.

[152] We know from Nilsson's letter to Baker on September 10, 1984 that the official IUPAP delegate attended the 20th ICSU General Assembly would be A. D. Bromley. Bromley would discuss with representatives from Taipei about the formulation of the adhering body. These discussions are carried out with T. D. Lee as the mediator. Nilsson knew that Ta-You Wu would be at Ottawa and he guessed Wu would either visit Lee on his way to Ottawa or Lee will personally go to Ottawa to discuss it with him in person. Nilsson also informed Bromley that representatives of CAST will be there and that he should make use of the opportunity to finalize the agreement. Jan S. Nilsson to F. W. G. Baker, September 10, 1984, IUPAP Gothenburg China.

[153] CCCPC Party Literature Research Office, ed. 中共中央文献研究室编, *Chronology of Deng Xiaoping*, vol. 2 邓小平年谱 1975–1997 下. (Beijing: Zhong yang wen xian chu ban she 北京: 中央文献出版社, 2004), 999.

[154] Qian Sanqiang to K. Siegbahn, October 5, 1984, IUPAP Gothenburg China.

From October 8 to 11, 1984, three mainland Chinese physicists led by Zhou Guangzhao participated in the Trieste General Assembly as official representatives from the PRC.[155] On the first day of the assembly, Zhou signed a memorandum with IUPAP President K. Siegbahn, which states:[156]

> After discussions including Professor Zhou Guangzhao, the representative of the Chinese Physical Society, Professor C.W. Wang, the representative of the Physical Society located in Taipei, Taiwan, and Professor Kai Siegbahn, President of IUPAP, it is agreed that the two adhering organizations from China in all official IUPAP documents and communications be referred to as:
>
> CHINA—The Chinese Physical Society
> —The Physical Society located in Taipei, China

Having endorsed this memorandum, the CPS finally became an IUPAP member, adhering to the One-China Principle while also retaining membership for their compatriots in Taiwan. This great achievement stands in part as a testament to the unwavering commitment exhibited over decades by various IUPAP officials and contributors within the global physics community. Tsung-Dao Lee was one outstanding contributor, to whom Jan S. Nilsson, the IUPAP Secretary General, penned a letter on November 10, conveying the Union's appreciation for his "extraordinary efforts" that paved the way for CPS's membership.[157]

Conclusion

The admission of the CPS to IUPAP in 1984 marked the resolution of a long-standing problem in the Chinese physics community.[158] This challenging episode spanned nearly three decades and was finally resolved through the persistent efforts of Chinese physicists, IUPAP leaders, and other esteemed scientists like Needham and Lee who cared deeply about the advancement of physics in China and the promotion of international cooperation in the field.

[155] Zhao Kaihua 赵凯华, "The IUPAP has admitted the CPS as its member 国际纯粹和应用物理学联合会 (IUPAP) 接纳中国物理学会为会员," *Physics 物理* 14, no. 3 (1985): 134. The three physicists were Zhou Guangzhao, Zhao Kaihua (赵凯华), and Du Xiangwan (杜祥琬).

[156] IUPAP Gothenburg China. C. W. Wang (王纪五) was then the Director of the Int'l Affairs and Collab. Div. of the National Science Council, Executive Yuan in Taiwan. See "中华民国物理学会会议记录 [Meeting Minutes of the ROC Physical Society]," *Physics Bimonthly* 34, no. 4 (2012): 350. According to the list of participants of the 1984 Assembly, the participants from China-Taipei were Y. C. Liu, C. S. Shen (沈君山), and K. P. Wang (王亢沛).

[157] Jan S. Nilsson to T. D. Lee, November 10, 1984, IUPAP Gothenburg China.

[158] Yang Guozhen 杨国桢 and Nie Yuxin 聂玉昕, "Mr. Zhou Guanzhao and the Chinese Physical Society 周光召先生和中国物理学会," In *The Comrade Guangzhao We Knew: collected papers on Zhou Guangzhao's Scientific Thought and Spirituality* 我们认识的光召同志: 周光召科学思想科学精神论集, ed. Xu Guanhua 徐冠华. (Beijing: Science Press 北京:科学出版社, 2010), 123–7.

Since becoming a member of IUPAP, the CPS has actively participated in every General Assembly, playing a vital role in the organization's development. Engaging in IUPAP's academic activities has enabled the CPS to strengthen its exchanges with the global physics community, covering diverse areas such as physics education, semiconductors, condensed matter, acoustics, nuclear physics, particles and fields, biophysics, computational physics, and astrophysics. These achievements in turn also reflect how much loss the PRC might well have suffered during those years of exclusion. Moreover, the relations between the physics communities in mainland China and Taiwan have also grown stronger, leading to joint conferences and other collaborative initiatives. A particularly noteworthy event was Ta-You Wu's visit to the mainland in 1992, the first since his departure forty-six years before. His return fostered the first delegation of mainland Chinese scientists visiting Taiwan, further deepening the ties between the two regions and promoting scientific collaboration across the Taiwan Strait.[159]

The crux of the dispute between the PRC and IUPAP, as well as other international organizations, revolved around the "One China" principle. Balancing the need to uphold this principle steadfastly while also seeking room for flexibility to achieve a mutually beneficial outcome posed a distinctive and significant challenge to all parties involved. The resolution of this issue was not solely determined by scientists; it was deeply influenced by the ever-evolving international geopolitical landscape, particularly the fluctuating dynamics of Sino-US relations, and the domestic politics in both countries during the Cold War.

For instance, in December 1954, Washington signed the "Mutual Defense Treaty between the United States of America and the Republic of China" with Chiang Kai-shek's Nationalist Government in Taiwan. This move escalated the long-standing tensions between Beijing and Taipei, intensifying the dispute across the Taiwan Strait. The Taiwan issue has been a vital point of contention between the United States and the PRC. Shortly after the 1958 Grenoble IUPAP Executive Committee meeting, the Taiwan Strait Crisis erupted on August 23, 1958. Since the USA had no intention to fight another costly war against the PRC after the Korean War, the Eisenhower administration appeared to have actively promoted Taiwan in various international scientific organizations to undermine the PRC's One-China Principle. This helps explain the American maneuvers in IUPAP and several other international organizations in the late 1950s.

In the late 1950s, the PRC first decided to join IUPAP but then quickly withdrew from it because Taiwan also applied for this Union soon afterwards based on its ICSU membership, apparently with support from the United States. The 1958 ICSU General Assembly in Washington, DC approved a crucial statement that paved the way for Taiwan's admission into IUPAP and other scientific unions. In essence, ICSU pressured all affiliated unions through the umbrella organization model simultaneously.

[159] Shen Keqi 沈克琦, "*The master who created the miracle of physics education.* 创造物理教育奇迹的大师," (Kunming: Yunnan Education Press 昆明：云南教育出版社，2012), 137–8.

Following the United Nations' Resolution 2758 in 1971, UNESCO passed a resolution recognizing the PRC as the sole legitimate representative of China in its organization. This posed a dilemma for IUPAP and other unions, which maintained strict political neutrality. The challenge was to find a solution that would accommodate both the PRC and Taiwan within a scientific association.

Useful models gradually emerged between the late 1970s and the early 1980s when the PRC was admitted by the IUB, the IAU, and IUPAC, while Taiwan retained its separate membership in those unions. The US enactment of the "Taiwan Relations Act" in 1980, however, complicated the situation once again. To address this issue, IUPAP revised its statutes in 1981 to remove the obstacles for China's adherence. The Union provided more opportunities for Chinese physicists to participate in its sponsored activities and sent its officials to Beijing to negotiate and seek solutions in person. Tsung-Dao Lee, the eminent Chinese-American physicist and Nobel Laureate, also played a crucial role as a mediator, facilitating communication between the CPS and the physical society in Taiwan. Ultimately, resolving this thorny issue hinged on the contemporary geopolitical situations, on the goodwill, cooperation, and willingness of physicists from both mainland China and Taiwan, and on the insight and dedication of various IUPAP leaders. The arduous journey of the CPS to join IUPAP stands as a quintessential example of the science diplomacy during the Cold War. This investigation thus contributes to the growing field of the history of science diplomacy in general and of the Chinese science diplomacy in particular. The story could also serve as an enlightening historical lesson, helping people comprehend the significant harm that a new Cold War can potentially inflict upon the world.[160]

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[160] For recent general literature on Science Diplomacy, readers may start with: Matthew Adamson and Roberto Lalli, "Global Perspectives on Science Diplomacy: Exploring the Diplomacy-Knowledge Nexus in Contemporary Histories of Science," *Centaurus* 63, no. 1 (2021): 1–16; Royal Society and AAAS, *New Frontiers in Science Diplomacy* (London: Royal Society, 2010); Pierre-Bruno Ruffini, *Science and Diplomacy: A New Dimension of International Relations* (Cham: Springer, 2017). For readers particularly interested in the Chinese science diplomacy during the Cold War, a noteworthy new monograph is: Gordon Barrett, *China's Cold War Science Diplomacy* (Cambridge, United Kingdom: Cambridge University Press, 2022).

12
IUPAP, Cooperative Antagonism, and the GDR

Doubravka Olšáková

The controversy surrounding the German Democratic Republic (GDR)'s accession to the International Union of Pure and Applied Physics (IUPAP) is a typical example of cooperative antagonism. The countries of both blocs and their state representatives acknowledged that they had divergent political interests, but nonetheless tried to find a compromise to avoid a severe blockage of international cooperation or an escalation of political tensions. They did not have malevolent intentions, but neither were they altruistically inclined, serving competing national interests.[1] The negotiating process between East and West over the future of German representation in IUPAP was therefore driven by dynamic interactions between "cooperation" and "antagonism."

The case of East Germany is highly instructive in comprehending the tactics employed by distinct blocs for multiple reasons. The Hallstein Doctrine adopted in 1955 and the erection of the Berlin Wall in 1961 had a notable impact on international science policy; yet the international scientific community's inclination was mostly towards active collaboration rather than the isolation of the GDR.

The negotiations surrounding the GDR's role in the international scientific community in general, and IUPAP more specifically, sparked the discussion of crucial issues like political and non-political discrimination, the free movement of scientists, and the official recognition of the scientific community of a state that had not yet received official international recognition. On the level of international organizations, the interconnectedness of national policies, foreign relations, and scientific internationalism[2] are apparent and demonstrate how challenging the GDR's path to international recognition was. While international relations and the policy of United Nations Educational, Scientific and Cultural Organization (UNESCO) members heavily influenced the formal processes leading to the GDR's recognition in UNESCO, the acceptance of the GDR into IUPAP (and the International Council of Scientific Unions (ICSU), too) reveal the functioning of cooperative antagonism at a pragmatic level.

[1] Lynton Keith Caldwell, "Cooperation and Conflict," *Environment: Science and Policy for Sustainable Development* 27, no. 1 (1985): 6–39; Giulia Rispoli, and Doubravka Olšáková, "Science and Diplomacy around the Earth: From the Man and Biosphere Programme to the International Geosphere-Biosphere Programme," *Historical Studies in the Natural Sciences* 50, no. 4 (2020): 456–81.

[2] Geert J. Somsen, "A History of Universalism: Conceptions of the Internationally of Science from the Enlightenment to the Cold War," *Minerva* 46, no. 3 (2008): 361–79.

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In the first section of this paper, we discuss the chronology and function of East and West German physical associations formed after World War II. The Hallstein Doctrine, the erection of the Berlin Wall, and the fragmented institutional background of German physicists—whose main organization, the *Deutsche Physikalische Gesellschaft* (German Physical Society) had been abolished by the Allies after World War II—all contributed to the escalation of tensions between the two communities, whose cooperation had been going reasonably well in the late 1940s and the beginning of the 1950s. The second section of the paper provides an overview of the GDR's initial efforts to achieve international recognition in UNESCO and ICSU. The third section focuses on the strategy of East German science leadership in science diplomacy after their application to join UNESCO was rejected. The proactive agenda and growing self-confidence of the GDR in the international arena also influenced the policy of ICSU, which as a result adopted the Resolution of Political Non-Discrimination in 1958. The fourth section describes the process of the GDR's admission to IUPAP and highlights the symmetry of cooperative antagonism in the strategy of promoting the admission of the GDR as a new member coming from the Eastern bloc and Taiwan as a new member coming from the Western bloc. The last section before the conclusion briefly summarizes the final phase of the GDR's admission as a member of ICSU. The negotiations replicated previous IUPAP discussions: the procedure itself was relatively smooth, except for the protests of the West German representative of the *Deutsche Forschungsgemeinschaft*. We conclude by tracing the previous steps towards the establishment of the ICSU Standing Committee on the Free Circulation of Scientists in 1963, where the Soviet bloc countries were able to exert considerable influence.

Hallstein Doctrine and Travel Restrictions

By the end of World War II, there was great uncertainty about how German physicists would reconvene after the war and be represented internationally.[3] Nobody foresaw that the community would be institutionally divided (see Table 12.1). The international crisis culminating in the Berlin blockade and airlift led, on May 23, 1949, to the establishment of the Federal Republic of Germany (FRG), followed, five months later, by that of the GDR.[4] Even that, however, did not cause significant tensions or divisions within the German physics community. For instance, when the Allies abolished the German Physical Society because of its Nazi connections, German physicists swiftly re-organized and first re-established *the Physikalische Gesellschaft zu Berlin* and then, on October13, 1950, the Union of German Physical Societies (in German *Verband Deutscher Physikalischer Gesellschaften, e.V.*).[5] Karl Wolf, who served as the first President of the society, subsequently submitted a formal request to the IUPAP

[3] For a historical overview of the German Physical Societies, cf. *Festschrift zum 150 jährigen Jubiläum der Deutschen Physikalischen Gesellschaft, Physikalische Blätter* 51, no. 1 (1995): 3–238.

[4] Wolfgang Benz, *Wie es zu Deutschlands Teilung kam—Vom Zusammenbruch zur Gründung der Beiden Deutschen Staaten—1945–1949* (Berlin: dtv, 2018).

[5] Karl Wolf to Pierre Fleury, March 25, 1952, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP, Gothenburg secretariat (hereafter IUPAP Gothenburg), Center for the History of Science, Royal Swedish Academy of Sciences.

Secretary General, the French physicist Pierre Fleury, applying for membership in the Union. In April 1952, IUPAP welcomed the German physicists' return to international science and no objections were raised.[6] The issue of separate representations of East and West German physics was not a topic of discussion since at the beginning of the 1950s, the existence of two German states appeared to be a transitional solution on the way to the post-war establishment of a new German state. The society *Verband Deutscher Physikalischer Gesellschaften* was established in 1950 as a collaborative effort between communities and individual researchers, regardless of their geographical location, and collaboration between the Eastern and Western German physicists proceeded relatively seamlessly. For example, the *Physikalische Gesellschaft zu Berlin* had 430 members in 1955, eighty of them from East Berlin.[7] Things started rapidly to change from 1952 when the official membership of the Union of German Physical Societies as a member of IUPAP was officially accepted on September 29, 1952, and the East Berlin group founded the *Physikalische Gesellschaft in der DDR* (Physical Society in the GDR) on September 26 of that year, officially registered with the Ministry of the Interior on October 31, 1952.[8] It was evident that both communities were able to work together, but they were also beginning to rethink their activities in the new context of a divided state and to claim more space for their own agendas. As a result, it became apparent that both communities wanted to fortify their standing within the global scientific community.

In international relations, the FRG did not recognize the existence of an independent GDR after 1949.[9] Following the signing of the Paris Agreement in May 1955, the FRG was granted full membership in the North Atlantic Treaty Organization (NATO), and the occupation by Allied forces officially ended. During the attempt to establish official diplomatic relations with the USSR in the autumn of 1955, it became clear that this principle would have to be violated, since diplomatic relations between the USSR and the GDR were established shortly after the foundation of the independent GDR on October 19, 1949. State Secretary Walter Hallstein subsequently formulated the fundamental principle of West Germany's new state doctrine, which stipulated that the state would refrain from establishing diplomatic relations with countries that recognized the GDR.[10] The doctrine that was implemented from 1955 to 1969, and officially terminated in 1972, rendered East Germany's representation on the global stage impossible due to West Germany's practical application of the policy. For almost twenty years, such a West German foreign policy of "calculated ambiguity," as the German historian Hermann Wentker aptly characterized it,[11] also shaped international scientific relations.

[6] Fleury to Wolf, April 7, 1952, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

[7] Horst Nelkowski, "Die Physikalische Gesellschaft zu Berlin in den Jahren nach dem Zweiten Weltkrieg," *Physikalische Blätter* 51, no. 1 (1995): 143–56.

[8] Dieter Hoffmann, "Die Physikalische Gesellschaft (in) der DDR," *Physikalische Blätter* 51, no. 1 (1995): 157–82; Dieter Hoffmann and Thomas Strange, "DDR-Physik(er) im Spiegel der „Physikalischen Blätter," *Deutschland Archiv—Zeitschrift für das vereinigte Deutschland* 28 (1995): 752–8.

[9] Hermann Wentker, *Außenpolitik in Engen Grenzen. Die DDR im Internationalen System* (München: Oldenbourg Verlag, 2007), 109f.

[10] Wentker, *Außenpolitik in Engen Grenzen*, 170.

[11] Wentker, *Außenpolitik in Engen Grenzen*, 171.

Table 12.1 Overview of German Physical Societies (1950–1990)[a]

Verband Deutscher Physikalischer Gesellschaften		Physikalische Gesellschaft (in) der DDR		Deutsche Physikalische Gesellschaft	
1950–1951	Jonathan Zenneck	1955–1967	Gustav Hertz (speaker)	1964–1965	Friedrich Bopp
1952–1953	Karl A. Wolf	1967–1975	Gustav Hertz (Honorary President)	1966–1967	Wolfgang Finkelnburg
1954	Richard Becker	1970–1988	Robert Rompe	1968–1969	Martin Kersten
1955	Karl A. Wolf	1988–1990	Joachim Auth	1970–1971	Karl Ganzhorn
1956–1957	Walter Gerlach			1972–1973	Werner Buckel
1958–1959	Ferdinand Trendelen-burg			1974–1975	Otto Koch
1960–1961	Wilhelm Walcher			1976–1977	Hans-Joachim Queisser
1962–1963	Konrad Ruthardt			1978–1979	Hans Welker
				1980–1982	Horst Rollnik
				1982–1984	Karl J. Schmidt-Tiedemann
				1984–1986	Joachim Treusch
				1986–1988	Joachim Trümper
				1988–1990	Otto G. Folberth

[a] "Anhang," *Physikalische Blätter* 51, no. 1 (1995): 236.

In accordance with the Hallstein Doctrine, in the second half of the 1950s NATO member states generally refused to recognize passports issued by state authorities in the GDR, thereby denying GDR citizens entry to their respective countries and refusing to issue visas. Although citizens of the GDR complied with this directive and submitted applications for travel documents to the Allied Travel Office, the documents were usually not issued and were refused. As a consequence, in the 1950s and 1960s, the East German scientific community was ostracized to a degree that was more than evident in international science.[12]

[12] Günther Rienäcker, "Peaceful Coexistence and International Scientific Cooperation," *Scientific World* 8, no. 3 (1964): 23–5.

Already in 1960, the growing isolation of GDR scientists had caused a sensation. When the Royal Society invited Professor Werner Hartke, who served as the President of the *Deutsche Akademie der Wissenschaften zu Berlin* (DAW) from 1958 to 1968, and its Secretary, Günther Rienäcker, to attend the 300th anniversary of its foundation in London in 1960, the British envoys at the Allied Travel Office turned down their request for temporary travel documents.[13] The decision to decline an official invitation by Britain's foremost academy to the scientific representatives of East Germany was quite evidently politically motivated, as the invitation was made for the commemoration of a significant anniversary of one of Europe's most important scientific institutions.

These circumstances remained unchanged for quite some time, as evidenced by Rienäcker's 1964 correspondence claiming that "since the middle of 1961 a complete boycott has been imposed on travel by G.D.R. scientists to scientific meetings in N.A.T.O. countries."[14] The aforementioned circumstances resulted in East German scientific endeavors being mostly reliant on international collaboration with Soviet bloc countries for two decades.[15]

Furthermore, negotiations and collaboration between the East and West German physical communities, which had been hampered by conflicting foreign politics at the zenith of Stalinism in the Soviet Union, were made even worse by the implementation of the Hallstein Doctrine by the FRG and by the erection of the Berlin Wall in 1961.[16] Inevitably, they greatly affected the GDR's participation in inter- and non-governmental scientific organizations.

The Stalemate at UNESCO and ICSU

The crisis in German affairs had ramifications for international science. Facing travel restrictions and lack of official state recognition, East Germans started applying for membership in various international scientific organizations, but, at least up until 1960, this produced a stalemate as no organization was prepared to offer membership in the ongoing political crisis marked by the implementation of the Hallstein doctrine.

This is particularly evident with the DAW's request for the GDR to join UNESCO. The prospect of an application appeared as a sound prospect after 1953 since, with Stalin's death, there was a more conducive atmosphere within the Soviet bloc towards international activities. The interest of the presidium of the DAW in reinstating participation in UNESCO was great, and in November 1954 the leadership of the academy made a request for the GDR to join UNESCO. In this request, the academy stated that, after the entry of the USSR and the re-entry of Hungary and Czechoslovakia into UNESCO in 1954, the presidium recommended that the East German government

13 Rienäcker, "Peaceful Coexistence," 24.
14 Rienäcker, "Peaceful Coexistence," 24.
15 See the chapter by Turchetti in this volume.
16 Heather L. Dichter, "'A Game of Political Ice Hockey': NATO Restrictions on East German Sport Travel in the Aftermath of the Berlin Wall," in *Diplomatic Games: Sport, Statecraft, and International Relations since 1945*, ed. Heather L. Dichter and Andrew L. Johns (Lexington: University Press of Kentucky, 2014), 19–52.

should review the possibility of the GDR's entry into this institution in the name of the development of science and technology.[17] Subsequently, a new commission was established to prepare the case. This commission included representatives from the Ministry of Foreign Affairs, the Ministry of Employment and Workplace Education, the state secretariat for Higher Education, the *Deutsche Akademie der Künste*, the *Staatsbibliothek*, and the *Amt für Literatur und Verlagswesen*. On September 15, 1955, an official request was submitted.[18]

The initial formal nomination received official endorsement from the UNESCO National Committees of India, Egypt, and Yugoslavia, which suggests that the East Germans succeeded in mobilizing to their cause not only the Soviet bloc, but also countries that only six years later joined the non-aligned movement. This did not grant them success though. The Director General of UNESCO, Lother Evans, confirmed on December 29, 1955, that the request was declined.[19] A novel strategy was thus formulated, while also seeking out additional, more influential sponsors. Consequently, the Hungarian and Polish national delegations were formally solicited for assistance. Subsequently, both National Committees pledged to endorse the DAW appeal at the UNESCO General Assembly of Delhi in November of 1956.[20] Partial concessions were now made, and GDR representatives were allowed to participate as observers or hosts in the negotiations of several UNESCO Committees. The Hallstein Doctrine only came to a definitive end with the resolution of the East Berlin issue, and thus the effective completion of the division of the two German states, which was achieved in 1972 on the basis of the Quadripartite Agreement of September 3, 1971 and the Basic Treaty signed between the FRG and the GDR on December 21, 1972. Nothing stood in the way of the GDR's accession to international institutions; together with the FRG, it joined the United Nations (UN) on September 18, 1973, and the GDR then joined UNESCO on November 24, 1972, of which the FRG had been a member since 1951.[21]

Following this initial setback and the rejection of the GDR's bid to join UNESCO, East Germany developed a new approach and opted to concentrate on engaging with other actors and organizations. Upon hearing the informal announcement that UNESCO was inclined to reject the GDR's membership, Hans Wittbrodt, the DAW Scientific Secretary wrote, in November 1955, to the leadership of the Socialist Unity Party of Germany (*Sozialistische Einheitspartei Deutschlands*, hereinafter SED) seeking approval to a new plan for admittance into ICSU. In the letter, Wittbrodt stated

[17] Correspondence from the Presidium, December 23, 1954, sign. 507, Beziehungen zu Fremden Institutionen, Bestand Akademieleitung 1945–1968, Archiv der Berlin-Brandenburgischen Akademie der Wissenschaften (hereafter BBAW), Berlin.

[18] Kurzbericht über die Sitzung der UNESCO-Kommission der Deutschen Demokratischen Republik am 9.2.1956, sign. 507, Beziehungen zu Fremden Institutionen, Bestand Akademieleitung 1945–1968, BBAW, Berlin.

[19] Kurzbericht über die Sitzung der UNESCO-Kommission der Deutschen Demokratischen Republik am 9.2.1956, sign. 507, Beziehungen zu Fremden Institutionen, Bestand Akademieleitung 1945–1968, BBAW, Berlin.

[20] UNESCO Magyar Nemzeti Bizottsága, Budapest, 3.7.1956, sign. 507, Beziehungen zu Fremden Institutionen, Bestand Akademieleitung 1945–1968, BBAW, Berlin; Polnische UNESCO-Kommission, Warschau, den 17 Juli 1956, sign. 507, Beziehungen zu Fremden Institutionen, Bestand Akademieleitung 1945–1968, BBAW, Berlin.

[21] Wentker, *Außenpolitik in Engen Grenzen*, 442–5.

that it was only natural for the DAW to be selected, as a legally recognized, preeminent representative and leading institution of East German science, and therefore should be included among other members of ICSU of comparable caliber.[22] Presumably in appealing to the SED Central Committee, Wittbrodt thought that he could succeed exactly because ICSU, in contrast with UNESCO, was an international scientific agency representing the academies rather than the governments.

The ICSU Resolution of Political Non-Discrimination in 1958

During the September General Assembly of 1958, ICSU adopted a resolution on political non-discrimination which ultimately paved the way for the GDR's acceptance in various spheres of international science. ICSU experienced enormous growth in its activities at the end of the 1950s, which ultimately resulted in a scenario in the 1960s where the organization was forced to choose between competing political and scientific goals. When comparing the General Assemblies of ICSU in 1955 (Oslo) and 1958 (Washington), Eastern European scientists were highly appreciative of the new trend towards the internationalization of science that followed the Geneva Summit in July 1955. While the states of the Soviet bloc and the so-called "Third World" welcomed this state of affairs, US oceanographer Roger Revelle observed in 1962 that there was a significant divide and wrote: "The council is now in a critical stage, largely because of the increasing recognition by governments of the importance of science. In the future, I.C.S.U. may be largely controlled by the national unions."[23]

The non-discrimination resolution effectively marked a political triumph by the Soviet Union and its allies in the Soviet bloc and the successful rethink of bloc strategies following the refusal to accept the GDR into UNESCO. The *Aktionsplan* submitted by the East German Committee for acceptance into UNESCO in 1958 already provided evidence of the significant shift in the Soviet bloc's approach to international science, in that it posited that the socialist states, bolstered by the support of third world nations, ought to become increasingly assertive in shaping international meetings in response to evolving political circumstances.

The *Aktionsplan* examined the results of the Tenth General Conference of UNESCO, held in Paris at the end of December 1958, which followed the ICSU conference and the beginning of Khrushchev's talks with Eisenhower. The diplomatic struggle over the recognition of the GDR involved a clash between the Soviet bloc's insistence on recognizing the GDR and the Western bloc's insistence on recognizing Taiwan. The GDR thus developed the perception that its position within UNESCO was discriminatory. Further, the GDR decided to toughen its demands, announced its refusal to participate as a guest in UNESCO assemblies and other events, and instead adopted a distinct approach centered on building strong bilateral relations with the UNESCO National Committees of individual countries within the Soviet bloc and associated third world countries. This shift was facilitated by the growing influence

[22] Aufnahme der Akademie der Wissenschaften der DDR in ICSU 1954–1960, November 29, 1955, f. 1, sign. DY 30/IV 2/9.04/386, SAPMO, Bundesarchiv, Berlin.

[23] Roger Revelle, "Some recent lessons of scientific co-operation," *Scientific World* 6, no. 3 (1962): 14.

of the USSR and the Soviet bloc, which motivated the GDR to seek full membership in these international organizations and, in turn, promote general principles that would push ICSU to enforce non-discriminatory practices.[24] To overturn the ongoing discrimination at UNESCO and elsewhere, the Soviet bloc hence started campaigning at ICSU for introducing the need of free association for scientists regardless of their own beliefs (political or otherwise) as well as the need for international scientific organizations to give recognition to these associations regardless of whether they came from a group sited in an internationally recognized country or not.

The shift away from the initial rigid political stance of isolating the GDR was also impacted by a transition in the uppermost leadership positions of ICSU. The US scientist Lloyd V. Berkner, who served as the head of ICSU from 1955 to 1958, held a strong stance against the increasing influence of the Soviet Union. In contrast, his successor, the British biochemist Rudolph Peters, demonstrated a more favorable disposition towards collaboration, in comparison to the preceding leadership.[25] The objective of his mission was to address the escalating disputes between US and Soviet scientific institutions and organizations. Even more significantly between 1958 and 1964, Vladimir Alexandrovich Engelhardt, a prominent member of the Soviet Academy of Sciences, served as the ICSU Vice Chairman, hence directly informing its discussions.[26]

Correspondence from Soviet bloc officials confirms that the preparation of a general principle was seen as the best way to support the GDR application to ICSU. Engelhardt exchanged ideas with the DAW Secretary General regarding the acceptance process and transmitted to him duplicates of the official ICSU correspondence pertaining to this issue.[27] In the first half of 1958, a comprehensive re-assessment of the situation took place under Engelhardt's leadership. A letter from Wittbrod to Engelhardt on November 25, 1959 confirms that an ICSU Antidiscrimination Declaration served as the starting point for further negotiating a GDR admission. Wittbrod also noted that South Korea, which, was not affiliated with any scientific union, would also seek admission to ICSU in April 1959 based on this declaration, as highlighted by Engelhardt.[28]

The statement eventually approved at the 1958 ICSU General Assembly recognized that: "to ensure the uniform observance of its basic policy of political non-discrimination, ICSU affirms the right of the scientists of any country or territory to adhere to or to associate with international scientific activity without regard to race, religion or political philosophy," and that "such adherence or association has no implications with respect to recognition of the government of the country or territory

[24] Aktionsplan für das weitere Vorgehen der zuständigen Stellen der DDR gegenüber der Organisation der Vereinten Nationen für Erziehung, Wissenschaft und Kultur und sich daraus ergebende Schlussfolgerungen für die „Kommission für UNESCO-Arbeit in der DDR, September 5, 1959, sign. 507, Beziehungen zu Fremden Institutionen, Bestand Akademieleitung 1945–1968, BBAW, Berlin.

[25] Allan A. Needell, *Science, Cold War and the American State: Lloyd V. Berkner and the Balance of Professional Ideals* (Singapore: Harwood Academic Publishers, 2000): 355.

[26] Engelhardt acted as elected member of the ICSU Bureau from 1955 to 1958.

[27] Aufnahme der Akademie der Wissenschaften der DDR in ICSU 1954–1960, Günther Engelhardt to Georg Reinäcker, f. 34–35, sign. DY 30/IV 2/9.04/386, SAPMO, Bundesarchiv, Berlin.

[28] Hans Wittbrodt to Werner Hartke and Georg Rienäcker about ICSU, December 1, 1959, sign. 500, ICSU, Bestand Akademieleitung 1945–1968, BBAW, Berlin.

concerned."[29] Its impact was plain to see almost immediately, but not within ICSU; rather within IUPAP.

The International Union of Pure and Applied Physics

The implementation of the Hallstein doctrine by the FRG in 1955 and the subsequent physical division of East and West Berlin in 1961 exerted increasing pressure on the physics communities of both states. IUPAP played a positive role and sought a way out of the impasse notwithstanding the refusal of UNESCO to accept an East German representation. Already in 1955, hence before the GDR application to UNESCO, Alfred Büchner, the Secretary of the *Physikalische Gesellschaft in der DDR*, proposed a meeting in Paris with Fleury to discuss the terms and conditions for establishing an East German Committee in IUPAP.[30] As for other scientific organizations, East German officials believed that the proposal had momentum, also due to the recent acceptance of Soviet scientific societies and scientists within scientific unions affiliated with ICSU.[31]

Several strategies were considered, including the establishment of a joint committee. Between 1955 and 1956, two GDR representatives, Gustav Hertz and Friedrich Möglich, engaged in discussions regarding the possibility of a joint representation of the two German communities, and, on September 7, 1956, they sent a telegram to Fleury requesting that the acceptance process of the GDR be interrupted due to ongoing discussions surrounding the possibility of a joint German committee.[32] But since their stance was in opposition to the GDR government bodies advocating a formal recognition of East Germany, the proposal was mothballed, and nothing changed.[33]

The real breakthrough occurred following the approval of the ICSU political nondiscrimination principle, which set a clear precedent in that it compelled to accept applications coming from committees of countries that had not been internationally recognized. A further push towards the approval came from the IUPAP deliberations on the related issue of the "two Chinas"; i.e., when the scientific academies of both the Republic of China (Taiwan) and the People's Republic of China had both requested acceptance to IUPAP notwithstanding their ongoing struggle for international recognition. And if the Soviet bloc was insistent in acknowledging the GDR, the Western bloc was equally forceful that Taiwan should be acknowledged wherever possible in the international political and scientific domains. In July 1959, the IUPAP Executive Committee therefore agreed to accept Taiwan as a member, albeit with the abstention of two committee members.[34]

[29] Frank Greenaway, *Science International—A History of the International Council of Scientific Unions* (Cambridge University Press: New York, 1996), 94.

[30] Alfred Büchner to Pierre Fleury, September 21, 1955, series e6, vol. 7, folder 20 "German Democratic Republic and Germany (one country from 1990)," IUPAP Gothenburg.

[31] Pierre Fleury to Rolf Ebert, October 6, 1955, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

[32] Pour M. Pierre Fleury, Traduction du télégramme allemande, September 7, 1956, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

[33] Jens Niederhut, *Wissenschaftsaustausch im Kalten Krieg: die ostdeutschen Naturwissenschaftler und der Westen* (Köln: Böhlau, 2007), 25–37.

[34] See the chapter by Hu, Liu, and Yin in this volume.

Since the Taiwanese and East German cases were comparable but symmetrical from the perspective of bloc geopolitics (both unrecognized, one in the Eastern bloc and the other in the West), this gave Büchner an opportunity to push for further abandoning plans for a joint application with the West Germans and press ahead for adhesion of an independent GDR Committee. Indeed, since the Soviet physicist Abraham Joffe was one of the two IUPAP Executive Committee members who abstained in the decision about the Taiwanese admission, he seemingly passed on the relevant information to the East German physical society that persuaded its officers about the merit of moving ahead for full membership.

In September 1959, Büchner sent to Fleury the formal petition of the *Physikalische Gesellschaft in der DDR*.[35] At this point, the IUPAP Secretary expeditiously reached out to Ferdinand Trendelenburg, the President of the West German Physical Society 1957–59 and IUPAP Vice-President in that period, who replied immediately objecting again to admitting an East German Committee.[36] In particular, Trendelenburg emphasized the existence of a singular joint committee, the *Deutsches Nationales Committee*, which had been in operation since 1952 and was open to nominations for members from East Germany. Hence, he argued, the German physics community should be represented by one committee only.[37]

At this point Fleury experienced significant pressure, especially since Joffe reiterated in a letter in February 1960 that the acceptance of Taiwan set a precedent and there was no justification for delaying the GDR request for admission.[38] Fleury himself was puzzled by the situation[39] and conveyed in discussion with the IUPAP President, the Italian physicist Edoardo Amaldi, that if East and West German physicists failed to devise a satisfactory resolution, there would be no opposition to the admission of the GDR.[40] Trendelenburg's letter of March 1960 urged instead Fleury to halt the proceedings for a separate East Germany Committee and put the matter as an item for discussion at the forthcoming IUPAP's General Assembly of Ottawa.[41] Trendelenburg was surprised that by then the IUPAP Executive Committee had already agreed to accept the GDR without waiting for his approval, as Fleury confirmed to Büchner on February 23, 1960.[42] Trendelenburg immediately complained and urged Amaldi to stop the procedure, but Amaldi explained to him that:

[35] Physikalische Gesellschaft in der DDR—Der Vorstand—to Pierre Fleury, September 7, 1959, series e6, vol. 7, folder 20 "German Democratic Republic and Germany (one country from 1990)," IUPAP Gothenburg.

[36] Pierre Fleury to F. C. A. Trendelenburg, September 30, 1959, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

[37] F.C.A. Trendelenburg to Pierre Fleury, October 5, 1959, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

[38] Adolf Abramovich Joffe to Pierre Fleury, February 19, 1960, series e6, vol. 7, folder 20 "German Democratic Republic and Germany (one country from 1990)," IUPAP Gothenburg.

[39] Fleury to Edoardo Amaldi, January 20, 1960, box 106, folder 1, subfolder 4 "Corrispondenza Presidente 1957–1960," Subfondo Archivio Dipartimento di Fisica, Fondo Edoardo Amaldi (hereafter AEA), Physics Deparment Archives of Sapienza University of Rome, Rome.

[40] Pierre Fleury to F. C. A. Trendelenburg, September 30, 1959, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

[41] F.C.A. Trendelenburg to Pierre Fleury, March 4, 1960, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

[42] Pierre Fleury to Adolf Büchner on the Acceptance of GDR to the IUPAP, February 23, 1960, series e6, vol. 7, folder 20 "German Democratic Republic and Germany (one country from 1990)," IUPAP Gothenburg.

> the situation, as you know, is rather difficult also because our decision, taken in Moscow, about the two Chinas, constitutes a precedent for the case of East and West Germany. It would be extremely difficult to postpone the admission of East Germany, while we have decided of accepting immediately the membership of Formosa. I hope that in the case of East and West Germany, it will be possible to reach an agreement so that the two groups will collaborate together and maybe at some time later fuse in a single representation.[43]

In comparison with the other scientific unions, IUPAP was one of the very few where the question of a joint settlement of the representation of both German states had not been resolved in the late 1950s (see Table 12.2). This made the position of IUPAP within ICSU particularly peculiar.

Eventually, Fleury explained to Trendelenburg and Wilhelm Walcher that the acceptance of Taiwan had established a novel framework for the decision-making process within IUPAP. Hence, it had been imperative for the Executive Committee to examine the GDR case in light of the Taiwanese Committee's comparable circumstances, wherein analogous issues arise with regard to accepting it regardless of its state's international recognition. In his communication with Amaldi, who

Table 12.2 Adherence to the International Scientific Unions (early 1960)[44]

	ICSU	IAU (a)	IUBS	IUPAC (b)	IUCr (c)	IUGG (d)	IGU (e)	IUHPS	IUTAM (f)	IUPAP	URSI	IMU (g)	IUPS	IUB (h)
GDR	x	x		x	x	x	x		x			x		x
FRG	x	x	x	x	x	x	x	x	x	x	x	x	x	x

a) The *Deutsche Astronomische Gesellschaft* adhered to the International Astronomical Union in 1951 on behalf of both the GDR and FRG.
b) The *Deutsche Zentralausscuss für Chemie* adheres to the International Union of Pure and Applied Chemistry on behalf of both the GDR and FRG.
c) The *Deutsche Mineralogische Gesellschaft* adhered to the International Union of Crystallography in 1960 on behalf of both the GDR and FRG.
d) The Academies of Berlin and Munich adhere jointly to the International Union of Geodesy and Geophysics.
e) The *Deutsche Forschunggemeinschaft* (Bonn) has adhered since 1946 to the International Geographical Union, the Deutsche Akademie der Wissenschaften (Berlin) since 1960.
f) The *Gesellschaft für Angewandte Mathematik und Mechanik* adheres to the International Union of Theoretical and Applied Mechanics on behalf of both the GDR and FRG.
g) The *Deutsche Mathematische Vereinigung* adheres to the International Mathematical Union on behalf of both the GDR and FRG.
h) The *Gesellschaft für Physiologische Chemie* adheres to the International Union of Biological Sciences on behalf of both the GDR and FRG, through the National Committee for Biochemistry.

[43] Amaldi to Trendelenburg, March 17, 1960, box 106, folder 1, subfolder 4 "Corrispondenza Presidente 1957–1960," AEA.

[44] Administrative Secretary of the ICSU to Secretaries of all Unions: German Adherences, November 14, 1960, Annex A, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

was regularly kept informed about the situation, Fleury ironically remarked that the current state of affairs challenged IUPAP no less than the so-called "United" Nations in terms of diplomatic complexities.[45]

The IUPAP General Assembly held in Ottawa ratified both the deliberations on the representation of Chinese and Taiwanese physicists, as well as those regarding the GDR. The ICSU political non-discrimination principle, therefore, kickstarted the process leading to the IUPAP assembly's consensus that claims on China, Taiwan, and the GDR's political orientation or the orientation of their citizens would not matter when considering their admission. One argument in favor of the immediate acceptance of China over Taiwan was its size and numerical superiority. However, maintaining a non-political approach when dealing with disputes involving national and political entities became the key. All that mattered was that all those entities' academic or physics societies had asked to be recognized as IUPAP members and had presented a commendable case for their own acceptance.

The voting procedures went fairly smoothly at Ottawa: the acceptance of committees from Pakistan and Romania was unanimously approved; the East German proposal obtained forty-seven votes (the West Germans and Spaniards abstained); the PRC request received fifty-three votes (three abstained). Interestingly, the Taiwanese application received only thirty-eight votes, ten votes against, (mostly from Eastern bloc delegations like the USSR, Czechoslovakia, and Poland), and eight abstentions (including West Germany, Spain, and Japan). The five state delegations now accepted were Pakistan, Romania, East Germany, the Republic of China, and the People's Republic of China; but the latter eventually withdrew its application upon learning that Taiwan had submitted one too.[46]

At ICSU again

The decision taken at the IUPAP General Assembly subsequent to the 1958 political non-discrimination principle lent further support to the GDR Academy of Sciences' request to join ICSU, which was approved at the 9th ICSU General Assembly in London in 1961.

Prior to the conference, the President of the West German *Deutsche Forschungsgemeinschaft* (DFG), Gerhard Hess, vigorosly complained about the GDR application, which posed a challenge to DFG's standing as the sole representative of the German scientific community within ICSU. In his letter addressed to the ICSU President, Rudolf Peters, Hess posited that the inclusion of the GDR academy marked a politicization of scientific representation within ICSU. Less convincingly, Hess also contended that such inclusion was incongruous with ICSU's policy of political non-discrimination, from which, in fact, the deliberation originated.[47] Hess's letter to

[45] Pierre Fleury to Edoardo Amaldi, March 18, 1960, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

[46] Procès-verbal de la Dixième Assemblée Générale (1960), Janvier 1961, 24, series b2aa, vol. 3, folder 1 "General Reports 1923–1966," IUPAP Gothenburg.

[47] Gerhard Hess to Rudolf Peters, October 12, 1960, series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

Peters summarized the advancements made in previous years, indicating that scientific collaboration between East and West Germany was most effective when political considerations were minimized and open discourse was permitted without interference from party directives.[48] Consequently, he made a request to the Executive Committee to decline the East Berlin Academy's application for membership as a "national member."[49] He urged the academy and the DFG to collaborate and devise a proposal for the joint representation of both entities. Therefore, he asked that the German 'national member' not be represented at ICSU by separate East and West German institutions but rather collectively, under the all-encompassing name of Germany. Gerhard Hess held a similar stance during the Executive Committee meeting of ICSU in Lisbon in November.[50]

To counter this opposition, a secret gathering was held among delegates from various institutions and delegations representing the Soviet bloc. During the meeting, they deliberated on their voting strategy and agenda for ICSU, which entailed Poland putting forward the official proposal in support of the GDR application.[51]

The proceedings reiterated the contentious nature of the deliberations pertaining to the formal inclusion of the GDR within ICSU.[52] While the assembly accepted Hungary, Sri Lanka, and Ghana without the need for further discussion, the motion to accept the GDR was typified by a spirited debate, with the West German representative vibrantly opposing the proposal and advocating for ICSU to reject the motion.

The acceptance of Taiwan into ICSU produced similar tensions, too. The ICSU discussions on Taiwan and the GDR are a vivid example of the organizational structure and the respective roles of different actors in science diplomacy. The Soviet bloc demonstrated a strong commitment to opposing the inclusion of Taiwan in international associations under the auspices of ICSU. Similarly, the Western bloc actively opposed the recognition and admission of the GDR as a member.[53]

The biggest surprise of the 9th General Assembly was when Great Britain, specifically the Royal Society, announced that it was willing to sponsor the GDR's candidacy alongside the Polish Academy of Sciences, a representative of Poland. The proposal was opposed by West Germany and the USA, as well as by IUPAC's representatives. Poland's application was formally reviewed by a Special Commission consisting of India, Sweden, and the United Arab Republic. The Commission raised no formal

[48] Gerhard Hess to Rudolf Peters, October 12, 1960, folder 36, sign. DY 30/IV 2/9.04/386, SAPMO, Bundesarchiv. Also found in series e6, vol. 6, folder 19 "Federal Republic Germany," IUPAP Gothenburg.

[49] In German "*Nationales Mitglied*."

[50] Jens Niederhut, *Wissenschaftsaustausch*, 177.

[51] Sprawozdanie z IX. Walnego Zgromadzenia Międzynarodowej Rady Unii Naukowych/ICSU/, after September 1961, folder 142–143, sign. 237/XVI–243, series PZPR, Archiwum Akt Nowych (hereafter AAN), Warsaw.

[52] Sprawozdanie z IX. Walnego Zgromadzenia Międzynarodowej Rady Unii Naukowych/ICSU/, after September 1961, folder 142–143, sign. 237/XVI–243, series PZPR, AAN, Warsaw.

[53] Comité National Tchécoslovaque de Physique to Pierre Fleury, Secrétaire Général de l'IUPPA, July 28, 1960, series e5, vol. 5, folder 14 "Czechoslovakia," IUPAP Gothenburg.

objections. In the confidential vote that followed, fifty ICSU members voted in favor of accepting the GDR, fifteen members voted against, and three members abstained.[54]

The 1961 ICSU meeting in London was significant not only for the recognition of the GDR but also for the negotiation of the future structure and form of the organization. It was at this meeting that the ICSU Special Commission was elected to plan the transformation of ICSU. In addition to the direction and planning of major scientific projects, the agenda also included the establishment of contacts between Western academies and the new socialist academies, in which ICSU wanted to play a much greater role.[55]

Unquestionably, the Soviet bloc may be viewed as winning this item on the agenda of the ICSU meeting. The level of interest and response in Central and Eastern Europe was significant. Poland in particular demonstrated significant interest in joining the newly established Coordinating Committee. Its composition reflected existing power balances in that three additional members would be included in addition to the delegates from the four superpowers (Georges Laclavère of France, Harold W. Thomson of Great Britain, Evgeny Konstantinovich Fedorov of the USSR, and Brank of the USA).[56] The outcome of the commission's negotiations could have an impact on how major international scientific initiatives are structured in the future, and thus on how criteria for future scientific cooperation are set.

As a consequence of the establishment of this new committee, it was also agreed in London that the venue of the next ICSU board meeting (September 19–21, 1962), and Executive Committee (September 24–28, 1962) would take place in a country located behind the Iron Curtain. Prague was selected as the venue since the members of IUPAP anticipated that the choice of Prague would enhance the impact of academies within ICSU.

The resolution adopted by ICSU was a milestone in addressing the political ramifications of the Cold War that hindered the movement of East German scientists, although the London meeting had taken place right in the middle of the boycott and hence with East Germans virtually absent. According to the text, it can be inferred that during the initial discussions held in Moscow in May 1960, the DAW was accepted by six members of the ICSU Bureau, with no opposing votes and only one abstention. The abstention was made by Lloyd V. Berkner, the US scientist who was also a former ICSU President.

Conclusion

International science and its institutions served as a vehicle for the Soviet leadership's growing political confidence in the late 1950s and 1960s. Due to the Cuban missile crisis and Czechoslovakia's occupation by five armies of the Warsaw Pact in August 1968, this growth in political confidence brought the world to the brink of a third

[54] United Arab Republic was a political union of Egypt and Syria existing from 1958 to 1971.

[55] Sprawozdanie z IX. Walnego Zgromadzenia Międzynarodowej Rady Unii Naukowych/ICSU/, after September 1961, folder 144, sign. 237/XVI–243, Series PZPR, AAN, Warsaw.

[56] Sprawozdanie z IX. Walnego Zgromadzenia Międzynarodowej Rady Unii Naukowych/ICSU/, after September 1961, folder 144, sign. 237/XVI–243, Series PZPR, AAN, Warsaw.

world war in the realm of international relations. In the realm of international science, however, the scientists of the Soviet bloc owed this growing Soviet self-confidence to the fact that representatives of socialist states made their way into the international scientific community.

The inclusion of the GDR into global scientific frameworks represented a significant triumph for the Soviet sphere. The GDR's standing within the global scientific community was tenuous, and its scientific community underwent a challenging phase of complete international seclusion. This period persisted until 1959–1960 when the USSR initiated international collaboration and advanced its objectives on the international stage. The cessation of isolation was formalized in 1972, coinciding with the GDR induction as a recognized member of UNESCO.

International scientific institutions were not successfully instrumentalized to the same extent as global international organizations like the UN and UNESCO, which served as a battlefield for certain national and political goals. In contrast, national scientific associations frequently advocated for scientific internationalism, even when it conflicted with the political or international objectives of their respective nations. The scientific community's persistent search for and discovery of novel alternative approaches served as the foundation for the grassroots implementation of science diplomacy during the Cold War. Simultaneously, the case of the GDR highlights an effective approach to science diplomacy from within the Soviet bloc in that there was a successful search for the "stumbling block" that prevented the GDR admission to international science and an understanding of how once that was down, metaphorically speaking, all the others (i.e., exclusion from other societies) would crumble.

Acceptance of the GDR as a member of IUPAP was a dynamic process that was prompted by the 1958 ratification of the ICSU Resolution of Political Non-Discrimination and led to the 1963 establishment of the ICSU Standing Committee on the Free Circulation of Scientists (SCFCS). The ICSU Executive Committee Meeting in Prague on September 19–21, 1961 recalled the prioritization of visa policies in socialist nations and third world countries, especially in response to the travel boycott of GDR scientists.[57] After that, the SED tasked its officials and scientists with producing a thorough report on the mobility patterns of the East European community. As a result, the first contribution officially presented by the GDR after the entry of the GDR to ICSU was this report. This paved the way, in 1963, to the formation of the SCFCS. The committee's membership in 1963 consisted of the United Kingdom, France, the Soviet Union, Czechoslovakia, the United States of America, and Norway.[58] The underlying rationale was straightforward and drew on the discriminatory experience of East German scientists with the Allied Travel Office located in Berlin. Even after the establishment of this committee, however, East Germans continued to travel as private citizens rather than as representatives of recognized GDR institutions.

[57] Zasedání ICSU v Praze 1962, point 9, Archival Unit 394, file 233, Series Central Committee of the Communist Party of Czechoslovakia—Secretariat 1954–1962, National Archives of the Czech Republic, Prague.

[58] Greenaway, *Science International*, 94–5.

The executive organs of ICSU experienced a boost in the Soviet bloc's prestige during its session in Prague. This was evidenced by the subsequent election of the Czech microbiologist Dionýz Blaškovič to the position of Secretary General in the following year. Blaškovič served as the first representative of the Soviet bloc in this capacity from 1963 to 1966.[59] Attributable to his efforts, Czechoslovakia became a member of the SCFCS. There is no doubt that Engelhardt, as the Soviet Vice-Chair of ICSU, helped to elect him. Blaškovič's election to the ICSU leadership, on the other hand, was further evidence of the changing nature of international cooperation in science. The event marked the initiation of the ascendance of Soviet sway in ICSU, which persisted until 1972. This culminated during the period from 1968 to 1972 when the presidency of ICSU was occupied by Viktor A. Ambartsumian (1908–96), a Soviet professor of astrophysics of Armenian origin.[60]

The scenario involving IUPAP, in conjunction with the IUBS, the IUHPS, URSI, and the IUPS, was unique. The biological sciences in the Soviet Union were significantly influenced by Stalinism and the indoctrination of science, particularly in the fields of biological and physiological sciences, which were impacted by Lysenkoism and radical Pavlovism. In contrast, physics and radio sciences were considered strategic by both sides of the Iron Curtain. The aforementioned hindrances resulted in a setback in their smooth integration into international societies. The political tensions arising from the implementation of the Hallstein doctrine and the subsequent erection of the Berlin Wall were compounded by ideological differences and a deferred discussion on the role of dual representation of the GDR and the FRG in these scientific unions and ICSU.

At the beginning of the 1950s, however, the German scientific community assumed that the re-establishment of a unified German state was only a matter of a few years. Until 1955, there were no signs that the international situation was moving towards a definitive division of the two German states. Their policy of calculated ambiguity fundamentally influenced the practical implementation of foreign policy of both states, and cooperative antagonism thus became one of the successful strategies for negotiating the gradual steps leading to the final settlement of the position of the two German republics on the international scene.

After the de-Stalinization of the Soviet sphere, global cooperation had begun to flourish, but political divergences were becoming an obstacle. The conflicting international objectives and aspirations of the opposing blocs heightened the pace of cooperation and antagonisms, which alternated rapidly and stimulated discourse within the global scholarly community. The divergent interests of the two blocs were offset by their respective requirements for global acknowledgment of the GDR and Taiwan. Both states were admitted not due to altruistic motives or collaborative efforts, but rather as a result of a mutually beneficial approach of win-win strategy if not necessity.

What remained was the dispute over official state names. The inclusion of the names of both communities, along with their respective states, emerged as a

[59] Greenaway, *Science International*, 243.
[60] Greenaway, *Science International*, 243.

prominent topic on the political agenda of the official minutes of IUPAP. The nomenclature employed by the FRG and the GDR officially reflected the political division, which ran counter to the scientific community's desire to remain impartial. The Executive Committee of IUPAP has implemented a policy that aims to steer clear of any political connotations related to terminological matters. In their written works, they have consistently referred to West Germany as "Allemagne de l'Ouest" and East Germany as 'Allemagne orientale.'

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13
Edoardo Amaldi and the Scientific Collaboration with the USSR

Daniele Cozzoli

Soviet Physics and the West

This essay focuses on the role Edoardo Amaldi played in promoting international scientific collaboration with the Soviet Union during his presidency of the International Union of Pure and Applied Physics (IUPAP). Amaldi was President of the Union for three years, between 1957 and 1960, a crucial period for the processes of decolonization, European integration, and the Cold War confrontation. Although the views and the actions of physicists in IUPAP cannot be considered as a direct consequence of their governments' decisions, the development of international cooperation in physics must be framed within a broader political context.

In the 1950s theoretical physics and mathematics became the most advanced scientific fields in the USSR.[1] A group of talented young physicists, the most important of whom was Lev Davidovich Landau, had introduced quantum mechanics in the USSR in the previous decades and developed it throughout the 1940s and 1950s.[2] In 1956, the Joint Institute for Nuclear Research was created in Dubna, with the aim that it should play the same role as the European Organization for Nuclear Research (CERN) for the socialist camp. One year later, the Soviets built Akademgorodok, the city of science in Siberia.[3] In 1958, three Soviet scientists, Igor Tamm, Ilya Frank, and Pavel Cherenkov, were awarded the Nobel Prize in physics "for the discovery and the interpretation of the Cherenkov effect." Four years later, it was the turn of Lev Landau to be awarded the Nobel Prize.

Thus, it comes as no surprise that in the 1950s many Western physicists became interested in knowing more about research carried out by their colleagues in the USSR. Soviet books were translated into Western languages throughout the 1950s and 1960s. Landau and Lifshitz's textbooks were translated into English beginning in 1951.[4]

In 1977, a survey of the US National Academy of Sciences (NAS), which assessed the exchange program between the NAS and the Academy of Sciences of the Soviet

[1] See Alexei Kojevnikov, *Stalin's Great Science: The Times and Adventures of Soviet Physicists* (London: Imperial College Press, 2004), 72.

[2] Kojevnikov, *Stalin's Great Science*, 78.

[3] See Paul Josephson, *New Atlantis Revisited: Akademgorodok, the Siberian City of Science* (Princeton: Princeton University Press, 1997).

[4] See Karl Hall, "'Think Less about Foundations': A Short Course on Landau and Lifschitz's *Course of Theoretical Physics*," in *Pedagogy and the Practice of Science: Historical and Contemporary Perspectives*, ed. David Kaiser (Cambridge: MIT Press), 253–86.

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Union, reported that US physicists and astronomers considered very positive the exchange program with their Soviet colleagues, even "if they feel the program had not been useful to them in generating new results." Physicists deemed very important the sharing of existing knowledge.[5] Nonetheless, in 1957, when Amaldi was elected President of IUPAP by Western scientists, the Soviet Union was still "a riddle wrapped in a mystery inside an enigma," as Winston Churchill said in a BBC radio broadcast delivered on October 1, 1939.

The Election of Amaldi and Relations with the Soviets

The re-establishment of relations with Soviet physicists was one of the main reasons for the appointment of Amaldi as President of IUPAP. Amaldi's candidacy was promoted by the President of the Union, Nevill F. Mott, and the Secretary General, Pierre Fleury (Figure 13.1).

On August 16, 1956, Mott asked Amaldi if he could propose his name to the Executive Committee of IUPAP for the presidency of the Union. Mott recalled that the most important task of the previous years had been the re-establishment of the contacts with Soviet physicists in the international community: "When I accepted the position as successor of Kramers I thought that the chief and most important job of the Union would be in re-establishing contact with the Russians."[6] Mott and Fleury had previously established contacts with Soviet physicists. On November 2, 1955 Fleury sent a letter to the Soviet Embassy in Paris addressed to the President of the Academy of Sciences of the Soviet Union, in which he asked the academy to join IUPAP.[7] Some months later Patrick Blackett also sounded out Vladimir Englehardt, a member of the Academy of Sciences of the Soviet Union, at a meeting of the International Council of Scientific Unions (ICSU).[8] The inclusion of the Soviet Union in IUPAP was part of the mission of the Union, as one of its aims was to create and encourage international cooperation in physics.[9] Amaldi accepted Mott's proposal.[10] On December 10, 1956 Mott communicated to Amaldi that the Executive Committee agreed on his candidacy.[11] Some years before Mott had collaborated with the Italians to circulate Eastern European science in the West. Mott wanted the translation of a number of Eastern Europe studies into English. Giovanni Polvani offered the journal of the Italian Physics Society (SIF, from its Italian name *Società Italiana di Fisica*) he

[5] Karl Kaysen, *Review of U.S.-U.S.S.R. Interacademy Exchanges and Relations*, (Washington, DC: National Academy of Sciences, 1977), 70.

[6] Nevill Mott to Edoardo Amaldi, August 16, 1956, box 34, folder 1, subfolder 2, "IUPAP 1948–1959," Fondo Edoardo Amaldi, subfondo Archivio Dipartimento di Fisica, Physics Department Archives of Sapienza University of Rome (hereafter AEA).

[7] Pierre Fleury to the President of the Academy of Sciences of the Soviet Union, November 2, 1955, series E6, vol. 12, folder 42, "Russia 1947–1999," IUPAP, Gothenburg secretariat, Center for the History of Science, Royal Swedish Academy of Sciences (hereafter IUPAP Gothenburg).

[8] Patrick Blackett to Fleury, January 18, 1956, series E6, vol. 12, folder 42, "Russia 1947–1999," IUPAP Gothenburg.

[9] *L'Union Internationale de Physique Pure et Appliquée. Procès verbal de la VIIIe Assemblée Générale*, 29, series B2aa, vol. 1, IUPAP Gothenburg.

[10] Amaldi to Fleury, August 22, 1956, box 34, folder 1, subfolder 2, AEA.

[11] Mott to Amaldi, December 16, 1956, box 34, folder 1, subfolder 2, AEA.

Figure 13.1 Edoardo Amaldi at the IUPAP Executive Committee meeting in 1952. To his left is John Slater. In the center on the opposite side of the table Nevill F. Mott and Pierre Fleury can be recognized

Source: Sapienza University of Rome, Archives of the Department of Physics, Edoardo Amaldi Fund, Amaldi Heirs Archive Subfund, third deposit, box 3, folder Photo Collection 4. Image digitized by the Sapienza Library System, and extracted from the Sapienza Digital Library digital resource (URI: AMALDI0265).

directed, *Il Nuovo Cimento*.[12] Two special issues of *Il Nuovo Cimento* came out, the first one in 1953 and the second one in 1955.[13] Mott was disappointed because contacts had been re-established at the Geneva conference on Atoms for Peace in 1955

[12] See Boutry to Fleury of February 8, 1954 and Amaldi to Polvani in AEA box 34, folder 1, subfolder 2. Polvani had been a member of the Union's commission on publication since 1954. See International Union of Pure and Applied Physics. Position at January 1, 1958. "Report of the Ninth General Assembly (1957)," 9, in series B2aa, vol. 1, folder A, IUPAP Gothenburg.

[13] See *Il Nuovo Cimento*, April 1953, supplement issue 4, and January 1955, vol. 1, supplement issue 4, "Rassegne di Lavori di Fisica Pubblicati Negli ultimi Anni in Europa Orientale e Particolarmente in Russia." Contributions of the 1953 Special issue included J. Turkevich, "Soviet Physics;" R. W. Cahn, "Soviet Work on Mechanical Twinning;" A. L. Mackay, "Recent Soviet Work in the Field of Crystallography;" A. L. Mackay, "Crystallography in Eastern Europe;" M. Magat, "Travaux soviéetiques sur la théorie de la liaison chimique"; S. Rosemblum, "Sur les travaux de magnétisme en U.R.S.S.;" D. Schoenberg, "Recent research on superconductivity in the U.S.S.R."; W. J. Swiatecki, "Polish Physics;" G. Wataghin, "Recent research on cosmic radiation in the Soviet Union;" J. Wilks, "Recent Russian work on liquid helium." Contributions to the 1955 Special issue included: J. G. Valatin, "Foreign Language Publications in Physics of the Hungarian Academy of Science;" L. Jánosst, "Survey of Researches in Physics in Hungary (I);" B. S. Lement, "Review of Recent Papers on Martensitic Transformations Published in the USSR;" A. Stoyko, "Travaux soviétiques

and not thanks to the efforts of the Union. Nonetheless, Mott thought that IUPAP had to play a part in re-establishing connections with Soviet physicists.

It had been diplomatic action rather than that of scientists that fostered the resumption of contacts with the USSR. On July 18, 1955 a meeting between the foreign affairs ministers of Britain, France, the USA and the USSR took place in Geneva. The three Western ministers submitted a seventeen-point proposal to remove barriers on information and science to the Soviet foreign affairs minister, Vyacheslav Molotov, who rejected it. Molotov was instead willing to promote bilateral or multilateral agreements, which could mirror what was of interest for the countries involved.[14] After the Geneva meeting, the USA and the USSR started discussing an agreement on cultural, scientific and technological cooperation. In the same year, 1955, a few cultural exchanges took place. US scholars, politicians, and religious leaders visited the USSR. Soviet musicians performed in the USA and vice versa.[15] In December 1955, Alexander Nesmeyanov, the President of the Academy of Sciences of the Soviet Union, invited a delegation of ten or twelve members of the US NAS to visit the USSR for three to four weeks to discuss future collaboration. Detlev Bronk, the President of the NAS, took his time. He discussed the matter with the Department of State. In August and October 1956 two drafts of answers were prepared.[16] In October 1956, however, after the Soviets invaded Hungary, the USA broke off negotiations.[17] The re-establishment of connections with the Soviets was the result of the combined geopolitical strategies of the USA and the USSR, in which science and technology played a pivotal role. Mott and Fleury thought that physicists had to take the initiative. In 1956, the Academy of Sciences of the Soviet Union had officially asked to enter IUPAP.[18] On October 4, 1957 the Soviets launched Sputnik 1, the first unmanned satellite to orbit around the Earth. It was the beginning of the space race, but it also accelerated the resumption of negotiations between the USA and the USSR. In the same years in which scientific and technological competition between the two blocs was intensified, the USSR and the USA also resumed their collaboration on science and technology. In 1958 the "Agreement Between the United States of America and the Union of Soviet Socialist Republics on Exchanges in the Cultural, Technical and Educational Fields," the so-called the Lacy–Zaroubin Agreement, was signed. Under the Lacy–Zaroubin scheme some 400 US researchers and 400 Soviet researchers traveled each way. By the end of the 1950s the USSR and some of the Eastern European countries also returned to a number of international organizations from

sur le service de l'heure;" A. Stoyko, "Rapport succinct sur les travaux russes d'astronomie fondamentale;" and two errata by Mackay. See also, the chapter by Da Silva in this volume.

[14] Robert F. Byrnes, *Soviet-American Academic Exchange, 1958–1975* (Bloomington: Indiana, 1976).

[15] Yale Richmond, *Cultural Exchange and the Cold War: Raising the Iron Curtain* (Philadelphia: University of Pennsylvania Press, 2003), 10.

[16] Memorandum From Cornell to Bronk of January 15, 1958, NAS/NRS Archives, "International Relations 1959." US-USSR exchange of scientists. Interacademy Agreement: Agreement.

[17] Memorandum of Zaroubin-Lacy, conversation of September 9, 1957, Central Intelligence Agency (CIA) Archives available under the FOIA RDP62S00346A000100050001-1; translated copy of Memorandum handed to Ambassador Lacy by Zaroubin in CIA Archives available under the FOIA CIA-RDP62S00346A000100050002-0.

[18] Mott to Amaldi, August 16, 1956, box 23, folder 1, subfolder 2, AEA.

which they had withdrawn in the Stalin years, such as the World Health Organization (WHO), the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and IUPAP itself. This strategy mirrored Khrushchev's design of competing peacefully for worldwide hegemony with a view to the countries that were gaining independence from their former colonizers. "Peaceful coexistence" would allow the Soviet Union to boost the domestic standard of living. At the same time scientific and technological achievements would expand Soviet influence in the developing countries. In Khrushchev's view, in the medium run, the standard of living of citizens of the Soviet Union would overtake that of US citizens, and in the long run capitalism would collapse. In 1961, after the Soviets had sent the first man into space, Khrushchev declared that by the end of the decade the USSR would overtake the USA in the standard of living of its citizens. This claim is often understood in the light of the so-called Kitchen Debate, and after the collapse of the USSR it might appear to be a boastful statement. It is worth noting, however, that at the beginning of the 1960s all major US economists were persuaded that, given the current growth rates, the Soviet economy would overcome that of the USA in a few decades. In 1961, Paul Samuelson foresaw that the Soviet economy would overtake that of the USA in a period of between twenty-three and thirty-six years.[19]

US science policymakers were interested in closer contact with the Soviets. In 1977, a report of the NAS, the federal institution that under the Lacy–Zaroubin Agreement was in charge of the management of the interchange program with the Soviet Academy of Sciences, remembered that the program had allowed to keep a closer eye on the Soviets' progress in science and technology and avoid another Sputnik surprise.[20]

Amaldi as a Science Policymaker

Edoardo Amaldi was proposed by Fleury and Mott as President of the Union. Mott appreciated Amaldi's personal qualities. He wrote to Amaldi that some members of the Executive Committee (including himself) thought that Fleury was too formal. Amaldi replied that:

> During the Assembly I was also told by some of the members that Fleury seems to be sometimes formal in his Secretary's work. I must however tell you that I am not able to understand quite well what he ought to do to improve his office organization.
>
> I will, on my hand, try to keep personal contacts with the various national committees. Any advice you will give to me will be extremely helpful.[21]

In the following years, Amaldi and Fleury worked together to stimulate international cooperation. Whenever a complex question arose, Amaldi consulted Mott.

[19] See David M. Levy and Sandra J. Peart, "Soviet Growth and American Textbooks: An Endogenous Past," *Journal of Economic Behavior and Organization*, 78 (2011): 110–25.

[20] Kaysen, *Review.*

[21] Amaldi to Mott, October 1, 1957, box 106, folder 4, subfolder 1, "Corrispondenza Presidente 1957–1960," AEA.

Amaldi was proposed not only because of his personal qualities, but also because of his vision and his ability to handle intertwined complex issues. Amaldi was a pupil of Enrico Fermi, who had gathered around him a number of talented young physicists mostly working on nuclear physics and cosmic rays. According to Amaldi, the events of 1938—the Nazi occupation of the Sudeten, the *Anschluss*, and the promulgation of the Racial Laws in Italy, which restricted liberties for Italian citizens of Jewish origin—were crucial for the history of the group.[22] Apart from Ettore Majorana, who had disappeared with no trace during a sea journey from Palermo to Naples in 1935, all the others were affected in one way or another by the events of 1938.[23] Fermi, whose wife was Jewish, went to Stockholm for the award ceremony of the Nobel Prize and did not return to Italy. He and his family embarked on a ship to the USA, formally accepting an invitation as visiting professor at Columbia University, and did not go back to Italy.[24] Emilio Segrè and Bruno Pontecorvo were already abroad. Segrè was in Berkeley, and decided not to go back to Italy. He was in a way forced to stay as he had been "released from service." Pontecorvo was in Paris, but after the Racial Laws could not return to Italy.[25] Two years later, when the Germans occupied Paris, he fled to Canada. Franco Rasetti had moved to Canada in 1939.[26]

Amaldi on the contrary decided to remain in Italy. After the war, he took the lead of the whole community of Italian physicists. His task was to (re)construct Italian

[22] Edoardo Amaldi, "Gli Anni della Ricostruzione," 1979, box 89, folder 3, Fondo Edoardo Amaldi, subfondo Edoardo Amaldi Eredi, Physics Department Archives of Sapienza University of Rome (hereafter AAE). The manuscript was published by Gianni Battimelli in the *Giornale di Fisica*; see also Edoardo Amaldi, *Da via Panisperna all'America: I fisici italiani e la Seconda guerra mondiale*, G. Battimelli, M. De Maria, and A. La Rana, second expanded edn, (Rome: Editori Riuniti, 2022). On the Racial Laws and the persecution of the Jews see Renzo de Felice, *Storia degli Ebrei Italiani sotto il Fascismo* (Turin: Einaudi, 1972); Enzo Collotti, *Il fascismo e gli ebrei* (Rome-Bari: Laterza, 2006). On the persecution of Jewish scientists and their diaspora, Edoardo Amaldi, "Il caso della fisica," in "Le conseguenze culturali delle leggi razziali," *Atti del Convegno Lincei 84* (Rome: Accademia Nazionale dei Lincei: 1990), 107–133; Giorgio Israel and Pietro Nastasi, *Scienza e razza nell'Italia fascista* (Turin: Boringhieri 1998); Roberto Maiocchi, *Scienza italiana e razzismo fascista* (Florence: La Nuova Italia, 1999); Francesco Cassata, *Molti, sani e forti. L'Eugenetica in Italia* (Turin: Bollati Boringhieri, 2006); Francesco Cassata, *"La Difesa della razza". Politica, ideologia e immagine del razzismo fascista* (Turin: Einaudi, 2008); Annalisa Capristo, "Italian Intellectuals and the Exclusion of Their Jewish Colleagues from Universities and Academies," *Telos* 164 (2013): 63–95; Annalisa Capristo, "L'impatto delle leggi del 1938 sulla comunità scientifica italiana," in *Bruno Zevi intellettuale di confine. L'esilio e la guerra fredda culturale italiana 1938–1950*, ed. F. Del Bello (Rome: Viella, 2019), 79–100.

[23] Majorana's disappearance would later give rise to a number of hypotheses and even to novelistic reconstructions: Leonardo Sciascia, *La scomparsa di Majorana* (Turin: Einaudi, 1975); Erasmo Recami, *Il caso Majorana. Epistolario, documenti, testimonianze* (Milan: Mondadori, 1987); Erasmo Recami, *Il vero Ettore Majorana* (Rome: Di Renzo Editore, 2017); João Magueijo, *A Brilliant Darkness: The Extraordinary Life and Disappearance of Ettore Majorana, the Troubled Genius of the Nuclear Age* (New York: Basic Books, 2009).

[24] On Fermi see Emilio Segrè, *Enrico Fermi, Physicist* (Chicago: University of Chicago Press, 1972); G. Maltese, *Enrico Fermi in America. Una biografia scientifica* (Bologna: Zanichelli, 2003).

[25] Later on Pontecorvo fled to the USSR. He also became a member of the Soviet National Committee of IUPAP. See Union Internationale de Physique Pure et Appliquée. Circulaire d'information Juillet 1960, box 107, folder 2, "Corrispondenza e documentazione IUPAP 1957–61," AEA. On Pontecorvo see Miriam Mafai, *Il lungo freddo. Storia di Bruno Pontecorvo, lo scienziato che scelse l'URSS* (Milan: Rizzoli, 2012); Simone Turchetti, *The Pontecorvo Affair: A Cold War Defection and Nuclear Physics* (Chicago: Chicago University Press, 2012); F. Close, *Half-Life: The Divided Life of Bruno Pontecorvo, Physicist or Spy* (New York: Basic Books, 2015).

[26] On Rasetti see Valeria Del Gamba, *Il ragazzo di via Panisperna* (Turin: Bollati Boringhieri, 2007); C. Buttaro and A. Rossi, *Franco Rasetti. Una Biografia Scientifica* (Rome: Aracne, 2007).

physics.[27] The diaspora had not only affected Fermi's group. Bruno Rossi, Giulio Racah, Ugo Fano, Eugenio Fubini, Sergio de Benedetti, Leo Pincherle, and others had also left the country between the late 1930s and the 1940s. One should say that, rather than 'reconstruct' Italian physics, an altogether new way of doing physics was 'constructed'. After World War II, research in certain sectors of physics, such as nuclear physics, could not be carried out at a small-scale laboratory level, but required the construction of big machinery, huge resources, and the coordination of various subjects, such as the state, the scientific community, and industry. This was also one of the reasons for Fermi, Segrè and other Italian physicists to migrate to the USA and not to return after the war ended. Doing research in physics after World War II was not just a matter of hiring and instructing a small group of talented young physicists as in Fermi's time.

Soon after the war, Amaldi, together with Gilberto Bernardini, Gian Carlo Wick, and Bruno Ferretti, decided that the scant resources of Italian physics should be concentrated in a few centers of excellence.[28] At the same time, between 1947 and 1951, Amaldi explored the possibility of building a particle accelerator in Italy. The small accelerator of the *Istituto Superiore di Sanità* (the Italian National Institute of Health) could compete with analogous machines in the major European and US laboratories.[29] Soon, however, the construction of nuclear reactors would have made these machines obsolete. Amaldi's attempts to build a more powerful particle accelerator, however, did not materialize.[30]

Inter-European Scientific Collaboration

These experiences likely led Amaldi to think that physics could not be carried out in Italy unless the country was integrated into an international-scale research context. He promoted both the creation of the National Institute of Nuclear Physics (INFN) and of CERN, of which he became General Secretary between 1952 and 1954.[31] In Amaldi's view the national venture and the inter-European one had to be complementary.[32] The Italians created a commission within the CNR (*Centro Nazionale delle Ricerche*, the Italian National Research Council) to coordinate the work of Italian physicists who were involved in IUPAP, this committee acting as the IUPAP national committee.[33] The committee also commented on Italian participation in the CERN project.[34]

[27] See Amaldi, 1979 "Gli Anni della Ricostruzione;" Edoardo Amaldi, *Da via Panisperna.*

[28] See Amaldi 1979 "Gli Anni della Ricostruzione."

[29] See Giovanni Battimelli, "Le origini del laboratorio di fisica," *Rendiconti dell'Accademia Nazionale delle Scienze detta dei XL. Memorie di scienze fisiche e naturali V* XXIII, II, I (1999): 149–60.

[30] See Giovanni Battimelli and Ivana Gambaro, "Da via Panisperna a Frascati: gli acceleratori mai realizzati," *Quaderni di Storia della Fisica* 1 (1997): 319–33.

[31] Amaldi had been sounded out for directorship of the CERN laboratories but refused as he would have not had time to devote to research.

[32] See H. Armin, J. Krige, and D. Pestre, *A History of CERN*, 3 vols. (Amsterdam: North Holland, 1987–1996); G. Battimelli, M. De Maria, and G. Paoloni, *L'Istituto Nazionale di Fisica Nucleare. Storia di una comunità di ricerca* (Roma-Bari: Laterza, 2001).

[33] Minutes of the meetings of this commission are in box 106, folder 1, "IUPAP 1948–61," AEA.

[34] Comitato Nazionale di Fisica di collegamento con la IUPAP, box 106, folder 1, "IUPAP 1948–61," AEA.

In the diaspora of Fermi's group there was a clear divide between those, like Fermi himself and Segrè, who participated in military research, and those, like Rasetti, who did not want to be involved in the construction of nuclear weapons. Rasetti gave up physics and focused instead on paleontology, geology, and botany. Amaldi was persuaded that research in physics had to be kept free from the military. When he paid a visit to Fermi, he was struck by the militarization of physics in the USA. Fermi could not speak freely to him of his research. Nor could Amaldi visit Fermi's laboratory.[35] The secrecy on research hindered the free circulation of ideas.

During fascism, Amaldi also learned something about the relations between science and politics. The "via Panisperna boys", as Fermi's research group was called, always recalled that Orso Mario Corbino, professor of experimental physics in Rome and Fermi's mentor, was worried about the rise of fascism, and that he aimed to protect the group from political interference. When Mussolini was entrusted by the king to form the government after the march on Rome, he formed a government including Catholic and liberal ministers. In 1923, the liberal Corbino was appointed Minister of National Economy, a newly created ministry. Fermi was appointed to the newly created *Reale Accademia d'Italia*, the institution that Mussolini created to contrast the *Reale Accademia dei Lincei*, which was dominated by antifascist scientists.

Amaldi had not compromised with fascism, and after the fall of fascism never adhered to any political party nor held any political post. He became a model civil servant.

In 1957, when Amaldi became President of IUPAP, the Treaties of Rome were signed. Although the process leading to the signature of the Rome Treaty was the result of negotiation between conflicting views, both the USA and the major European countries promoted the creation of forms of stronger inter-European economic integration.[36] The creation of inter-European scientific organization was also promoted as part of this process. Amaldi struggled for the peaceful nature of all the inter-European institutions. It can be instructive to consider Amaldi's contemporary action with regard to space and satellites research. At the eighth General Assembly of, the International Council of Scientific Unions (ICSU), which took place in Washington on October 2–6, 1958, it was decided to create the Committee on Space Research (COSPAR). The primary purpose of the new committee was "to provide the world scientific community with the means whereby it may exploit the possibilities of satellites and space probes of all kinds for scientific purposes."[37] ICSU aimed to continue the collaboration on satellites and space research of the International Geophysical Year (IGY). IUPAP, which formed part of ICSU, also participated in meetings of COSPAR.[38] In December 1959, Amaldi was asked to represent IUPAP in COSPAR,

[35] Amaldi "Gli Anni della Ricostruzione."

[36] See Alan Milward, *The Reconstruction of Postwar Europe* (London: Routledge, 1984); P. M. Leffler, *A Preponderance of Power: National Security, the Truman Administration, and the Cold War* (Stanford: Stanford University Press, 1992); G. Lundestad, *"Empire" by Integration: The United States and European Integration, 1945–1997* (Oxford: Oxford University Press, 1998).

[37] Eighth General Assembly of ICSU, State Central Archive, National Research Council, Space Activities, San Marco series (hereafter ACS/CNR/Attività Spaziali/Serie San Marco) B 1.

[38] See Union Internationale de Physique Pure et Appliquée, "Rapport du Secrétariat générale," Avril 1960, box 107, folder 2, "Corrispondenza e documentazione IUPAP 1957–61," AEA.

but he refused.[39] Amaldi likely did not want an international role in COSPAR. On April 30, 1959 he sent a report to the President of the CNR and to a selected group of scientific policymakers in Europe.[40] This report reveals Amaldi's strong position with regard to the peaceful use of scientific research and inter-European cooperation. After summarizing the most important research that had been carried out and the most important results that had been achieved thanks to rockets and satellites up to that time, Amaldi suggested creating an inter-European institution in the field of space research and technology along the lines of CERN. He recalled that only the USA and the USSR had been able to launch satellites hitherto. If European countries did not want to be left out of space research and technology, they should set up an inter-European organization like CERN. According to Amaldi, the venture was urgent, otherwise within twenty years the gap would be too huge to catch up later. He recalled that satellite launches entailed not only achieving major scientific breakthroughs, like the discovery of the Van Allen radiation belts, the study of the atmospheric density up to the height of 400 km, and the measurement of the flow of micro-meteorites. They also entailed "an extraordinary industrial and technological development in the field of propellants, metallurgy, electronics, etc., development that has consequences on the whole productive level of the country."[41] Amaldi was also aware of the huge resources that such an organization required; his rough estimation was that the budget should be twice as large as that of CERN, some 130 million CHF.[42] Both Rabi and Kármán suggested that the North Atlantic Treaty Organization (NATO) could be involved in the project.[43] But Amaldi wanted to keep research free from the military. It is worth recalling that in the 1960s Amaldi would also be involved in the Pugwash movement.[44]

[39] D. C. Martin to Fleury, December 3, 1959, box 106, folder 6, subfolder 6, "Corrispondenza Fleury," AEA.

[40] John Krige and A. Russo, *A History of the European Space Agency, 1958–1987. Vol I. The Story of ESRO and ELDO, 1958–1973* (Noordwijk: ESA, 2000), 19. The group also included Auger, President of the French CRS, J. H. Bannier, the director of the Netherlands Organization for the Advancement of Pure Research (ZWO), A. Hocker, at the German *Bundesministerium für Atomfragen*, J. Willems, the President of the Belgian *Institut Inter-Universitaire de Sciences Nucléaires*, C. J. Bakker, CERN's Director General, and the President of the Euratom Commission. See also Michelangelo De Maria and Lucia Orlando, *Italy in Space: In Search of a Strategy* (Paris: Beauchesne, 2006); M. De Maria, *Europe in Space: Edoardo Amaldi and the Inception of ESRO*, available at https://www.esa.int/esapub/hsr/HSR_05.PDF.

[41] Edoardo Amaldi, Introduzione alla discussione su: Ricerche Spaziali in Europa, ACS/CNR/Attività Spaziali/Serie San Marco B 1. What later came to be called the Van Allen belts were discovered thanks to Explorer 1; see Krige and Russo, *A History*, 7.

[42] Edoardo Amaldi Introduzione alla discussione su: Ricerche Spaziali in Europa in ACS/CNR/Attività Spaziali/Serie San Marco B 1. See Lodovica Clavarino, *Scienza e politica nell'era nucleare. La scelta pacifista di Edoardo Amaldi* (Rome: Carocci, 2014).

[43] See Lorenza Sebesta, "Italian Space Policy," in *Italy in Space: In Search of a Strategy* ed. Michelangelo De Maria and Lucia Orlando (Paris: Beauchesne, 2006), 51.

[44] Alison Kraft and Carola Sachse, eds., *Science, (Anti-)Communism and Diplomacy* (Leiden: Brill, 2019). See Lodovica Clavarino, *Scienza e politica nell'era nucleare. La scelta pacifista di Edoardo Amaldi* (Rome: Carocci, 2014); Lodovica Clavarino, "Italian Physicists and the Bomb: Edoardo Amaldi's Network for Arms Control and Peace during the Cold War," *Journal of Contemporary History* 56, no. 3 (2021): 665–92.

Amaldi was far from being anti-American. In a letter in support of Amaldi's candidacy, Fleury praised Amaldi's personality and also stressed the importance of his connections with the USA.[45]

The Two Germanies and the Two Chinas

As President of IUPAP Amaldi promoted his view of peaceful inter-European and international scientific collaboration. Amaldi, Mott, and Fleury worked together to integrate Soviet physicists into IUPAP's activities.

At the Rome Assembly of IUPAP on September 17–20, 1957 the USSR became a member of the Union. In 1958, Amaldi was appointed foreign member of the Academy of Sciences of the USSR.

Soon after Amaldi's election, Mott ironically reminded him which were to be his most difficult tasks: "I very much hope you enjoy your six years of office with the Russians and the Chinese, I think you will have an interesting time."[46] As President of the Union, Amaldi had to face two big questions: the entrance into the Union of the German Democratic Republic and of China. As there are two chapters dedicated to these matters in this book, we will not follow the details of the events, but we will focus on how Amaldi handled the issue. West Germany had been a member of IUPAP since 1952 under the name *Deutsches Nationales Komitee*.[47] In most scientific associations which adhered to ICSU, East Germany and West Germany participated together under names that did not mention the two states, but only the German nation. On September 21, 1955, Alfred Büchner, the Secretary of the East German Physical Society, wrote to Fleury to enquire about the conditions for joining the Union.[48] As early as 1956, physicists of the two Germanies began negotiating joint participation. Thus, Gerlach, on behalf of the West German Physical Society, asked Fleury to stop the adhesion procedure of East Germany.[49] Negotiations did not come up with a positive solution, and in 1959 Büchner officially asked to join IUPAP. In 1958, both Taiwan and the People's Republic of China asked to join the Union. As already recalled, IUPAP was committed to encouraging international cooperation, so Amaldi's duty as President was to promote integration of the communities of physicists. Moreover, the IUPAP statutes stated that any country could be represented in the Union, whereas a country was defined as "*tout territoire ayant une activité scientifique indépendante*."[50] Thus, for IUPAP a country did not coincide with an independent state. At the meeting

[45] Fleury to Amaldi, August 13, 1956, box 34, folder 1, subfolder 2, AEA.

[46] Mott to Amaldi, September 24, 1957, box 106, folder 4, subfolder 1, "Corrispondenza Presidente," AEA.

[47] See the chapters in this volume by Olšáková, and by Hu, Liu, and Yin.

[48] A. Büchner to Fleury, September 21, 1955, series E6, vol. 7, folder 20, "German Democratic Republic 1955–1990 East Germany," IUPAP Gothenburg.

[49] W. Gerlach to Fleury, September 7, 1956, series E6, vol. 7, folder 20, "German Democratic Republic 1955–1990 East Germany," IUPAP Gothenburg.

[50] Union Internationale de Physique Pure et Appliquée. Confidentiel. Réunion du Comité Exécutif (Moscou 1959). Compte-rendu succinct, July 11–13, 1959, box 106, folder 6, subfolder 1, "IUPAP 1948–61," AEA.

of the Executive Committee held in Moscow in 1959 IUPAP accepted Taiwan. Continental China had been accepted at the Grenoble meeting in 1958. As Joffe argued with Fleury, this decision created a precedent for the two Germanies' case.[51] Fleury consulted the Executive Committee and explained to his colleagues that on the basis of the statutes and the Taiwan/People's Republic of China precedent, they had to accept a separate representation of the German Democratic Republic.[52] The Executive Committee approved Fleury's proposal and the decision was ratified by the General Assembly in Ottawa. When Chou Pei-Yuan, the President of the Physical Society of the People's Republic of China, was informed that Taiwan too had been accepted in the Union, he vehemently protested. Pei-Yuan sent a letter to Mott, who forwarded it to Amaldi, in which he threatened to withdraw from the Union unless the "so-called Chinese Physical Society" was expelled from IUPAP.[53] Amaldi asked Mott for advice.[54] Mott thought that it was not correct that Westerners should consult each other and exclude members of the Executive Committee from the Socialist bloc. He also advised Amaldi not to forward the letter to the Executive Committee, to prevent its members from consulting their government, but to disclose it only when they met in Ottawa, "while they are united in the friendly atmosphere of a general assembly."[55] Mott suggested that Amaldi should write to Chou Pei-Yuan first. Amaldi took his time. He considered this letter a very complicated task. Then, he wrote to Chou Pei-Yuan and politely explained the matter to him.

> I would like to describe you the executive committee's point of view. According to the IUPAP regulations, even two bodies belonging to the *same country* (in a political sense) may become members of the IUPAP provided they represent physicists who are conducting their activities in two different geographical areas.[56]

In his reply Amaldi tried to downplay the national nature of the representations in IUPAP. The two delegations should be intended as representatives of physicists working in two different geographical areas. By accepting either delegation, the Union did not commit itself to recognizing a state:

> Bearing in mind this the Union's Executive Committee has taken the decision mentioned above with a view to avoiding that an important political issue arise within the Union which, on the other hand, is endeavouring to secure the collaboration of <u>all</u> physicists, irrespective of the political divergences prevailing in the world.[57]

[51] Joffe to Fleury, February 9, 1960, series E6, vol. 6, folder 19, "Fed. Republic of Germany 1952–1998," IUPAP Gothenburg.
[52] Fleury to the Executive Committee, December 23, 1959, series E6, vol. 6, folder 19, "Fed. Republic of Germany 1952–1998," IUPAP Gothenburg.
[53] President of the Physical Society of the People's Republic of China to Mott, November 12 1959, box 106, folder 1, subfolder 6, "Corrispondenza Fleury 1959–60," AEA.
[54] Amaldi to Fleury, November 23, 1959, box 106, folder 1, subfolder 6, "Corrispondenza Fleury 1959–60," AEA.
[55] Mott to Amaldi, November 27, 1959, box 106, folder 1, subfolder 6, "Corrispondenza Fleury 1959–60," AEA.
[56] Amaldi to Chou Pei-Yuan, February 24, 1960, box 106, folder 1, subfolder 6, "Corrispondenza Fleury 1959–60," AEA.
[57] Ibid.

Amaldi also reminded Pei-Yuan that the same decision had been taken for East and West Germany. The Communist Chinese, however, could not accept this position. At that time the conflict between Continental China and Taiwan had come to a stalemate and the People's Republic of China was not even admitted in the United Nations. Chou Pei-Yuan communicated to Amaldi their decision to withdraw from the Union.[58] Amaldi communicated to the IUPAP assembly at Ottawa that, as the problems were of a political nature, it was better to wait for the decision of ICSU, on which IUPAP depended, but this proposal was not accepted by the General Assembly because each union "must settle its own affairs."[59] At the assembly it was restated "that countries should be designated by their geographical position." Amaldi and Fleury did not succeed in persuading the Communist Chinese that the United Nations and IUPAP were two different organizations. Eventually, China only entered the Union in 1984.[60]

High Energy and Low Energy

In 1958, a Commission on High Energy Physics was created.[61] The creation of this commission was, in a way, an attempt to extend the peaceful scientific collaboration of CERN and integrate the Soviets into it.[62] The commission aimed to circulate knowledge on high energy by means of conferences, visits and exchange of preprints, but its goals went far beyond IUPAP's mission.[63]

Not all the members of IUPAP shared the *Ostpolitik*. The integration of Eastern Europeans into IUPAP also had dissenting voices. On December 23, 1957 Verwey wrote to Mott that he was against the organization of an IUPAP conference on semiconductor physics in countries beyond the Iron Curtain, as most Western European physicists would not participate.[64] Mott replied that either the Eastern and Western Europeans organized separate conferences, and IUPAP tried to support both, or there

[58] Chou Pei-Yuan to Amaldi, June 1, 1960, box 106, folder 6, subfolder 1, "Corrispondenza Fleury 1959–60," AEA.

[59] See Amaldi, opening speech delivered at the 11th General Assembly of IUPAP, in Ottawa, box 107, folder 2, "Corrispondenza e documentazione IUPAP 1957–61," AEA; see also Consiglio Nazionale delle Ricerche. Commissione Nazionale di fisica pura e applicata, box 106, folder 1, subfolder 1, "IUPAP 1948–1961," AEA. For the discussions at the Ottawa general assembly, see "Report of the 10th General Assembly, Ottawa September 1960," series B2aa, vol. 2, 22, IUPAP Gothenburg.

[60] See the chapter by Hu, Liu, and Yin in this volume.

[61] Initially the commission had seven members. Two came from the USSR, I. E. Tamm (in 1958 replaced by D. Blokhintsev) and V. I. Veksler; two from the USA, R. E. Marshak and W. H. K. Panofsky (succeeded by E. M. McMillan); one from CERN (C. J. Bakker, succeeded by G. Bernardini); one from Japan (H. Yukawa); and one was French, R. E. Peierls (later succeeded by L. Leprince-Ringue). Minutes of IUPAP High Energy Commission First Meeting, vol. 4; "Fleury's Correspondence 1957–63," folder 29 "Commission on High Energy Physics, Minutes of the meetings 1958–1962," IUPAP, Quebec Secretariat, Center for the History of Science, Royal Swedish Academy of Sciences (hereafter IUPAP Quebec); Position at January 1, 1958. "Report of the Ninth General Assembly (1957)," 11, series B2aa, vol. 1, folder A, IUPAP Gothenburg. See the chapter by Barbara Hof in this volume.

[62] On the CERN model see M. Kohlrausch and H. Trischler, *Building Europe on Expertise: Innovators, Organizers, Networkers* (London: Palgrave Macmillan, 2014).

[63] See Barbara Hof's chapter in this volume.

[64] Verwey to Mott, December 12, 1957, box 34, folder 1, subfolder 2, "Verbali, documenti," AEA.

would be joint conferences. Mott concluded that it would be up to Amaldi, the next President, to handle the issue.[65]

In 1958, a study Committee on Low Energy Nuclear Physics was created to explore the possibility of also creating a commission on that field of knowledge. The Europeans participated in this committee individually; there was no member from CERN. The members of the committee were G. Djulepov (USSR), B. Flowers (England), Huber (Switzerland), G. Racah (Israel), L. A. Turner (USA), K. Siegbahn (Sweden), and A. Bohr (Denmark).[66] The future commission would coordinate the organization of international conferences on nuclear energy, but in the committee it was also discussed that the commission could have a broader scope. Kai Siegbahn, the Secretary of the Study Committee, suggested that the commission should assume a more important role: "... some members of the committee have suggested other possible forms of activities, e. g. helping inexperienced countries in deciding upon different kinds of accelerators and reactors."[67] Siegbahn omitted such remarks from the final report sent to Fleury.[68] Although Siegbahn's reports suggested establishing a commission on low energies, according to Robert Brode his arguments appeared to the Executive Committee of the Union not strong enough. Interpreting the feelings of the Executive Committee's colleagues, Brode thought that they were unhappy with Siegbahn's work hitherto and suggested to Fleury that Siegbahn be replaced by Flowers.[69] In 1958 the IUPAP Executive Committee decided not to establish a Commission on Low Energies.[70] The commission was, however, established two years later.[71]

Integrating Asian Physicists

At the Executive Committee in Moscow Amaldi communicated his decision not to continue as President of IUPAP for three years more.[72] Fleury too wanted to resign, as he thought that someone else should take over. Joffe and Staub asked him to make up his mind.[73] Since Amaldi had quitted, Fleury represented continuity with the positive work of integrating communities of physicists of the Socialist bloc and developing countries. As Joffe wrote to Fleury, "*c'est à mon avis une condition indispensable pour que l'Union ne soit pas dispersée.*"[74] Fleury accepted to remain on the condition that a

[65] Mott to Verwey, December 17, 1957, box 34, folder 1, subfolder 2, "Verbali, documenti," AEA.

[66] Siegbahn to Fleury, June 10, 1958, series E1, vol. 4, folder 30, "Fleury's Correspondence 1957–1963. Commission on Low Energy Physics," IUPAP Quebec.

[67] Ibid.

[68] "Report of the Committee for Low Energy Nuclear Physics," series E1, vol. 4, folder 30, "Fleury's Correspondence 1957–1963. Commission on Low Energy Physics," IUPAP Quebec.

[69] Brode to Fleury, October 24, 1959, box 106, folder 6, subfolder 1, "Corrispondenza Fleury 1959–60," AEA.

[70] Fleury to Siegbahn, July 17, 1958, series E1, vol. 4, folder 30, "Fleury's Correspondence 1957–1963. Commission on Low Energy Physics," IUPAP Quebec.

[71] "Annual Report of the Commission for Low Energy Physics for the period 1962–1963," series E1, vol. 4, folder 30, "Fleury's Correspondence 1957–1963." Commission on Low Energy Physics," IUPAP Quebec.

[72] Amaldi to Mott, July 28, 1959, box 106, folder 1, subfolder 6, "Corrispondenza Fleury 1959–60," AEA.

[73] Staub to Fleury, February 17, 1960, Joffe to Fleury, February 19, 1960, box 106, folder 1, subfolder 6, "Corrispondenza Fleury 1959–60," AEA.

[74] Joffe to Fleury, February 19, 1960, box 106, folder 6, subfolder 1, "Corrispondenza Fleury 1959–60," AEA.

younger colleague be appointed Adjunct Secretary. Eventually the choice fell on the British physicist Clifford Charles Butler.

Amaldi wanted to change President every three years to assure the involvement of more nations and a balance between Western and Socialist countries.[75] Amaldi started trading letters with Brode and Mott. It was not just a matter of finding a person with the right qualities. They had to decide the priorities of the Union for the following years. The Union was facing two challenges: the improvement of the recently re-established relations with Soviet and Eastern European physicists, and the integration of the community of physicists of some of the largest Asian countries (China, India, and Japan). As we have seen with the discussion on the adhesion of the two Chinas and the two Germanies, the two issues were intertwined. IUPAP members diverged on which of the two issues they considered the most urgent. Brode proposed to modify the statute to appoint a first Vice-President who would be automatically elected President after three years.[76] Amaldi endorsed Brode's proposal and in turn proposed that the Executive Committee should comprise the former Presidents, the President, the Secretary, the Vice-Presidents, and a first Vice-President who would become the new President after three years.[77] Both Amaldi and Mott thought that a Soviet President was desirable, but they were afraid to appoint a Soviet President at that time. Mott wrote to Amaldi that:

> I am a bit reluctant to put the presidency in the hands of the representative of a country where the government still exercises so close a control over scientific activities, and in which the western concept of "an independent scientist" is only just beginning to find a place.[78]

Amaldi agreed with Mott. At the time, US physicists were inclined to have a Soviet physicist as President. Brode initially proposed Fleury for President and Tamm (USSR) for Vice-President:

> The country with the largest physics activity which has not provided a president is obviously Russia, and it would seem appropriate to consider a president from that country in the near future.[79]

His position mirrored the desire of the US scientific community to interact more with the Soviets. Ferdinand Trendelenburg (West Germany) was also in favor of the Nobel Prize laureate Tamm (USSR) as the first Vice-President.[80]

[75] Amaldi to Bhabha, May 23, 1960, box 106, folder 1, subfolder 4, "Corrispondenza Presidente 1957–1960," AEA.

[76] Moscow meeting in AEA, box 106, subfolder 6; see also Staub to Fleury, February 17, 1960, 106, folder 1, subfolder 6, "Corrispondenza Fleury 1959–60," AEA.

[77] Assemblée Générale d'Ottawa. Ordre du jour provisoire, box 106, folder 1, subfolder 6, "Corrispondenza Fleury 1959–60," AEA.

[78] Mott to Amaldi, March 9, 1960, box 106, folder 1, subfolder 4, "Corrispondenza Presidente 1957–1960," AEA.

[79] Brode to Amaldi, July 25, 1960, box 106, folder 1, subfolder 4, "Corrispondenza Presidente 1957–1960," AEA.

[80] Ferdinand Trendelenburg to Amaldi, June 8,1960, box 106, folder 1, subfolder 4, "Corrispondenza Presidente 1957–1960," AEA.

In the consultations previous to the General Assembly Amaldi proposed the following scheme to members of the Executive Committee: Homi J. Bhabha (India) President, Fleury (France) Secretary, Butler (UK) Adjunct Secretary, and Smyth (USA) first Vice-President, and three years later to elect a Soviet first Vice-President. Amaldi was inclined to elect a President from one of the two major Asian countries in the Union, India and Japan. Amaldi consulted the Executive Committee. He justified his proposal by the will to maintain a "certain balance between the Eastern and the Western countries,"[81] a very diplomatic formula which made reference to geography only and avoided mentioning political conflicts.

Kotani (Japan) expressed some concerns about Bhabha, because of his position as Secretary of the Indian Government with responsibility for the development of atomic energy in India. Interestingly enough, he motivated his propensity for Joffe (USSR) by saying that "he is not too rigidly bound to the Soviet government."[82] Kotani was also concerned that the sequence Amaldi-Bhabha-Smyth entailed too strong a commitment to atomic physics. Herzberg (Canada) too was concerned about Bhabha "because of the many Indian affairs in which Bhabha is involved," and opted for Yukawa (Japan).[83] In the end the General Assembly in Ottawa elected Bhabha President and the French physicist Louis Néel the first Vice-President. As J. de Boer (Netherlands) had written to Amaldi during the consultation process, it was important to keep Fleury as long as possible also because it was crucial to have a bureau in Paris, where UNESCO and ICSU were located.[84] Maybe this was one of the reasons for choosing a French future President. In 1966, a Soviet physicist, Dimitri Ivanovich Blokhintsev, became President of IUPAP.[85]

Conclusion

Edoardo Amaldi was elected President of IUPAP at a particular moment, in which a number of Western physicists aimed to exploit the favorable conjuncture to re-establish connections with Soviet physicists. Fleury and Mott were persuaded that Amaldi was the ideal candidate to pursue this goal. Amaldi was not only a respected physicist, but also a scientific policymaker with a very clear vision. He had come to the conclusion that Italian physics had to be integrated into the inter-European collaborative projects. It comes as no surprise that the representative of CERN in the IUPAP High Energy Commission was Italian, Gilberto Bernardini. Italian physics could play a part only if integrated into European physics. Otherwise the country was destined to decline. Amaldi's action and those of other Italian physicists involved in international and inter-European projects mirrored that of the Italian governments.

[81] Amaldi to Rasmussen, April 14, 1960, box 106, subfolder 4, "Corrispondenza Presidente 1957–1960," AEA.

[82] Kotani to Amaldi, May 6, 1960, box 106, folder 1, subfolder 4, "Corrispondenza Presidente 1957–1960," AEA.

[83] Amaldi to Brode, May 17, 1960, box 106, folder 1, subfolder 4, "Corrispondenza Presidente 1957–1960," AEA.

[84] De Boer to Amaldi, May 16, 1960, box 106, folder 1, subfolder 4, "Corrispondenza Presidente 1957–1960," AEA.

[85] See the chapter by Silva Neto and Kojevnikov in this volume.

At the same time, Amaldi conceived of inter-European ventures in terms of peaceful collaborative projects. He promoted peaceful cooperation over other forms of collaboration, such as the contemporary ones in space and satellites research, which were connected to military interests.

Amaldi, Mott, and Fleury sought to integrate socialist countries into the Union. Although they all came from Western countries, they proved to be extremely fair towards their colleagues from the socialist camp. Handling the difficult cases of the "two Germanies" and "the two Chinas," they showed that their respect for the Union's principles was beyond political interests. They did not accept pressure from West German physicists to prevent East German physicists from having a proper delegation. Nor did they accept pressure from the People's Republic of China to exclude Taiwan from the Union. As Amaldi pointed out, writing to Fleury:

> *Il me semble que les complications naissent aussi pour les deux Allemagnes. Je crois toutefois que l'Union doit tenir une attitude commune pour tous les pays: c'est à dire les représentants des physiciens d'une région qui désirent participer aux activités de l'UIPPA, ils doivent être libres de le faire sans aucune opposition ou interférence.*[86]

Amaldi endeavored to implement the idea of peaceful cooperation experienced with CERN as one that could benefit all the partners.

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[86] Amaldi to Fleury, March 24, 1960, box 106, folder 6, subfolder 1, "Corrispondenza Fleury 1959–60," AEA.

14
National Individuals and International Unions
Gleb Wataghin's Experience with IUPAP (1951–1959)

Luciana Vieira Souza da Silva

As has been discussed in this volume, the International Union of Pure and Applied Physics (IUPAP) was organized between 1922 and 1923, following World War I, aiming to join physicists from various countries in a single community. The chapters presented in this volume analyze the history of IUPAP from different perspectives, taking into consideration scientific, social, and political aspects. As we have observed, throughout the 20th century, new nations joined IUPAP, and alliances with other international institutions were established after World War II.[1]

Considering the context in which IUPAP emerged and its impact on the collective organization of physicists around the globe, the present chapter aims to highlight another way in which this institution can be understood: the individual experience. It discusses from bottom to top how the personal trajectories of physicists who did not occupy any position of power within the institution interacted with its international character and its rules of affiliation. The chapter analyzes these questions with the case study of the Russian-Italian physicist Gleb Wataghin's participation in IUPAP in 1950s, arguing that scientific and personal ambitions were fundamental for his interaction with the institution in a period of significant changes in the international political frame.

As we will see, Wataghin's personal and professional trajectory is markedly transnational,[2] so the delimitation of his national identity is a non-trivial task. All the same, the interplay between his national affiliations and the international political frameworks during that time was fundamental for his path through IUPAP. In his case, nationality was a crucial matter for the construction of his social and professional networks. To establish a contrast between the structure and functioning of an international institution and Wataghin's nationality issue, this study has adopted the term "national individual," namely, the idea that every physicist who wanted to become a member of IUPAP should first have their nationality represented in the

[1] On the origins of IUPAP, see Danielle Fauque and Robert Fox's chapter in this volume. On the changes in IUPAP after World War II, see Roberto Lalli's chapter.

[2] As argued in my PhD dissertation, Luciana Vieira Souza da Silva, "Ciência, universidade e diplomacia científica: a trajetória brasileira de Gleb Vassilievich Wataghin (1934–1971)," (PhD diss., Universidade de São Paulo, 2020), available at https://doi.org/10.11606/T.48.2020.tde-29092020-165017, and in Heráclio D. Tavares, Alexandre Bagdonas, and Antonio A. P. Videira, "Transnationalism as Scientific Identity: Gleb Wataghin and Brazilian Physics, 1934–1949," *Historical Studies in the Natural Sciences* 50, no. 3 (2020), available at https://doi.org/10.1525/hsns.2020.50.3.248.

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institution. Given the interplay between Wataghin's Russian origin and his Italian citizenship, the national individual term may allow us to juxtapose individual ambitions with the broader objectives of an international institution. As theorized by Revel,[3] the socio-historical micro-analysis is an interesting way to understand the relations established by individuals with their social universe (professional communities, for example). In this sense, more than writing an alternative institutional history or a biography, this chapter aims to investigate IUPAP from the perspective of one of its participants. Thus, the "national individual" term is used here more to emphasize the analysis based on a play of scales—by contrasting the international and the national, local, and personal perspectives—than to establish a rigid concept to be applied in a specific case.

The historical sources were collected at the IUPAP archives, at the University of Turin Historical Archive (ASUT),[4] at the Edoardo Amaldi Fund at Sapienza University of Rome, at the Cesar Lattes Central Library of the University of Campinas, and at the *Il Nuovo Cimento* journal.[5] This chapter is organized as follows: the first section discusses how the analysis of individual trajectories can be useful to study the international circulation of knowledge; the second section presents Wataghin's trajectory in Brazil and his re-encounter with his Russian origins, which can be related to his activities within IUPAP in the 1950s; the third section discusses the personal and scientific consequences of his participation in IUPAP; finally, the chapter ends with remarks on the implication of national borders in the international circulation of scientists.

Individual Trajectories and International Scientific Institutions: Initial Considerations

The circulation of knowledge depends on the material circulation of papers, books, data, instruments, and bodies, in a movement that transcends national borders.[6] At the same time, national governments are constantly fostering and improving their border rules, according to changes in diplomatic and foreign policies. For these reasons, the actors and materials involved in the circulation of knowledge are also dependent on political decisions which can allow or prevent their entry or exit from different countries.[7]

[3] Jacques Revel, "Micro-analyse et construction du social," in *Jeux d'échelles: la micro-analyse à l'expérience*, ed. Jacques Revel (Paris: Seuil/Gallimard, 1996), 15–36.

[4] The documents were consulted in 2019, as part of my doctoral research on the Brazilian trajectory of Gleb Wataghin.

[5] *Il Nuovo Cimento* (1943–1954), Springer Link, accessed February 17, 2023, available at https://link.springer.com/journal/40761/volumes-and-issues/10-4/supplement.

[6] John Krige, "Introduction: Writing the Transnational History of Science and Technology," in *How Knowledge Moves: Writing the Transnational History of Science and Technology*, ed. John Krige (Chicago: University of Chicago Press, 2019), 1–31.

[7] Mario Daniels, "Restricting the Transnational Movement of 'Knowledgeable Bodies': The Interplay of US Visa Restrictions and Export Controls in the Cold War," in *How Knowledge Moves: Writing the Transnational History of Science and Technology*, ed. John Krige (Chicago: University of Chicago Press, 2019), 35–61.

Since its inception, IUPAP was organized following the national-international interplay. The end of World War I was accompanied by the creation of many international scientific institutions, such as the International Research Council (IRC), whose constitutive assembly occurred on July 28, 1919, in Brussels. According to Brigitte Schroeder-Gudehus, the IRC's leading scientists "were convinced they were establishing the foundation for a new era in the life of the international community of science and, at the same time, conforming to the principles of international morality in accomplishing an indispensable act of justice,"[8] given the general political context after the war. Despite the IRC "internationalist mentality," it was only in 1926 that the council removed from its statutes the restrictions on the participation of a broader set of countries.[9]

The analysis of an international institution imposes a reflection on the influence of the national borders in the circulation of scientists.[10] Observing the interaction between these two poles, we note that the state apparatus is only one element in controlling and stimulating displacements; scientific, cultural, familial, friendship, and other personal motivations are also relevant.[11] By proposing the aggregation of physicists from different nations into a single collectivity, IUPAP inevitably had to deal with the nationality of the physicists and the problems of a diplomatic nature arising from the relations established by the nations which aimed to be part of that institution. Consequently, both the institution's activities and the aspirations of its participants were directly affected by the broader diplomatic political framework.

The interaction between scientists and the diplomatic apparatus has been a matter of interest in recent years, both in the field of the history of science and in international relations, under the concept of science diplomacy.[12] Analyzing the literature on the history of science diplomacy,[13] it can be inferred that the interactions between

[8] Brigitte Schroeder-Gudehus, "Challenge to Transnational Loyalties: International Scientific Organizations after the First World War," *Science Studies* 3, no. 2 (1973): 94.

[9] Edoardo Amaldi, "The Unity of Physics," in *Physics 50 Years Later*, ed. Sanborn C. Brown (Washington DC: National Academy of Sciences, 1973), 13–35.

[10] Daniels, "Restricting."

[11] On this subject, see for example Michel J. Barany, "The Officer's Three Names. The Formal, Familiar, and Bureaucratic in the Transnational History of Scientific Fellowships," in *How Knowledge Moves: Writing the Transnational History of Science and Technology*, ed. John Krige (Chicago: University of Chicago Press, 2019), 254–80; Olival Freire Jr, and Indianara Silva, "Scientific Exchanges between the United States and Brazil in the Twentieth Century. Cultural Diplomacy and Transnational Movements," in *How Knowledge Moves: Writing the Transnational History of Science and Technology*, ed. John Krige, (Chicago: University of Chicago Press, 2019), 281–307; Adriana Minor, "Manuel Sandoval Vallarta. The Rise and Fall of a Transnational Actor at the Crossroad of World War II Science Mobilization," in *How Knowledge Moves: Writing the Transnational History of Science and Technology*, ed. John Krige (Chicago: University of Chicago Press, 2019), 227–53.

[12] Maria Rentetzi, "Living with Radiation or Why we Need a Diplomatic Turn in History of Science," *Kjemi*, no. 6 (2017), 21–4; Pierre-Bruno Ruffini, *Science and Diplomacy. A New Dimension of International Relations* (Cham: Springer, 2017), 11–45; Pierre-Bruno Ruffini, "Diplomatie scientifique. De quelques notions de base et questions-clés," *Philosophia Scientiæ* 23, no. 3 (2019): 67–80; Pierre-Bruno Ruffini, "Conceptualizing Science Diplomacy in the Practitioner-Driven Literature: A Critical Review," *Humanities and Social Sciences Communications* 7, no. 124 (2020), available at https://doi.org/10.1057/s41599-020-00609-5; Matthew Adamson, and Roberto Lalli, "Global Perspectives on Science Diplomacy: Exploring the Diplomacy-Knowledge Nexus in Contemporary Histories of Science," *Centaurus* 63, no. 1 (2021): 1–16.

[13] See for example Adriana Minor, "Up-and-Down Journeys: The Making of Latin America's Uniqueness for the Study of Cosmic Rays," *Centaurus* 62, no. 4 (2020): 697–719; Simone Turchetti et al.,

scientists, knowledge, diplomats, governments, and diplomacy are not fixed analytical categories. Its historical and contemporary meanings still need to be studied in more depth.

There are several possibilities to understand science and diplomacy as associated practices in both the scientific and the diplomatic fields. In general, there are examples of scientists who formally acted in the diplomatic apparatus and others in which they contributed only indirectly to foreign affairs. Throughout his scientific trajectory, the physicist Gleb Wataghin was closer to the second type, acting as someone who was not a diplomatic authority but a physicist aware of the importance of foreign policies in the production of scientific knowledge.[14] In Michel de Certeau's terms, Wataghin developed tactics to better organize his activities as a physicist and professor, following to the changes in the national and international political frameworks:[15] he often organized his scientific practice according to the diplomatic policies of the countries where he worked.

In this chapter, I will discuss his participation in IUPAP as part of his tactics of establishing international cooperation with Soviet physics according to institutional and diplomatic agreements and possibilities. In the analysis, his personal and scientific ambitions will also be considered. This study may contribute to understanding IUPAP's functioning from another perspective. Beyond the institutional history, the bottom-top analysis brings to light the individual perspective. Ultimately, the physicists who took part in IUPAP were affected by its statutes and activities in different ways, so Wataghin's case can inspire other historical works.

Gleb Wataghin's Trajectory in Brazil and His Approach to the Russian Community

Wataghin (1899–1986) was born in Birsula, Ukraine, during the Russian Empire. After his university formation in Kiev, around 1919 and 1920 he moved with his family to Turin, Italy, because of the 1917 Revolution and the Civil War.[16] In 1920, he was registered at the University of Turin, where he received his physics degree (1922)

"Introduction: Just Needham to Nixon? On Writing the History of 'Science Diplomacy,'" *Historical Studies in the Natural Sciences* 50, no. 4 (2020): 323–39; Sönke Kunkel, "Science Diplomacy in the Twentieth Century: Introduction," *Journal of Contemporary History* 56, no. 3 (2021): 473–84; Adamson, and Lalli "Global Perspectives;" Lif Lund Jacobsen, and Doubravka Olšáková, "Diplomats in Science Diplomacy: Promoting Scientific and Technological Collaboration in International Relations," *Ber. Wissenschaftsgesch* 43, no. 4 (2020) 465–72.

[14] This is the main argument of my PhD thesis: Silva, "Ciência, universidade e diplomacia científica."

[15] Certeau defined tactics as the "art of the weak," this is, the actions that someone without power can develop according to the changes imposed by the power holders, which he called "strategies." Michel de Certeau, *A invenção do cotidiano: 1 artes de fazer*, trans. Ephraim Ferreira Alves (Petrópolis: Vozes, 1994), 100–1.

[16] Marina Moseykina, "Отец Бразильской ядерной физики. Глеб Васильевич Ватагин в Сан-Пауло," *РОДИНА*, no. 10 (2013), 62–4; Enrico Predazzi, "Gleb Wataghin," in *La Facoltà di Scienze Matematiche Fisiche Naturali di Torino*, ed. Clara Silvia Roero (Turin: Deputazione Subalpina di Storia Patria, 1999), 283–94; Gleb Wataghin, "Gleb Wataghin (depoimento, 1975)," interview by Cylon Eudóxio Silva, Rio de Janeiro, *CPDOC*, 2010.

and his mathematics degree (1924).[17] Between 1925 and 1933, he taught mathematical analysis and experimental physics at the *Reale Accademia e Scuola di Applicazione Artiglieria e Genio*, in Turin. Between 1929 and 1934, he was in charge of the rational mechanics course, and from 1933 to 1934 of the superior physics course, both at the University of Turin.[18] From 1934 to 1949, he was a visiting professor at the University of São Paulo, in Brazil. Given his international education and experience, his scientific identity can be understood as "transnational."[19]

Wataghin's national identity issue can be observed earlier in his trajectory. Although arriving in Italy between 1919 and 1920, he only got his Italian citizenship in 1929.[20] He went to Brazil in 1934 as a member of a diplomatic mission supervised by the Italian Ministry of Foreign Affairs. In Brazil, he was recognized as an Italian citizen, but his Russian origins were also remembered by the press.[21] In that year, the São Paulo state government inaugurated the University of São Paulo (USP). Its founders hired the first lecturers of the Faculty of Philosophy, Sciences and Letters (FFCL) in Europe instead of Brazil, under the justification that they wished to shape a "new intellectual elite."[22] For this reason, they sent a representative to Italy, France, Germany, and other countries to hire the first faculty members. The Italian Mission, as the Italian professors were known at USP, was mainly designated to teach the exact sciences. In Italy, Enrico Fermi was responsible for indicating Wataghin's name to the new university.[23]

Despite the Italian fascist government policies that encouraged the international circulation of intellectuals as a mechanism of soft power,[24] among the Italian lecturers at USP the political adherence was not homogeneous and most of them were anti-fascists, such as the physicists Giuseppe Occhialini[25] and Wataghin.[26] Regardless, the Italian lecturers were obliged to send an annual report to the diplomatic authorities to give an account of their activities. Furthermore, during his time in Brazil, Wataghin was always attached to Italian universities and was affiliated with the University of Turin from 1934 to 1938 and the University of Sassari from 1938 to 1948.[27]

[17] Verbale di Laurea. Matricola 2478. Verbale di Laurea in Magistero di Scienze Naturali ecc. dal 27/10/1902 al 16/11/1925. University of Turin Historical Archive (hereafter ASUT).

[18] Predazzi, "Gleb Wataghin."

[19] Tavares, Bagdonas, and Videira, "Transnationalism."

[20] Predazzi, "Gleb Wataghin."

[21] Silva, "Ciência, universidade e diplomacia científica."

[22] Irene Cardoso, *A Universidade da Comunhão Paulista: O projeto de criação da Universidade de São Paulo* (São Paulo: Editora Autores Associados/Cortez Editora, 1982).

[23] Wataghin, interview.

[24] Emilio Gentile, *Fascismo: storia e interpretazione* (Roma-Bari: Laterza, 2002); João Fábio Bertonha, *O fascismo e os imigrantes italianos no Brasil* (Porto Alegre: EDIPUCRS, 2001); Matteo Pretelli, "Il fascismo e l'immagine dell'Italia all'estero," *Contemporanea* 11, no. 2 (2008), 221–41.

[25] Leonardo Gariboldi, "Giuseppe 'Beppo' Occhialini. Dal positrone alla mappa gamma della galassia," *Emmeci Quadro* (2007): 64–74.

[26] The political positions of Wataghin were not so explicit in his first years in Brazil. However, after 1942 and the Brazilian diplomatic rupture with the Axis, he clearly declared himself an antifascist. See: Olival Freire Jr, and Indianara Silva, "Diplomacia e ciência no contexto da Segunda Guerra Mundial: a viagem de Arthur Compton ao Brasil em 1941," *Revista Brasileira de História* 34, no. 67 (2014), available at https://doi.org/10.1590/S0102-01882014000100009; and Silva, "Ciência, universidade e diplomacia científica."

[27] Fascicolo personale Gleb Wataghin. Ministerio della Pubblica Istruzione. Direzione Generale Istruzione Universitaria. Stato di Servizio. Prof. Wataghin Gleb, s.d. ASUT.

Wataghin is known in the Brazilian historiography of physics as the precursor of modern physics in the country. In Italy, he worked on quantum field theory. In Brazil, he continued working on theoretical topics and began experimental research in cosmic-ray physics.[28] He was also recognized for his teaching qualities, for being close to his students, available to listen to them, and engaging to promote their international circulation.[29] Among his students, Marcello Damy went to Cambridge in 1938; Mario Schenberg worked with George Gamow in Washington in the 1930s; Paulus Aulus Pompeia with Arthur Compton in the 1940s; Sonja Ashauer with Paul Dirac, in 1945; and Cesar Lattes with Cecil Powell in England, in 1946, and with Ernest Lawrence, in Berkeley, USA, in 1948, when he collaborated with the detection of the artificial pi-meson.[30] Wataghin's disposition to work in experimental and theoretical physics was also related to his ideals about physics pedagogy. According to him, the only way to learn physical phenomena in secondary and university education was from theoretical definitions and laboratory experimentation.[31]

Although this chapter does not focus on analyzing the scientific and educational work of Wataghin in Brazil, his Brazilian trajectory is fundamental to understanding his path through IUPAP. When we analyze the literature on Wataghin's time in Brazil, we observe that, at the beginning, one of his main concerns was the geographical distance from his scientific circles. This is probably the reason why he was always in contact with his European networks, sending papers and manuscripts, traveling to Italy every year, inviting guest speakers to Brazil, and sending his students on fellowship programs to Europe and the United States.[32]

Since their first years in Brazil, Wataghin and the other USP Italian lecturers joined the Italian community in São Paulo,[33] which was shaped mainly by immigrants arriving in the 19th and early 20th centuries and their descendants.[34] In

[28] Antonio Augusto Passos Videira, and Martha Cecilia Bustamante, "Gleb Wataghin en la universidad de São Paulo: un momento culminante de la ciência brasileña," *Quipu* 10, no. 3 (1993): 33–40.

[29] Videira and Bustamante, "Gleb Wataghin;" Roberto Aureliano Salmeron, "Gleb Wataghin," *Estudos Avançados* 16, no. 44 (2002): 310–5; Tavares, Bagdonas, and Videira, "Transnationalism."

[30] Marcelo Damy, "Marcelo Damy: Revolução No Ensino Da Física," *Estudos Avançados* 8, no. 22 (1994): 79–95; Antonio Augusto Passos Videira, and Cássio Leite Vieira, *Reflexões sobre Historiografia e História da Física no Brasil* (São Paulo: Editora Livraria da Física, 2010); Freire Jr, and Silva, "Diplomacia e ciência;" Maria Amélia Mascarenhas Dantes, and Walkiria C. F. Chassot, "Sonja Ashauer (1923–1948)," in *Mulheres na Física: casos históricos, panorama e perspectivas*, ed. Elisa Maria Baggio Saitovitch et al. (São Paulo: Editora Livraria da Física, 2015), 95–113; Ana Maria Ribeiro de Andrade, *Físicos, Mésons e Política: a dinâmica da ciência na sociedade* (São Paulo/Rio de Janeiro: Hucitec, Museu de Astronomia e Ciências Afins, 1999); Heráclio Duarte Tavares, "Estilo de pensamento em física nuclear e de partículas no Brasil (1934–1975): César Lattes entre raios cósmicos e aceleradores" (PhD diss, Universidade Federal do Rio de Janeiro, 2017).

[31] Silva, "Ciência, universidade e diplomacia científica."

[32] Videira and Bustamante, "Gleb Wataghin;" Tavares, "Estilo de pensamento;" Freire Jr, and Silva, "Diplomacia e ciência;" Silva, "Ciência, universidade e diplomacia científica;" Tavares, Bagdonas, and Videira, "Transnationalism."

[33] Luciana Vieira Souza da Silva, "A Missão Italiana da Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo: ciência, educação e fascismo (1934–1942)" (Master diss, Universidade de São Paulo, 2015).

[34] Brazil and Italy had a good relationship since the last decades of the 19th century. After the end of slavery in Brazil, in 1888, the Brazilian government developed strategies to exclude formerly enslaved people from society. The political incentives for Italian immigration were part of this program, also aimed at

the 1930s, the Italian government created and funded cultural institutes abroad to spread their values among their compatriots, such as the Colombo Institute and the Brazilian-Italian Institutes of High Culture.[35] Over time, the internationalization of Wataghin's workplace in Brazil was his main tactic for educating the first generations of Brazilian physicists. However, this internationalization process was not randomly organized. Wataghin changed his tactics as the diplomatic agreements established by Brazil changed. For example, while Brazil enjoyed good relations with Italy, the physicist invested in his Italian networks by inviting collaborators to his department in São Paulo and, from 1938, helping colleagues to escape from the fascist persecution against the Jews.[36] After the beginning of World War II and the Brazilian approach with the United States given its Good Neighbor Policy with Latin American countries, Wataghin invested in the collaboration with US physicists, such as Arthur Compton, who went to Brazil in 1941 to do some experiments and to take part in conferences as part of a cultural mission supported by the Office of the Coordinator of Inter-American Affairs (OCIAA).[37]

In 1942, when Brazil declared war on the Axis powers (Italy, Germany, and Japan), the Italian professors at USP had to interrupt their employment contracts.[38] Unlike his colleagues, Wataghin was able to stay given his Russian origin,[39] as it is clearly observed in his 1943 contract, in which the university highlighted that he was "natural from Russia and of Italian nationality because of naturalization."[40] Evidence of Wataghin's Russianness was also seen in other documents. Only a few days after

the "whitening" of the Brazilian population. See: Bertonha, *O fascismo*; Zuleika M. F. Alvim, *Brava gente! Os italianos em São Paulo, 1870–1920* (São Paulo: Brasiliense, 1986); Jeffrey Lesser, *A negociação da identidade nacional: imigrantes, minorias e a luta pela etnicidade no Brasil*, trans. Patricia de Queiroz Carvalho Zimbres (São Paulo: UNESP, 2001).

[35] Angelo Trento, "'Dovunque è un italiano, là è il tricolore'. La Penetrazione del fascismo tra gli immigrati in Brasile," in *Fascisti in Sud America*, ed. Eugenia Scarzanella (Firenze: Le Lettere, 2005), 1–54.

[36] Luciana Vieira Souza da Silva, and Bruno Bontempi Junior, "From Europe to Brazil: Gleb Wataghin and the scientists' mutual cooperation in times of intolerance and war," *Lettera Matematica* 6 (2018): 203–10.

[37] Freire Jr, and Silva, "Scientific Exchanges."

[38] Luciana Vieira Souza da Silva, and Rogério Monteiro de Siqueira, "An Italian mission at the University of São Paulo: Science and education issues in the diplomatic relationships between Italy and Brazil in the 1930s," *Mélanges de l'École française de Rome—Italie et Méditerranée modernes et contemporaines* 130, no. 2 (2018): 407–19.

[39] The other professors had to leave the university. Some of them returned to Italy, but others stayed in Brazil. This was Occhialini's case, who had to obtain a safe-conduct from the Brazilian government to be able to travel around the country. In the following years, he returned to USP as an invited lecturer, and, in 1945, he finally could leave Brazil to work with Powell, in Bristol. See: Silva, "A Missão Italiana;" Silva, "Ciência, universidade e diplomacia científica;" Tavares, "Estilo de pensamento;" Leonardo Gariboldi, and Pasquale Tucci, "Giuseppe Paolo Stanislao Occhialini (1907–1993). A Short Biography," in *The scientific legacy of Beppo Occhialini*, ed. Pietro Redondi et al. (Berlim/ Heidelberg: Springer, 2006), XI–XXXVII; Leonardo Gariboldi, and Mattia Verzeroli, "Beppo Occhialini in Brazil between physics and politics," in *Atti del XL convegno annuale SISFA*, ed. Fabio Bevilacqua and Ivana Gambaro (Pisa: Pisa University Press, 2021), 133–9.

[40] "Registros de contratos de professores estrangeiros (para USP)," Instr. Públ., EO1145, 1943, 51, State of São Paulo Public Archive, cited in Luciana Vieira Souza da Silva, "Gleb Wataghin and the Department of Physics of the University of São Paulo: between Italian and Russian nationalities in times of hostility (1934–1949)," in *Proceedings of the 38th Annual Conference / Società Italiana degli Storici della Fisica e dell'Astronomia*, ed. Salvatore Esposito, Lucio Fregonese, and Roberto Mantovani (Pavia: Pavia University Press, 2020), 143.

Brazil joined the war, in August 1942, Wataghin sent a letter to the USP-FFCL dean, Fernando de Azevedo, affirming his loyalty to the Allies because of his Russian origins:

> despite staying outside my country for 23 years, my dedication and my love for Russia have always dominated my feelings. I have never forgotten that my actions, whether meritorious or flawed, will be judged as those of a Russian, and that the fact that I was naturalized as an Italian in 1930 and entered this country [Brazil] in 1934 with that country's passport, in no way alters this.[41]

From that time on, Wataghin was very active in the São Paulo-Russian community, especially during the years in which Brazil maintained diplomatic relations with the USSR (1945–1947). For example, in 1945 he became the Vice-President of the *Sub-Comitê Russo em São Paulo de Socorro às Vítimas da Guerra na U.R.S.S.*, an institution sponsored by the Red Cross to help the Soviet victims of World War II.[42] Wataghin also requested Soviet citizenship from the diplomatic authorities to contribute to the war effort. However, because of the lack of Brazilian-Soviet relations and communication most of the time, his request met with no response.[43] Moreover, because of the anticommunist ideology of the Brazilian authorities, the Russian community was always under suspicion. After diplomatic relations ruptured in 1947, there was an increase in repression against people labeled as "communists" (regardless of their actual political orientation).[44] Analyzing the police department archives, one can find reports on Wataghin's activity in the USP and in other countries, as well as his role as Vice-President of the Russian subcommittee. These investigations were probably secret. The major concern (and delusion) of the police authorities was that Wataghin's nuclear physics knowledge could be applied to the construction of an atomic bomb.[45] As a consequence, Wataghin was advised to leave Brazil.[46] In 1949, he returned to Italy and became the Director of the Physics Institute at the University of Turin, a position he held until 1971.[47]

As observed, Wataghin's return to Italy was directly related to the repression of the police authorities, resulting from his attempts to establish relations with the USSR. However, his geographical return to the Italian Academy was crucial to his success

[41] The word in brackets is mine. Gleb Wataghin to Fernando de Azevedo, August 28, 1942, Fundo Fernando de Azevedo, FA-CP-Cx34, 13, Instituto de Estudos Brasileiros-Universidade de São Paulo Archive, cited in Luciana Vieira Souza da Silva and Bruno Bontempi Jr, "Gleb Vassilievich Wataghin: Physics, University and Politics in Brazil (1934–1949)," *RUDN Journal of Russian History* 19, no. 4 (2020): 965–78, 970.

[42] Silva, and Bontempi Jr, "Gleb Vassilievich Wataghin;" Svetlana Ruseishvili, "Ser russo em São Paulo: os imigrantes russos e a (re)formulação de identidade após a Revolução Bolchevique de 1917" (PhD diss, Universidade de São Paulo, 2016).

[43] Moseykina, "Отец Бразильской ядерной физики."

[44] Erick Reis Godliauskas Zen, *Imigração e Revolução: Lituanos, Poloneses e Russos sob Vigilância do Deops* (São Paulo: Editora da Universidade de São Paulo/FAPESP, 2010); Carla Simone Rodeghero, "Religião E Patriotismo: O Anticomunismo Católico nos Estados Unidos e no Brasil nos Anos da Guerra Fria," *Revista Brasileira De História* 22, no. 44 (2002): 463–88.

[45] Silva, and Bontempi Jr, "Gleb Vassilievich Wataghin."

[46] Moseykina, "Отец Бразильской ядерной физики."

[47] Lucia Wataghin, "Fundação da Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo: a Contribuição dos Professores Italianos," *Rev. Inst. Est. Bras.*, no. 34 (1992): p151–173.

and, as we shall see in the next section, his connections with IUPAP made that possible.

Wataghin's Participation in IUPAP: Between Personal and Scientific Ambitions

The participation of Wataghin in IUPAP can be analyzed as part of his tactics for organizing his scientific network following both the good international relations between nations and his personal ambitions. Throughout his professional career, he participated in some scientific and cultural societies. His engagement in these institutions was fundamental for building and growing his scientific and social networks. During his time in Brazil, for example, he kept a particular interest in the Brazilian Academy of Sciences, where he presented papers and established professional connections. Between 1941 and 1950, he was also among the members of the Cultural Union Brazil-United States (UCBEU), a Brazilian institution devoted to the strengthening of university ties with the USA.[48] Considering these activities, it is no exaggeration to assume that Wataghin's adhesion to IUPAP can be part of his tactics regarding the construction of broader social and scientific networks.

The Italian physics community had been represented in IUPAP since the beginning, as Italy was among the sixteen countries that participated in the Paris Charter General Assembly, in 1923.[49] At the time, Wataghin was still a student at the University of Turin. Even after becoming a researcher and a university professor in the mid-1920s, his name appeared among IUPAP historical sources only in the 1950s. According to the "Report of the Seventh General Assembly," which took place at the Danish Academy of Sciences, Copenhagen, between July 11 and 13 of 1951, Wataghin joined the Italian delegation together with Edoardo Amaldi, Antonio Carrelli, Bruno Ferretti, and Eligio Perrucca.[50]

Although the sources on Wataghin's request for participating in this meeting were not found, it is important to make some considerations about the affiliation process of new members before understanding his involvement with the Soviet physicists after joining IUPAP. The first consideration concerns the meaning of the word "international" in the name of the Union. The relationship between nations can be understood from different perspectives, but in this chapter, the "internationalization process" of IUPAP should be seen as a non-abstract phenomenon, that is, the material circulation of knowledge through the international movement of books, papers, instruments, and people of flesh, blood, and nationality.[51] In these terms, an emergent question might be: how is the process required for an individual physicist of flesh, blood, and nationality to become a member of IUPAP? As already discussed in

[48] Silva, "Ciência, universidade e diplomacia científica."

[49] Pierre Fleury, "The International Union of Pure and Applied Physics from 1923 to 1972," in *Physics 50 Years Later*, ed. Sanborn C. Brown (Washington DC: National Academy of Sciences, 1973), 3–10.

[50] "Report of the Seventh General Assembly (1951)," 20. IUPAP, Gothenburg secretariat, (hereafter IUPAP Gothenburg) series B2aa "General Reports," vol. 1, folder "1923–1960," Center for the History of Science, Royal Swedish Academy of Science.

[51] According to the considerations of Krige, "Introduction," and Daniels, "Restricting."

this book,[52] since its inception, the affiliation procedure with IUPAP was only from national committees.[53] Therefore, before being a union of physicists, IUPAP was the aggregation of national committees of physicists. However, it is important to highlight that each national committee was composed of individuals, so before taking part in IUPAP, the physicist should belong to a nation. In other words, they should be national individuals.

At the same time Wataghin joined the Italian committee, Soviet physics was becoming a matter of interest at IUPAP. Moreover, the international opening of the Soviet scientific field following Stalin's death in 1953 was fundamental for encouraging scientific exchanges with foreign countries.[54] This opening would lead a few years later to important international agreements, such as "The Soviet-American Executive Agreement on Cultural, Educational and Scientific Exchanges," from January 1958,[55] and the Italian-Soviet cultural agreement, from February 1960.[56] The movements inside and outside the USSR were crucial for the official affiliation of Soviet physicists with IUPAP in 1957, as can be clearly seen in other chapters of this volume.[57]

For the particular case of Wataghin and his personal and scientific ambitions of being closer to the Soviet Union, the specific initiatives taken by IUPAP were also fundamental. One of these initiatives was taken by the IUPAP Publications Commission, organized in 1949. Initially, this commission intended to promote the translation and printing of papers originally published in Russian.[58] This matter was discussed in the 1951 General Assembly,[59] and in 1952 the President of IUPAP, Nevill F. Mott, established cooperation with the editor of the Italian journal *Il Nuovo Cimento*, who accepted to publish reviews of papers from Russian and Eastern-European physics.

The special issue "Reviews of works on physics published during the last years in eastern Europe and particularly in Russia" was published in 1953[60] with the support of the International Council of the Scientific Unions[61] (ICSU) Abstracting Board.[62]

[52] See Danielle Fauque and Robert Fox's chapter.

[53] The membership rules only changed in 1981. See Roberto Lalli's chapter in this volume.

[54] Konstantin Ivanov, "Science after Stalin: Forging a New Image of Soviet Science," *Science in Context* 15, no. 2 (2002): 317–38.

[55] Olga Krasnyak, "Science Diplomacy and Soviet-American Academic and Technical Exchanges," *The Hague Journal of Diplomacy* 15, no. 3 (2020): 398–408.

[56] Alessandro Salacone, "A cinquant'anni dall'accordo culturale tra Italia e URSS," In *Ulica Ševčenko 25 korpus 2. Scritti in onore di Claudia Lasorsa*, ed. Valentina Benigni and Alessandro Salacone (Roma: Caissa Italia, 2011), 113–23.

[57] On the entry of the USSR into IUPAP in 1957 and the role of Edoardo Amaldi in this matter, see Cozzoli's chapter. On the activities of Soviet physicists in the IUPAP after their official affiliation, see Silva Neto and Kojevnikov's chapter.

[58] Report of the eight General Assembly (1954), 9–10. IUPAP Gothenburg, series B2aa "General Reports," vol. 1, folder "1923–1960."

[59] G. A. Boutry to P. Fleury, February 8, 1954, box 34, folder 1, subfolder 2 "Corrispondenza IUPAP 1948–1956" Fondo Edoardo Amaldi (hereafter AEA), subfondo Archivio Dipartimento di Fisica, Physics Deparment Archives of Sapienza University of Rome.

[60] Nevill F. Mott, "Introduction," *Il Nuovo Cimento*, Supplemento 10 s. 9, no. 4 (1953): 341–3.

[61] The former International Research Council (IRC). See International Council of Scientific Unions. *ICSU: A Brief Outline*, (London: ICSU Administration Office, n.d.), box 106, subfolder 3, AEA.

[62] G. A. Boutry to P. Fleury, February 8, 1954, box 34, folder 1, subfolder 2, "Corrispondenza IUPAP 1948–1956." See also Annexe I à la circulaire SG 53-I, ICSU Abstracting Board, "Rapport présenté à la réunion du Comité Exécutif du Conseil International des Unions Scientifiques," Strasbourg, Juillet 9–10, 1953, 5, box 106, subfolder 3, AEA.

In the "Introduction" of the volume, Mott explained that the publication appeared following the "discussions between the Executive Committee of the International Union of Physics and the Publications Committee of the Union on the need to do something about the inadequate knowledge in many countries of the work on physics published in Eastern Europe and particularly in Russia." Mott pointed out that among the reasons for that inadequate knowledge was the linguistic barrier as many physicists did not understand the Russian language, "in which most of this work is written." To solve this problem, the Executive Committee decided to publish yearly reviews on the Russian works in physics in scientific journals "with a high international reputation and wide circulation."[63] Therefore, that special issue in *Il Nuovo Cimento* was supposed to be the first effort of a more ambitious project of IUPAP.

A brief analysis of the articles' titles of that volume shows some general information on the subjects of interest of IUPAP: "Soviet Physics," by J. Turkevich; "Soviet Work on Mechanical Twinning," by R. W. Cahn; "Recent Soviet Work in the Field of Crystallography," by A. L. Mackay; "Crystallography in Eastern Europe," by A. L. Mackay; "Travaux soviétiques sur la théorie de la liaison chimique," by M. Magat; "Sur les travaux de magnétisme en U.R.S.S.," by S. Rosenblum; "Recent Research on Superconductivity in the U.S.S.R.," by D. Shoenberg; "Polish Physics," by W. J. Swiatecki; "Recent Russian Work on Liquid Helium," by J. Wilks; and the "Recent Research on Cosmic Radiation in the Soviet Union," by Wataghin.[64]

I did not find any sources to explain the criteria used by IUPAP in choosing these authors. However, in Wataghin's case, one may infer that despite being an Italian citizen, he was also recognized as a physicist in Italy with Russian origins. Furthermore, given his engagement in the IUPAP Italian committee, he was probably aware about their initiatives related to Soviet physics. Besides being born in the Russian Empire, Wataghin's knowledge of the Russian language can be attested by some of the letters written and received by him held by both the Historical Archives of the University of Turin and of the Physics Institute at the University of São Paulo.[65] Moreover, despite IUPAP seeking support from the Russian community for that publication, they did not have any response from the Soviet Academy of Sciences.[66] Therefore, the participation of Wataghin and the other authors, who were knowledgeable in Slavonic languages and the Eastern physics field, was crucial.

In his paper, Wataghin presented a review of the recent Soviet works on cosmic radiation. In the "Introduction," he explained that before the June 1952 Conference on Comic Radiation in the Soviet Union, "no meeting on this subject was held in the previous fifteen years" because of the war and, for that reason, "the papers presented at this Conference had not only the purpose of communicating new results, but also of reviewing the work done during that period."[67] Wataghin's review briefly described the most important experimental results and summarized the theoretical physics papers presented at that conference. He accessed the material through the

[63] Mott, "Introduction," 341.
[64] Mott, "Introduction," 343.
[65] "Acervo Histórico do Instituto de Física da Universidade de São Paulo," IFUSP, accessed February 17, 2023, available at http://acervo.if.usp.br/.
[66] Mott, "Introduction."
[67] Gleb Wataghin, "Recent Research on Cosmic Radiation in the Soviet Union," *Il Nuovo Cimento* Supplemento 10 s. 9, no. 4 (1953): 489–508, 489.

special volume published by the *Annals of the Soviet Academy of Sciences* (Известия Академии Наук СССР) in 1953.[68] Given the difficulties of accessing the Soviet production in theoretical and experimental physics at the time, Wataghin's choice in reviewing these papers was a relevant contribution to increasing the knowledge in the West on the latest scientific developments in cosmic-ray physics from the other side of the Iron Curtain. As observed, the initiatives taken by IUPAP to publish this volume met Wataghin's personal ambitions. The coming events would be decisive in fulfilling his goals.

As discussed earlier, Wataghin was unsuccessful in his attempts to reconnect with his Russian origins by offering assistance to the Soviet authorities in the 1940s, during World War II. His participation in the volume organized by IUPAP in 1953 in *Il Nuovo Cimento* was a demonstration of how much he was still interested in building some sort of collaboration with the USSR. All the same, the official affiliation of the USSR with IUPAP in 1957 was the most important step for Wataghin's wish of establishing cooperation with Soviet physicists.

After the adhesion of the USSR, IUPAP began to discuss the importance of holding events there.[69] Following this concern, in May 1958, the conference on "Mechanical Properties of Nonmetallic Solids" was held in Leningrad under IUPAP auspices, and between August 12 and 14 of the same year, the Joint Commission on Spectroscopy met in Moscow.[70] In July 1959, both the Annual Meeting of the IUPAP Executive Committee and the Cosmic Ray Conference were held in Moscow, and the High Energy Physics Conference took place in Kiev.[71]

Once the USSR joined IUPAP and some events were organized in that territory, Wataghin finally had the opportunity to fulfill his personal and scientific ambitions by traveling to both conferences in Moscow and Kiev. Because of his research on cosmic rays with his group in Turin, Wataghin was indicated by Edoardo Amaldi, the then-President of IUPAP,[72] and invited by Bruno Rossi (Massachusetts Institute of Technology (MIT)),[73] the President of the IUPAP Cosmic Ray commission, to integrate the Italian commission in the meeting in Moscow.[74] Wataghin was told about the Kiev

68 Wataghin, "Recent Research."

69 N. F. Mott to E. J. W. Verwey, December 17, 1957, box 34, folder 1, subfolder 2, "Corrispondenza IUPAP 1956–57," AEA.

70 "Circulaire d'Information" by Union Internationale de Physique Pure et Appliquée, November 1958, box 34, folder 1, subfolder 1, AEA.

71 "Circulaire d'Information" by Union Internationale de Physique Pure et Appliquée, April 1959, Doc. SG. 59–2, box 281, AEA. See also: Pierre Fleury to the President of the USSR Academy of Sciences, January 20, 1959, box 28, folder 1, subfolder 16, "Mosca Executive Committee 11–13 luglio," AEA. For more information on the meeting of the High Energy Commission in Kiev, see Barbara Hof's chapter in this volume.

72 Edoardo Amaldi to Bruno Rossi, January 22, 1959. See also Edoardo Amaldi to Cecil F. Powell, January 22, 1959, box 28, folder 1, subfolder 16, "Convegno e Conferenza 1959 Mosca-Kiev IUPAP," Mosca Conferenza R. C. 6–11 luglio, AEA.

73 Bruno Rossi (1905–93) was an Italian physicist, responsible for the beginning of cosmic ray research in the country in the 1930s. In 1939, he moved to the United States to escape from the fascist regime. In 1943, he took part in the Manhattan Project. At the beginning of 1946, after the wartime, he was invited to hold a position at MIT, where he organized a Cosmic Ray Group at the Laboratory for Nuclear Science and Engineering. See: Luisa Bonolis, "From Cosmic Ray Physics To Cosmic Ray Astronomy: Bruno Rossi and the Opening of New Windows on the Universe," *Astroparticle Physics* 53 (2014): 67–85.

74 Bruno Rossi to Edoardo Amaldi, January 26, 1959, box 28, folder 1, subfolder 16, "Convegno e Conferenza 1959 Mosca-Kiev IUPAP," Mosca Conferenza R. C. 6–11 luglio, AEA.

Conference on High Energy Physics by Professor Cornelis J. Bakker (CERN), the commission's President,[75] and the official invitation was made by the Soviet Academy of Sciences.[76] Before traveling, he had to submit a request to the University of Turin's dean, Mario Allara, seeking authorization for his participation in the conferences and an extension of his passport's validity in Soviet territory.[77] Allara complied with Wataghin's request and forwarded it to the Director General of the Superior Instruction of the Ministry of the Public Instruction, adding a request for a service passport for him.[78]

On June 18, 1959, Wataghin sent a copy of his contribution to the meeting to the Organizing Committee of the High Energy Physics Conference, hoping that he could present his paper in the session on "New Theoretical Ideas."[79] He also sent his contributions to both the Cosmic Ray and High Energy Physics Conferences to Professor E. L. Feinberg, from the Lebelev Physical Institute of the Soviet Academy of Sciences.[80] As Wataghin's name was not found in the program of the High Energy Physics meeting, one may infer that his paper was presented by one of the rapporteurs of the session on Theoretical Investigations, N. N. Bogolyubov (Dubna), F. J. Dyson (Princeton), or M. L. Goldberger (Princeton).[81] On the other hand, Wataghin's contribution to the Moscow Cosmic Ray Conference, entitled "A Non Local Field Theory of High Energy Jets," can be found in the first volume of the meeting's proceedings.[82]

Wataghin's travel in 1959 was the first of a series of annual travels he would make to the USSR.[83] That can be considered a milestone of the beginning of his network of collaboration with Soviet physicists. In the following years, he also encouraged scientific missions of Soviet physicists in Italy and of Italian physicists in the USSR. For example, in 1966 he hosted at the University of Turin personalities such as Nikolai Bogolyubov (USSR Academy of Sciences), Dmitri Ivanenko (State University of Moscow), and Dmitry Blokhintsev (Dubna), the first Soviet President of IUPAP

[75] Pierre Fleury to the President of the USSR Academy of Sciences, January 20, 1959, box 28, folder 1, subfolder 16, "Mosca Executive Committee 11–13 luglio," AEA.

[76] Gleb Wataghin to Mario Allara, June 3, 1959, "fascicolo personale Gleb Wataghin," ASUT.

[77] Gleb Wataghin to Mario Allara, June 3, 1959, "fascicolo personale Gleb Wataghin," ASUT.

[78] Mario Allara to the General Direction of the Superior Instruction of the Ministry of the Public Instruction, June 5, 1959, "fascicolo personale Gleb Wataghin," ASUT.

[79] Gleb Wataghin to the Organizing Committee of the 1959 Annual International Conference on High Energy Physics in Kiev, Academy of Sciences of USSR, Moscow, 18 June 1959, "Copia Corrispondenza, dal 1º Gennaio al Dicembre 31, 59, Gleb Wataghin," ASUT.

[80] Gleb Wataghin to Professor E. L. Feinberg, June 20, 1959, "Copia Corrispondenza, dal 1º Gennaio al 31 Dicembre 59, Gleb Wataghin," ASUT.

[81] "The 1959 Annual International Conference on High Energy Physics in Kiev under the Sponsorship of the International Union of Pure and Applied Physics (IUPAP)," program, 3, box 28, folder 1, subfolder 16, Kiev Conference High Energy Physics 15–25 luglio, AEA.

[82] Gleb Wataghin, "A non local field theory of high energy jets," in *Proceedings of the Moscow Cosmic Ray Conference*, July 6–11, 1959, 1, (Moscow, 1960): 231–3, Cesar Lattes Central Library of the University of Campinas.

[83] Wataghin, interview.

between 1966 and 1969,[84] among others.[85] In 1968, he participated in a commission with Edoardo Amaldi and Gianpietro Puppi to promote exchanges between the Italian Academy of the *Lincei* in Rome, and the Joint Institute for Nuclear Research in Dubna. Over time, Wataghin became a point of connection between Italian and Soviet physicists, helping his colleagues not only in scientific affairs but also with diplomatic procedures.[86] According to Lucia Wataghin,[87] he also became a foreign counselor of the Ukrainian Academy of Sciences.

National Borders, Circulation of Scientists, and Personal Ambitions: Final Remarks

This chapter investigated the interplay between national individuals and international unions, from the case study of the participation of the Russian-Italian physicist Gleb Wataghin in IUPAP. When analyzing this case highlighting the interplay between the micro (the individual) and the macro (the international institution, the diplomatic apparatus, and the physics community) poles, it was observed that the personal ambitions of scientists and the goals of international scientific institutions can encounter barriers to cross national borders, making the circulation of people and knowledge difficult. Thus, it is remarkable how much the state apparatus and the political-diplomatic framework directly affect individual trajectories and institutional activities on an international scale. The transnational perspective of this chapter can be observed not only in the specific trajectory of Wataghin but also in my methodological analysis and the choice of historical sources.

When analyzing Wataghin's path through IUPAP, we observe how much the interplay between his national origin and his citizenship interfered with his actions within the scientific field: he was a physicist born in the Russian Empire who had to leave his country after the 1917 revolution, naturalized Italian and whose education was always based on international circulation. As can be seen in his trajectory in Brazil, he never abandoned his Russianness, even representing an Italian mission abroad. However, his involvement with the Russian communities of São Paulo ended up making him a target of Brazilian anti-communist policies, which saw immigrants from Eastern Europe as possible threats to national security. This hostile and prejudiced environment made Wataghin leave Brazil and return to Italy, assuming a relevant position within Italy's academia, as dean of the Physics Institute at the University of Turin. This is what made it possible for him to participate in IUPAP from Italy and, consequently, to finally approach USSR physicists.

[84] For details about Blokhintsev's trajectory and activities within IUPAP, see Silva Neto and Kojevnikov's chapter in this volume.

[85] Gleb Wataghin to the president of the National Research Council of Italy, July 7, 1966, "Copia Corrispondenza, Luglio 1966, Gleb Wataghin," ASUT.

[86] Luciana Vieira Souza da Silva, "Considerações sobre biografia científica e história transnacional das ciências: o caso da participação de Gleb Wataghin na cooperação ítalo-soviética (1959–1968)," *Em Construção*, no. 7 (2020), available at https://doi.org/10.12957/emconstrucao.2020.48121. Marina Moseykina, "Ученый-физик Глеб Васильевич Ватагин: русский эмигрант, гражданин Италии," in *Русские в Италии. Итальянцы в России* (СПб.: Изд-во СпбГАСУ, 2012), 79–90.

[87] Wataghin, "Fundação."

As observed in this chapter, at the same time IUPAP outlined actions aimed at including Soviet physics in its scientific agenda, the USSR was beginning to carry out diplomatic agreements on culture, science, and technology with Western nations. Thus, the political, diplomatic, and scientific conjuncture of the 1950s was what allowed Wataghin to achieve his personal goals and finally manage to establish scientific relations with Soviet physicists. More than that, it was from his activities with IUPAP that he was able to travel to the USSR for the first time since he had left his homeland and then establish Italian-Soviet collaboration networks.

The international circulation of science and scientists depends on a complex array of factors. In the case studied here, it is evident how much the personal ambitions of a national individual and the goals of an international institution are not sufficient to overcome the borders of the countries. A favorable state apparatus is needed and, above all, cultural and scientific diplomatic policies that make it possible to achieve transnational objectives. Wataghin found a possibility to expand his networks of international collaboration towards the USSR in IUPAP, which was only possible due to the political and diplomatic situation of the nations that made up the institution at the time and of the Soviet Union itself. Without it, Wataghin's personal and scientific ambitions would have had to wait longer to materialize. From his specific case, we can observe how national individuals' interests within international unions can be stimulated or interrupted according to the complexity of reconfigurations in the intersection of different scales: scientific, institutional, diplomatic, political, and personal spheres.

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15
The Only (Tense) Encounter of a Non-Existent Relationship?
NATO, IUPAP, and the 1963 Travel Ban Controversy

Simone Turchetti

Can the lack of communication between two international organizations tell us a great deal more about their relationship than many items of correspondence? This appears to be the case for that between the International Union of Pure and Applied Physics (IUPAP) and the North Atlantic Treaty Organization (NATO). Despite their shared interest in the promotion of the physical sciences, the two organizations were deliberately uncommunicative with each other during the whole Cold War, not even acknowledging their respective patronage roles. IUPAP (est. 1922) restarted its activities after World War II under the aegis of the International Council of Scientific Unions (ICSU, est. 1931), with an ambition to facilitate international exchanges even across the Iron Curtain. A NATO science program targeting the physical sciences materialized instead the search of political synergies between the members of the transatlantic defense alliance established in 1949 by promoting scientific collaboration aligned to Cold War alliances. These constitutive differences of the Atlantic alliance explain why IUPAP and NATO hardly ever entered into a conversation. Their archival collections confirm indifference, or lack of interest in establishing a dialog, as NATO hardly ever features in IUPAP's secretarial correspondence, General Assembly meetings, reports, and news bulletins. IUPAP is virtually absent from the official documentation of the Atlantic alliance. Indeed, given the absence of relevant exchanges one might even question the significance of writing an article on their interactions.

Yet it is exactly this silence that makes their relationship worth exploring, as it reveals the compresence of *diverging* agendas in the patronage of the physical sciences. Focusing on this divergence actually enriches our understanding of the historical lineage of what we now call "science diplomacy." Over the last decade, scholars from various disciplines have identified the promotion of scientific initiatives as paving the way to a distinctive form of diplomacy shaping parallel tracks in the administration of international affairs. However, the co-existence of competing science diplomacy schemes is a theme largely overlooked in the relevant literature. The works published so far have largely focused instead on cases of positive diplomatic returns associated with individual scientific exchanges, rather than contiguous but divergent patronage efforts consistent with rivalling diplomatic ambitions.[1] Yet,

[1] See for instance the set of examples in Royal Society/American Association for the Advancement of Science, *New Frontiers in Science Diplomacy* (London: Royal Society, 2010). See also Vaughan C. Turekian

Simone Turchetti, *The Only (Tense) Encounter of a Non-Existent Relationship?* In: *Globalizing Physics*. Edited by: Roberto Lalli and Jaume Navarro, Oxford University Press. © Oxford University Press (2024). DOI: 10.1093/oso/9780198878681.003.0016

the co-existence of contrasting science diplomacy projects is a distinctive feature of the Cold War. For instance, sponsorship of a NATO oceanographic committee produced disapproval from within the International Council for the Exploration of the Sea (ICES), as their officials complained that the alliance's patronage disrupted their collaboration with Soviet oceanographers and fishery scientists.[2]

Not dissimilarly, NATO's sponsorship affected the physical sciences as the alliance seized the opportunity to funding more lavishly international exchanges in Western Europe. Yet, in contrast with ICES, IUPAP executives did not engage with NATO's aggressive patronage strategy, especially given that from the 1950s the Union looked for new members in non-Western and developing countries, whereas the alliance retained a regional focus in Western Europe. Moreover, the different channeling of patronage efforts initially reassured IUPAP executives about the possibility to co-existing with NATO, as the Union operated as a non-governmental organization within the framework of national academies, whereas NATO's schemes resulted from an inter-governmental endowment.[3]

However, tensions escalated in the early 1960s at one decisive junction in Cold War history. Following the erection of the Berlin Wall, NATO endorsed and extended a ban to East German citizens requesting to travel to the alliance's member states. Since it affected scientists wishing to travel to international meetings too, IUPAP officials agreed to engage in a (tense) conversation with their NATO counterparts to have these restrictions removed. The episode proved formative for the authorities of both organizations as it focused their attention on international scientific relations, and their role within these relations. From that moment, IUPAP's championing of the free circulation of scientists was more sustained, and this campaigning increased its visibility, also providing a social responsibility agenda for the organization. By contrast, NATO's restraining stance on free circulation made it more difficult for its officials to promote its science initiatives over the following two decades. The criticism mounting on the ambitions of its science program eventually contributed to make it less relevant internationally. The final part of this article thus examines how these competing stances shaped the two organizations' patronage trajectory at the end of the Cold War.

and Norman P. Neureiter, "Science and Diplomacy: The Past as Prologue," *Science and Diplomacy* 1 (2012). For an appraisal see Pierre Bruno Ruffini, "Conceptualizing Science Diplomacy in the Practitioner-Driven Literature: A Critical Review," *Humanities & Social Sciences Communication* 7, no. 124 (2020), available at: https://doi.org/10.1057/s41599-020-00609-5. See also S. Turchetti, "A Diplomacy Turn? Writing the History of Science in the Context of International Relations," *Physis* 52 (2021): 225–44; S. Turchetti et al., "Introduction: Just Needham to Nixon? On Writing the History of 'Science Diplomacy,'" *Historical Studies in the Natural Sciences* 50, no. 4 (2020): 323–39.

[2] S. Turchetti, *Greening the Alliance: The Diplomacy of NATO's Science and Environmental Initiatives* (Chicago: University of Chicago Press: 2018), 55; See also Jacob Darwin Hamblin, *Oceanographers and the Cold War: Disciples of Marine Science* (Seattle: University of Washington Press, 2005).

[3] On the distinction between scientific non-governmental organizations and intergovernmental organizations, see Aant Elzinga, "Science and Technology: Internationalization," in *International Encyclopedia of the Social and Behavioral Sciences* (New York: Pergamon, 2001), 13633–8, on 13,635. See also Lalli in this volume.

A Tale of Silence? NATO and IUPAP in the Early Cold War Years

When in 1958 NATO publicized the launch of a science program, no ICSU or IUPAP official commented on the initiative. The distinctive sound of silence accompanied the announcement, actually, as IUPAP officials worried that this promotion could run against their efforts to increase opportunities for networking and exchange among physicists in a divided world, especially by reducing exchanges across blocs.

Efforts to sidestep the geopolitical orientation of individual governments in the promotion of international exchanges had already dotted the Union's post-war history. IUPAP initiatives implicitly reaffirmed the political non-discrimination principle that the 8th ICSU General Assembly deliberated in October 1958. It stated that adherence or association [to unions] had "no implication to recognition of the government or the country of the territory concerned."[4] Hence IUPAP representatives administered thorny membership cases recognizing the legitimacy for scientific academies and societies to join the Union, regardless of whether they operated in capitalist or communist blocs, or if their countries had received official recognition. For instance, the Union offered membership to both the physical societies of the recently established Popular Republic of China (PRC) and the Taiwan-based Republic of China (ROC), even though the ROC's acceptance led the Chinese Physical Society in Beijing to refuse membership. The same controversy emerged when the *Physikalische Gesellschaft in der Deutschen Demokratischen Republik* applied for membership in IUPAP. Their colleagues managing the Physical Society of Federal Republic of Germany opposed the request, arguing that their society represented all the physicists on German territory. But the Union's President Edoardo Amaldi (1957–60) felt compelled to accept the request in light of the political non-discrimination principle, and, in 1960, an East German committee joined IUPAP as its 35th national member.[5]

This happened at the end of a period particularly prolific for the organization despite the limited funding available. By the time Amaldi was appointed, IUPAP comprised of six more commissions (for a total of fifteen), and four inter-union committees. The French physicist Pierre Fleury, head of the *Institut d'Optique* in Paris, and Secretary General from 1947, played a part in the Union's impressive growth. He had prompted the recently established United Nations Education, Scientific and Cultural Organization (UNESCO, est. 1946) to fund IUPAP's activities recognizing the urgency to "promoting research and training in the most promising fields of physics."[6] Moreover, UNESCO offered a $200,000 grant-in-aid to ICSU's unions for "travelling expenses of those attending international scientific gatherings, movements

[4] "Subject only to payment of subscription [...] ICSU is prepared to recognize the Academy, Research Council, National Committee, or other *bona fide* scientific group representing scientific activity of any country or territory acting under a government de facto or de jure that controls it." ICSU, Resolution on Political Non-Discrimination, Washington DC, October 1958, Appendix D in ICSU, *Universality of Science. Handbook of ICSU's Standing Committee on Free Circulation of Scientists* (Stockholm: ICSU, 1990), 14. Copy in IUPAP, Gothenburg Secretariat (hereafter IUPAP Gothenburg), series E8 "Correspondence concerning visa problems," vol. 1, "1975–1996," Center for the History of Science, Royal Swedish Academy of Science.

[5] See the chapters by Hu, Liu, and Yin, Olšáková, Cozzoli and Lalli in this volume.

[6] Also assisting Fleury to set up an International Commission for Optics. Franck Dufour, "Quantum Leaps for Peace. Physics at UNESCO," in *Sixty Years at UNESCO* (Paris: UNESCO, 2006), 107–110, on 107.

across frontiers of younger scientific workers, contributions towards publications, the rehabilitation of scientific stations of international standing."[7]

These UNESCO funding streams helped IUPAP to expand and consolidate, also developing synergies with other national groups within non-Western academies. Alexis De Greiff notes that the Union continued to have a distinctive "Western constituency and image" given that by 1972 only ten out of thirty-nine IUPAP national committees were located in third world countries.[8] Yet it is equally true that from the late 1950s IUPAP sought to encourage memberships from other world regions, also assisting UNESCO in its promotion of science in less developed nations. Moreover, while the appointment of the Indian physicist Homi J. Bhabha as Amaldi's successor for the triennium 1960–63 was due to a variety of factors, it propelled this developmental agenda.[9] As Director of the Tata Institute for Fundamental Research in Bombay, Bhabha played a key role in attuning his country's scientific infrastructure to the political agenda of India's Prime Minister Jawaharlal Nehru, hence encouraging both country development through the sciences, and non-alignment. His appointment as IUPAP President gave visibility to these stances.[10]

NATO's patronage of the physical sciences, which began in same period of Bhabha's appointment, differed substantially from IUPAP's sponsorship. The establishment of an alliance in 1949 extended the US Government's ambition to contain communism in Western Europe by outlining a defense coalition tasked to repel a Soviet attack. In the alliance's formative years this defense coordination effort coupled with the search for political synergies, especially as, although twelve founding members had representation in its chief authority, the North Atlantic Council, three (the US, France, and Britain) dominated its proceedings.

NATO's backers in the USA had toyed with the idea of sponsoring fundamental research within the alliance from its establishment. But these plans materialized at the end of the 1950s partly due to the bad publicity that US sponsorship received following the publication of the anonymous French communist pamphlet *Un plan U.S.A. de mainmise sur la science* playing up connections between this patronage and covert intelligence operations.[11] Only the Suez crisis of 1956 paved the way to concrete steps to enact a science program, as the contrast between the alliance's three major powers on supporting Israel displayed a need for greater political harmonization. An ad hoc NATO committee named as Committee of the Three (also known as "Three Wise

See also John Howard, "The Founding of the International Commission for Optics," *Optics and Photonics News*, January 2003: 18–19.

[7] F. J. M. Stratton, "The International Council of Scientific Unions and the International Union of Pure and Applied Physics," *The Institute of Physics Bulletin* 13 (1951): 1–2. See also Frank Greenaway, *Science International: A History of the International Council of Scientific Unions* (Cambridge: Cambridge University Press, 1996), 72.

[8] Alexis De Greiff, "The Politics of Noncooperation: The Boycott of the International Centre for Theoretical Physics," *Osiris* 21 no. 1 (2006): 86–109, on 100. Roberto Lalli shows in this volume this Western constituency and image to be particularly prominent up until the mid-1950s.

[9] On other factors see Lalli in this volume.

[10] Bhabha had represented India in the Union, and five years later joined its executive committee. P. Fleury to H. J. Bhabha, June 25, 1955, IUPAP Gothenburg, series E6 "Correspondence with Liaison Members," vol. 7, folder "India (Indien) 1948–1989."

[11] S. Turchetti, "Contesting American Hegemony: Threats to US consensus-building in Europe, and strategies to deflate them," (forthcoming).

Men") proposed initiating scientific cooperation as a way to provide it, and the launch of the first Soviet satellite Sputnik, in October 1957, invigorated further the idea of a NATO-sponsored program. The following year the North Atlantic Council approved setting up a Science Committee. Chaired by a newly appointed NATO Assistant Secretary General on Scientific Affairs (US physicist Norman Ramsey), within two years the committee agreed on three funding schemes promoting individual fellowships to study abroad, international workshops (or Advanced Study Institutes (ASIs)) and collaborative research projects.[12]

The physical sciences featured in all these strands, and especially in the ASIs, since the funding scheme targeted already popular physics summer schools in Western Europe. From 1959, NATO became the chief sponsor of that organized at Les Houches (Pyrenees, France) by the French mathematician and physicist Cécile Morette (wife of Bryce DeWitt, a leading US physicist in the emerging field of general relativity). While the French *Commissariat a l'Energie Atomique* had initially sponsored the school, a Fulbright endowment funded its expansion, and from 1956 the Ford Foundation offered an annual grant which NATO took on three years later. While participation did not preclude the participation of physicists from other countries, only those from NATO had their expenses covered. Unsurprisingly, they represented the bulk of the seven hundred participants who traveled to Les Houches up until 1966.[13]

The following year, NATO stepped up this commitment to bring international training activities in line with Cold War alliances by offering a grant-in-aid of the Varenna physics summer school. Originally paid for by the Italian Physical Society, the yearly meetings at a villa sited in the tourist resort of Varenna (Lake Como, Italy) received NATO money from 1959. As for that at Les Houches, however, this sponsorship indirectly prompted a selection by covering the expenses of NATO nationals.[14] As the official documentation reiterated, funds were "made available [...] not to influence the policy of the institute nor its selection of students or staff" while covering only "living and travel expenses of *participants from NATO countries* [my emphasis]."[15]

In the context of the 1959 NATO program, $150.000 dollars funded the Varenna and Les Houches schools, and the alliance paid for three more physics-focused ASIs in Naples (Italy), Kjeller (Norway), and Corfu (Greece). No other discipline aside from physics received funding in that year, showing that at this stage NATO seized an opportunity to become a major patron for the physical sciences in Western Europe.[16] NATO officials were open too about their ambition to bring international exchanges

[12] Turchetti, *Greening the Alliance*, 26–33. See also John Krige, *American Hegemony and the Postwar Reconstruction of Science in Europe* (Cambridge, MA: MIT Press, 2006), 191–5.

[13] Pierre Verschueren, "Cécile Morette and the Les Houches Summer School for Theoretical Physics; Or, how Girl Scouts, the 1944 Caen Bombing and a Marriage Proposal Helped Rebuild French Physics (1951–1972)," *British Journal for the History of Science* no. 4 (2019): 595–616, on 608–610.

[14] Pierre Verschueren, "Cécile Morette and the Les Houches summer school for theoretical physics," 614.

[15] North Atlantic Council's Agreement on NATO Advanced Study Institute Programme, November 7, 1958, NATO Archives, NATO Headquarters, Brussels, Belgium (hereafter NATOA), Series AC137 "NATO Science Committee," AC137-D29, also available online at https://archives.nato.int/uploads/r/null/6/0/6008/AC_137-D_29_ENG.pdf (accessed July 3, 2021).

[16] Advanced Study Institute Programme, November 7, 1958, NATOA, AC137-D52, also available online at: https://archives.nato.int/uploads/r/null/6/1/6169/AC_137-D_52_ENG.pdf (accessed July 3, 2021).

in line with Cold War divisions. They argued that UNESCO and ICSU initiatives had "limited utility" because of "difficulties involved in co-operation between countries with different political belief." Moreover, the UN devoted "too much attention to the needs for technical aid in the newly developing countries." NATO wished to encourage scientific exchanges premised on "homogeneity of political outlook and economic development" instead as in its twinned defense alliances; the South-East Asian Treaty Organization (SEATO, est. 1954) and Central Treaty Organization (CENTO, est. 1955).[17]

IUPAP officials never commented on this aggressive sponsorship strategy, possibly persuaded that by targeting physics schools with pre-existing national sponsorships, NATO only shaped regional *multilateral* exchanges rather than *international* ones (accepting all academies and societies from *any* world region). They did not dispute NATO's stance even when French communist physicists agreed to organize a summer school alternative to that in Les Houches in protest with its divisive ambitions.[18] On the contrary, some IUPAP officials even agreed to involve themselves in NATO's initiatives. In 1959, Fleury became a member of the Advisory Panel making recommendations on its research grants, and from 1960 the physicist Louis Néel, who was a member of the IUPAP Executive Committee, became the French representative in the NATO Science Committee. He occupied this position for several years, even when he succeeded Bhabha as IUPAP President (1963–66).[19]

When NATO initiatives gained momentum, IUPAP officials kept quiet about them, although their uneasiness surfaced in correspondence. For instance, in February 1960, the Danish physicist Otto Kofoed-Hansen informed Fleury about a NATO summer school organized at the Danish Atomic Energy Commission. He actually asked for additional funds from the Union, given that NATO funds had allowed hiring five lecturers from the prestigious US laboratories of Livermore, Oak Ridge, and Princeton. Fleury marked the letter in blue and red, in what was seemingly a prelude to a reply emphasizing the contrast between the profligacy of NATO sponsorship and IUPAP's parsimonious approach.[20] He did not reply though. Yet, he could no longer keep silent about the alliance three years later, when NATO ratified restrictions preventing East German physicists from traveling, hence throwing a spanner into the routine mechanisms of free circulation of scientists wishing to attend international meetings. This time he and Bhabha had to engage in a tense exchange with NATO officials proving decisive to the history of IUPAP (and informing NATO's future science initiatives too).

[17] Comparison of the Scientific Activities of NATO, OECD, and Other International Organizations, May 28, 1962, NATOA, AC137-D139, 7.

[18] Verschueren, "Cécile Morette and the Les Houches summer school for theoretical physics," 612–15; Krige, *American Hegemony*, 96.

[19] Research Grants Programme, December 16, 1959, NATOA, AC137-D52, also available online at: https://archives.nato.int/uploads/r/null/6/1/6181/AC_137-D_55_ENG.pdf (accessed July 3, 2021). On Neél see also Turchetti, *Greening the Alliance.*

[20] O. Kofoed-Hansen to Fleury, February 2, 1960, IUPAP Gothenburg, series E6 "Correspondence with Liaison Members," vol. 5, folder "Denmark (Danmark) 1947–1999."

IUPAP's Pledge in Favor of GDR Physicists

After World War II, scientists had struggled to obtain visas to travel to international meetings more than once. In the years that followed the conflict, those in Soviet Russia had often to cancel their visits to the West, while their Israeli colleagues could not travel to Eastern bloc countries. In the early 1950s, the red scare propelled the approval of the McCarran Internal Security Act curtailing access to the USA to foreign scientists with a suspected communist affiliation. The 1956 Soviet repression in Hungary produced more bans.[21]

The erection of the Berlin Wall marked a more sustained travel crisis. From August 1961 a partition, permanently dividing the city's western sector from the other ones was under construction. The adoption of a separate flag and anthem for the self-appointed German Democratic Republic (GDR) exacerbated tensions already made palpable through the 1955 Hallstein Doctrine.[22] This situation also made impossible for East Germans to travel. They had that far been allowed to do so thanks to a Temporary Travel Document (TTD) made available by Western powers recognizing the GDR territory as a Soviet-occupied area of Germany rather than that of a sovereign state. Hence, the Allied Travel Office (ATO) of West Berlin, a bureau where consular authorities from the USA, the UK, West Germany, and France had their representatives, released TTDs replacing visas and passports.

From 1961 the number of East Germans receiving a TTD rapidly decreased, while NATO endorsed and extended a travel ban. As Heather L. Dichter has recently showed, NATO was drawn into the controversy due to the criticism that followed the ban of an East German team from the 1962 World Ice Hockey Championship. The ban caused a sensation because the ice hockey federation had already agreed that the team travel to Colorado (USA) for the competition, and therefore queried the US State Department's decision to not release travel permits for its players. Given that the four ATO powers were part of the alliance, the US representative at NATO now asked an official ban endorsement to deflect international disapproval.[23] The North Atlantic Council provided the ratification following advice from its Committee of Political Advisers (or Political Committee—assisting the council in the political consultation process). In January 1962, its head, Assistant Secretary General for Political Affairs Robin W. J. Hooper, confirmed the ban to be valid in all NATO member states.[24]

[21] Jan Nilsson, "What Can IUPAP Do for You?" *Physics World*, 1996: 13–14.

[22] Designed by the Federal Republic of Germany (FRG) diplomat Walter Hallstein, it aimed to isolate the GDR internationally by proclaiming that West Germany would not establish or would severe diplomatic relations with any country recognizing the GDR. See on this William Glenn Gray, *Germany's Cold War: the Global Campaign to Isolate East Germany, 1949–1969* (Chapel Hill: University of North Carolina Press, 2003).

[23] Heather Dichter, "'A Game of Political Ice Hockey': NATO Restrictions on East German Sport Travel in the Aftermath of the Berlin Wall," in *Diplomatic Games: Sport, Statecraft, and International Relations since 1945*, ed. H. L. Dichter and Andrew L Johns (Lexington: University Press of Kentucky, 2014), 19–52, on 31–2.

[24] An Oxford-educated pilot in the Royal Air Force, Hooper took the role of political adviser before moving permanently into the diplomatic career as UK ambassador in Tunisia from 1966, and in Greece from 1971. "Courage of pick-up pilot Robin Hooper," *Sussex Express* May 9, 2018, available at https://www.

Notwithstanding the NATO authorities' reassurance that the ban should "not be maintained any longer than absolutely necessary," very few East Germans could cross Checkpoint Charlie in 1962, and virtually none in 1963.[25] GDR scientists wishing to attend meetings did not receive their TTDs either. The UK Government, led by the Conservative Prime Minister Harold Macmillan, was particularly rigorous in implementing the ban and these developments troubled IUPAP officials exactly because the Union had recently welcomed a GDR national committee as a new member. Bhabha and Fleury understood the gravity of the situation when, in July 1962, no GDR physicist could attend the IUPAP-sponsored Conference on Semi-Conductors organized in Exeter (UK).[26]

The ban divided NATO too. The Danish representative in its Political Committee argued that the absence of East Germans at a scientific symposium in Copenhagen organized at the same time of the Exeter conference had produced "strong criticism, even in the most conservative press" of his country.[27] Moreover, there was disquiet about the possibility of retaliatory measures applied to the forthcoming physics conferences in Eastern Europe, such as the one due take place in East Berlin in summer 1963.[28] In the UK, a Labour Party member of parliament complained in the House of Lords that East German scientists were prohibited from traveling to the forthcoming London congress of the International Union of Pure and Applied Chemistry (IUPAC) (IUPAP's sister union for chemistry). Wayland Young (Lord Kennet) also recalled that ICSU now intended to approach UNESCO, since the ban had "given rise to such disquiet in international circles."[29] The UK Minister of State for Foreign Affairs deflected his political opponents' criticism by appealing to the NATO directive.[30]

At this point IUPAP officials began to view the alliance not only as bringing exchanges in the physical sciences in line with Cold War alliances, but also as *preventing* these exchanges outright. Indeed, the travel ban soon became the chief item in Bhabha's own agenda as the new IUPAP President.[31] Moreover, the GDR representative vibrantly protested with him and Fleury about the ban, arguing against Union-sponsored meetings in countries that disqualified the East Germans. So, when in January 1963 the IUPAP Executive Committee met at Bhabha's institute in

sussexexpress.co.uk/retro/courage-of-pick-up-pilot-robin-hooper-1,032,433. See also Linda Risso, *Propaganda and Intelligence in the Cold War. The NATO Information Service* (London: Routledge, 2014), 96; Donald Seaman and John S. Mather, *The Great Spy Scandal* (London: *Daily Express*, 1955), 62.

[25] Meeting Action Sheet, October 23, 1962, NATOA, Series AC119 "Papers of the Committee of Political Advisers," AC119-R(62)37.

[26] IUPAP, Minutes of Meeting held at the Tata Institute for Fundamental Research, Bombay, January 10–11, 1963, IUPAP, Quebec Secretariat (hereafter IUPAP Quebec), Series E1 "Larkin Kerwin's and Pierre Fleury's correspondence," vol. 2, "Fleury's Correspondence 1959–1963 + Minutes of IUPAP meeting Bombay 1963," Center for the History of science, Royal Swedish Academy of Sciences.

[27] Meeting Action Sheet, July 3, 1962, NATOA, AC119-R(62)26.

[28] Meeting Action Sheet, January 8, 1963, NATOA, AC119-R(63).

[29] "Visa for East German Scientists and Artistes," House of Lords Debate of March 21, 1963, in *Hansard* 247, 236–64.

[30] The Earl of Dundee (Henry Scrymgeour-Wedderburn) stated "this was a NATO decision, not an individual decision." Ibid.

[31] Charles Davis, "Report on the materials in the IUPAP dossiers," Institute d'Histoire et the Sociopolitique des Science, Universitè de Montrèal, 1980. Copy in IUPAP Quebec, series E1 "Larkin Kerwin's and Pierre Fleury's Correspondence," vol. 5, folder "Correspondence re: archives."

Bombay, the travel restrictions featured as a prioritized agenda item, and one that, unsurprisingly, led to a "lengthy discussion."[32] A comprehensive note summed up the committee's deliberations. Bhabha agreed to write directly to the NATO Assistant Secretary General for Scientific Affairs asking him to make representations in the alliance's political forum against the ban. Meanwhile Fleury informed the ICSU Executive Secretary, André E. Decae.[33]

Bhabha's letter spurred the ICSU officials into action. Its President, the Swedish embryologist Sven Hörstadius (University of Uppsala), first congratulated Bhabha for his initiative, and then went on to recall Bhabha's letter in the council's statement against the ban. By then the President, together with Decae, had already agreed to write to the science academies of ATO countries so that they could lobby against their governments' restrictions. The letter was also forwarded to British, French, and West German authorities through their embassies in Stockholm.[34] It clearly stated that "protests have been made on several occasions both by scientific bodies and by such eminent personalities as Professor Bhabha who ... recently put forward a plea ... to facilitate the obtaining of visas."[35]

NATO Ignoring IUPAP

For reasons explained in the conclusions, we do not know the content of Bhabha's letter. What we know instead is that US physicist William P. Allis, the Massachusetts Institute of Technology (MIT) professor appointed as NATO Assistant Secretary General for science Affairs in 1962, did little to address Bhabha's concerns. Internationally renowned for his work in applied physics as a former member of the MIT Radiation Laboratory, Allis had since played a prominent role in the American Physical Society (and was therefore familiar with IUPAP too). By the time NATO employed him, the alliance's science program had developed, now comprising sixty-seven ASIs completed, about one thousand fellowships awarded, and over one hundred cooperative scientific projects already finished or under way.[36]

Notwithstanding these achievements, criticism within the alliance was mounting, especially as French and British representatives contended that the scheme duplicated

[32] IUPAP, Minutes of Meeting held at the Tata Institute for Fundamental Research, Bombay, January 10–11, 1963, IUPAP Quebec, series E1 "Larkin Kerwin's and Pierre Fleury's correspondence," vol. 2, "Fleury's Correspondence 1959–1963 + Minutes of IUPAP meeting Bombay 1963."

[33] Fleury to A. E. Decae, the ICSU Secretary, January 17, 1963, IUPAP Quebec, Series E1 "Larkin Kerwin's and Pierre Fleury's Correspondence," vol. 6, folder "ICSU, Fleury's Correspondence 1963."

[34] Sven Hörstadius to Bhabha, February 19, 1953; and Decae to Hörstadius, December 24, 1962, ICSU Papers, International Science Council Main Office, Paris, France [ICSU Papers hereafter], Past officers of the ICSU Bureau Correspondence 1960s.

[35] Hörstadius and Decae were as worried as Bhabha about the travel ban also because of the imminent meeting of the committee organizing the International Year of the Quiet Sun, a large international collaborative exercise aiming to replicate in 1964 the successful initiative of the International Geophysical Year, 1957–58. Hörstadius's letter, January 29, 1963 in the ICSU, Past officers of the ICSU Bureau Correspondence 1960s.

[36] "Dr. Allis Appointed to NATO," Press Release (62)10, June 15, 1962, NATOA, also available online at: https://archives.nato.int/uploads/r/null/1/3/138136/PRESS_RELEASE__62_10_ENG.pdf (accessed July 3, 2021). On Allis see also Abraham Bers and Hermann A. Haus, "William Phelps Allis," *Physics Today* 52 no. 10 (1999): 106.

studies developed within the alliance's military research laboratories.[37] Partly because of this criticism, but also to conform to his government's stance, Allis never replied to Bhabha. In April, Fleury took on the responsibility of contacting directly Allis' office, especially given that he had previously acted as an evaluator in the selection of research projects. He thus wrote to the NATO Division of Scientific Affairs and succeeded in arranging a meeting with Allis and Hooper.[38]

As Fleury wrote to Bhabha after the meeting, removal of the ban continued to be *lettre morte* at the alliance's headquarters. He was tactful enough with the two NATO officials, repeatedly stressing that the case concerned physicists in the *zone soviétique allemande*, hence being of importance to international scientific cooperation rather than to the internal affairs of an unrecognized country like the GDR. But Allis and Hooper did not commit to anything, and Bhabha eventually learnt from Fleury that "as things stand ... we will not get any progress through our NATO channels [translation mine]."[39]

Exactly at that time, however, a new proposal was tabled. Since the representatives of Netherlands, Norway, and Denmark at NATO had been vocal against the travel ban, in the spring 1963 the ATO powers proposed a trial relaxation. GDR scientists would be allowed to travel, but only if they agreed to join an "all-German" delegation (hence comprising West Germans too). The US National Academy of Sciences representative, nuclear physicist Robert E. Bacher, confirmed that the academy was working hard on the proposal shaping all-German teams during the ICSU Bureau meeting of March 1963.[40]

But due to this detail in the proposal's design, the provisions had limited success. East German scientists received permits to travel to Berkeley (California) for the International Union of Geodesy and Geophysics (IUGG) conference of August 1963.[41] But, as Decae wrote to Fleury, the disagreement between the two German academies had intensified making "difficult to propose this solution as a fix to all the troubles we are currently going through [French in the original, my translation]."[42]

Indeed, the East German Academy of Sciences complained about the IUGG meeting, so that eight GDR scientists attempted to gain admission outside an all-German delegation. Nine more GDR scientists hoped to attend the International Union of Crystallography congress, but their country's authorities refused exit permits, denouncing the all-German provisions as discriminatory.[43] In July 1963, the President of the East German Academy of Sciences informed Hörstadius that the academy

[37] Turchetti, *Greening the Alliance*, ch. 4.

[38] Fleury to Bhabha, April 3, 1963, IUPAP Quebec, series E1 "Larkin Kerwin's and Pierre Fleury's Correspondence," vol. 6, folder "ICSU, Fleury's Correspondence 1963."

[39] Fleury to Bhabha, April 3, 1963, IUPAP Quebec, series E1 "Larkin Kerwin's and Pierre Fleury's Correspondence," vol. 6, folder "ICSU, Fleury's Correspondence 1963."

[40] Item 12, Visa for Scientists, ICSU Papers, ICSU Bureau 29th meeting, Rome, March 25–27, 1963.

[41] Meeting Action Sheet, May 6, 1963, Confidential, NATOA, AC119-R(63)16.

[42] Fleury to A. E. Decae, April 23, 1963, and A. E. Decae to Fleury, April 30, 1963, IUPAP Quebec, series E1 "Larkin Kerwin's and Pierre Fleury's Correspondence," vol. 6, folder "ICSU, Fleury's Correspondence 1963."

[43] Report by the French Representative on the Application of the New Measures Concerning TTDs, NATO Confidential, Annex to Summary Record of Council meeting, November 13, 1963, NATOA, CR(63)63 in series CR "North Atlantic Council Meeting Records," 31–2.

discouraged its members be part of an all-German delegation.[44] The International Genetics Conference (The Hague, Netherlands) confirmed the NATO solution to be short-lived, as no all-German delegation could be assembled.[45]

By September 1963, with the 11th IUPAP General Assembly in Warsaw (Poland) approaching, the ban was still pretty much in the frame. Bhabha and Fleury had to work hard to make sure that participants could travel, especially given that Eastern European authorities began to refuse visas to West German physicists.[46] In Poland, the IUPAP General Assembly reiterated the ban condemnation made at the previous Executive Committee meeting. It acknowledged that "free travel possibilities of all scientists for the participation in international scientific conferences form an indispensable basis for successful international co-operation," and deliberated that the restrictions should be removed immediately. Moreover, as stated in the minutes of the IUPAP General Assembly, ICSU's national committees were about to take "appropriate steps with their respective governments for arranging facilities for granting exit and entry visas to all scientists attending international scientific conferences."[47]

In November 1963, the 10th ICSU General Assembly followed up on these deliberations by approving the Vienna Resolution on Free Circulation of Scientists. Decae and Hörstadius had prepared the it carefully by seeking to circumvent an "unpleasant row" on the resolution between opposite factions.[48] The officers thus suggested setting up a small working group to deliberate on these matters. Drawing on the 1958 declaration of political non-discrimination, the group eventually resolved that the council should "take all measures within its powers" to ensure the participation of scientists and set up an executive committee to operate accordingly, hence fully embracing the free circulation principle.[49] While especially Bhabha, but also Fleury, contributed to set this principle in the agenda of both IUPAP and ICSU, they were about to leave this campaigning to their successors. In that year, the French Néel replaced the Indian physicist in the routine rotation of IUPAP Presidents, while Fleury left the IUPAP Secretariat in the hands of the Briton C. C. (Clifford Charles) Butler.[50]

Meanwhile the NATO Science Committee did not even debate the travel ban once, as US officials succeeded in making sure that its involvement in these matters be

[44] Hörstadius to Decae, July 23, 1963, ICSU Papers, Past officers of the ICSU Bureau Correspondence 1960s.

[45] "Contrary to the assurances given to the Italian Government." Meeting Action Sheet, October 3, 1963, Confidential, NATOA, AC119-R(63)32; Meeting Action Sheet, September 19, 1963, Confidential, NATOA, AC/119-R(63)30.

[46] Charles Davis, "Report on the materials in the IUPAP dossiers," Institute D'Histoire et the Sociopolitique des Science, Universitè de Montrèal, 1980. Copy in IUPAP Quebec, series E1, "Larkin Kerwin's and Pierre Fleury's Correspondence," vol. 5, folder "Correspondence re: archives."

[47] IUPAP, Report of the General Assembly, Warsaw, 1963, second session, September 29, 1963, 20, copy in IUPAP Gothenburg, series B2aa "General Reports," vol. 1, folder B "IUPAP 1960–1966."

[48] Decae to Hörstadius, September 17, 1963, ICSU Papers, Past officers of ICSU Bureau Correspondence 1960s.

[49] Resolution of Working Group 4, November 28, 1963, ICSU Papers, 1963 GA circulars and documents of ICSU, Resolution on Free Circulation of Scientists, Vienna, November 1963, Appendix D in ICSU, *Universality of Science*.

[50] Fleury had offered resignations already in 1960 but was then confirmed in his role for three more years (see Lalli in this volume). Butler was Secretary General until 1972 and President from 1975. Ian Butterworth, "Sir Clifford Charles Butler. 20 May 1922–30 June 1999," *Biographical Memoirs of the Fellows of the Royal Society* 47 (2001): 39–54.

prevented. In September 1963, the Foreign Secretary of the National Academy of Sciences, Harrison Brown, consulted with the US ambassador at NATO, Thomas Finletter, and its representative on the Science Committee, Isidor Isaac Rabi. They agreed to avoid bringing "the matter of TTD up before the Science Committee" and alerted Allis accordingly.[51] Thus, not only was Allis non-committal with Fleury, but ready to castrate efforts to debate the travel ban at Science Committee meetings. Indeed, he pounced on the Danish representative, the physicist Henning Højgaard Jensen, when he attempted to raise the issue at the meeting of October 28, 1963, a month after the Warsaw IUPAP conference. Jensen urged Allis to "press for a relaxation of the present regulations, with the view of allowing free scientific exchange." Yet, Allis dismissed his remarks, prevented other representatives from joining the discussion, and claimed that the issue had too "high political content" to be debated at committee meetings. He did not even set it as an agenda item for the next one.[52]

Jensen had presented the issue speaking in his personal capacity, but his plea anticipated that of the Danish ambassador at the North Atlantic Council, and Erik Schram-Nielsen spoke as government representative. The diplomat recalled the problematic consequences of the ban in his country, and noted with regret that the Bertolt Brecht theatrical company had not entered Denmark to stage the recently defunct playwright's last piece. He also explained that the ban had had consequences for illustrious scientists too. The world-renowned East German physicist Gustav Hertz could not travel to Copenhagen to deliver the Helmholtz medal to Niels Bohr's wife. "Taking into consideration Professor Hertz" international standing and the purpose of his visit to Copenhagen," Schram-Nielsen pointed out "Danish scientists have reacted sharply to this refusal."[53]

The Danish statement, which the NATO Secretary General Dirk Stikker judged "very persuasive," shaped a more visible opposition to the travel restrictions. Stikker thus arranged a follow-up debate for the council's meeting of November 6, 1963. On that day the German ambassador Wilhelm G. Grewe conceded that the rigid measures had weakened the alliance politically, but insisted that restrictions to freedom of movement in the Soviet Zone associated with the building of the Wall were to blame. The measures endorsed by NATO, were "merely a rather weak and hesitating response to the brutal and inhumane measure of building a wall right through Berlin."[54]

The German ambassador now proposed the scheme which would take the controversy to an end. He suggested removing the "all-German" principle, but at the same time, he was firm that "the 'so-called DDR' citizen abroad should refrain from political activity (including flying the flag)," and called for the East Germans to match

[51] Harrison Brown, National Academy of Sciences to W. Allis, NATO Science Advisor, October 9, 1963 [copy in the correspondence of the NATO ASG for Scientific Affairs]. Brown had previously stated with Decae during a visit at ICSU that the travel issues depended entirely on the GDR administration and not that of NATO countries. Decae to Hörstadius, September 17, 1963, ICSU Papers, past officers of ICSU Bureau Correspondence 1960s.

[52] Minutes of Meeting, December 9, 1963, Restricted, NATOA, series AC137 "Science Committee," AC137-R17_E, 44.

[53] Restrictions on Travel of East Germans, Secret, in Summary Record of Meeting, October 31, 1963, NATOA, Series CR "North Atlantic Council Meeting Records," CR(63)61, 10–12.

[54] Summary Record of Meeting, November 13, 1963, Secret, NATOA, CR(63)63, 15–20.

the ban relaxation with similar determinations in their country.[55] The Political Committee debated these measures before the council finally approved the provisions.[56] Yet the German resolution did not lead to implementing straightaway the relaxation it advocated. In 1964, GDR sportsmen and scientists received over three hundred TTDs, but refusals continued to be high in number in both France and Italy, while much lower in Britain.[57] In any case, it was not thanks to the IUPAP executives that the controversy ended, even if Fleury and Bhabha assisted in raising international attention to the travel ban. At the same time, the decision made IUPAP authorities more alert about the free circulation of scientists as an item that the Union should champion more actively. Conversely, in the decades after the travel ban controversy, the relationship with NATO went back to its non-existent past.

IUPAP's and NATO's Diverging Trajectories from the 1970s

Given its involvement in the 1963 controversy, IUPAP officials became even more active in championing the free circulation of scientists internationally during the 1970s. This is not to say that IUPAP was alone in this campaigning. ICSU stepped up its commitment through setting up a Standing Committee on the Free Circulation of Scientists in line with the 1963 resolution elaborated by "Working Group 4."[58] Yet IUPAP's campaigning interjected the call for greater social responsibility coming from within the physicists' community, and hence conferred a virtually unique political goal to the Union.

The 1970s was a decade typified by tensions in the physics community, especially after the revelations contained in the so-called Pentagon Papers that a US Government's advisory group comprising prominent physicists, JASON, had been responsible for designing bombing strategies for the Vietnam conflict. The members of grassroot organizations now campaigned for a social agenda in the physical sciences, while becoming more alert to instances of discrimination in scientific societies. All these issues called for greater commitment to social causes, and, in turn, many physicists framed social responsibility as an item to prioritize in national and international scientific affairs.[59]

[55] I.e. citizens of the *Deutschen Demokratischen Republik*. Meeting Action Sheet, December 10, 1963, Confidential, NATOA, series AC119 "Committee of Political Advisers," AC119-R(63)42.

[56] Meeting Action Sheet, November 28, 1963, Confidential, NATOA, AC119-R(63)40.

[57] Restrictions on Travel by Soviet Zone Residents. Report by the Chairman of the Committee of Political Advisers, June 16, 1965, Confidential, NATOA, Series CM "North Atlantic Council Memoranda," CM(65)43.

[58] IUPAP Executive Committee meeting, 16/9/1978, 6–7, copy in Larkin Kerwin Fonds (P202), subseries P202/B4 IUPAP (hereafter IUPAP Kerwin), folder 1.12 "Conseil exécutif 1978—Stockholm (Suède) 1978." Division de la gestion des documents administratifs et des archives, Université Laval, Quebec, Canada.

[59] On JASON see Sarah Bridger, *Scientists at War. The Ethics of Cold War Weapons Research* (Cambridge, MA: Harvard University Press, 2015), 195–200. Some aspects of the controversy are also summarized in the dossier "The War Physicists" put together by Bruno Vitale as part of the activities of the radical science group Science for the People (see https://science-for-the-people.org/wp-content/uploads/2014/02/The-War-Physicists.pdf). See also Gerardo Ienna, "Fisici Italiani Negli Anni '70 fra Scienza e Ideologia," *Physis* 55 (2020): 412–42.

When, in the summer of 1971, the Canadian physicist Larkin Kerwin succeeded Butler as IUPAP Secretary General, he thus more vibrantly endorsed the campaign on the free circulation of scientists to display this as the chief item of a social responsibility agenda for the Union. Hence, not only did his activism give furtherance to Bhabha's and Fleury's commitment of the early 1960s, but chimed with the growing demand for social engagement.[60]

Kerwin endorsed and propelled the free circulation advocacy also to shield IUPAP from accusations regarding racial discrimination following a 1971 ICSU investigation on scientific unions. Just before resigning, Kerwin's predecessor had thus received a questionnaire about the Union's stance and records. South Africa's membership to IUPAP now emerged as a sticky issue given its apartheid legislation, even if Butler was quick to point out that no South African delegate had attended the last IUPAP General Assembly.[61] A few weeks later, the recently appointed Kerwin more vocally replied to the ICSU Secretary General recalling that the championing of free circulation of scientists was the chief evidence of the Union's non-discriminatory approach. Indeed, not only had scientists been able to freely attend scientific meetings, but since the post-war years IUPAP had accepted membership of academies from capitalist and communist countries alike. There was enough evidence that the Union operated in line with the ICSU resolutions on free circulation and non-discrimination.[62]

Kerwin also wrote about the campaign in the official magazine of the American Physical Society, *Physics Today* in a time when, exactly because of the JASON controversy, its editorial board had attempted to give resonance to cases of social engagement. His article displayed IUPAP's role in championing the free circulation of scientists in a divided world, and the challenges that lay ahead in defending this stance. He focused especially on what he defined as "harassment" cases, when there was not an explicit ban, but the release of visas was delayed long enough to prevent a physicist from travelling.[63]

Over the decade, there were more moments on tension when flagging up this non-discriminatory approach proved important for IUPAP executives. In 1974, the Yom Kippur war led UNESCO to condemning Israel, and, in retaliation, a group of physicists with Israeli connections boycotted meetings at the International Centre for Theoretical Physics (ICTP) of Trieste.[64] In the same year, the IUPAP General Assembly deliberated new measures on the free movement of scientists dictating that the organizers of union-funded meetings ought to provide written reassurance that refusal to grant a visa would lead to suspending sponsorship. IUPAP would no

[60] The American Physical Society had also set up its Forum on Physics and Society in 1972,. Bridger, *Scientists at War*, 201.

[61] C. C. Butler to F. A. Stafleu, ICSU Secretary General, July 23, 1971, IUPAP Kerwin, folder "ICSU, 1966–1984."

[62] Kerwin to F. A. Stafleu, August 18, 1971, in IUPAP Kerwin, folder "ICSU, 1966–1984." In September 1972 ICSU approved a stricter Resolution on the Free Circulation of Scientists which stressed the affiliated unions' obligations with regards to implementing its guidelines. See ICSU, Resolution on the Free Circulation of Scientists, Helsinki, September 1972, Appendix D in ICSU, *Universality of Science*, 16. Copy in IUPAP Gothenburg, series E8 "Correspondence concerning visa problems," vol. 1, "1975–1996."

[63] Larkin Kerwin, "IUPAP on Freedom," *Physics Today* 26 no. 12 (1973): 11.

[64] De Greiff, "The Politics of Noncooperation," 101.

longer "sponsor a conference if visas are refused to travel to it purely on grounds of nationality or citizenship."[65]

By 1975, Kerwin recalled at the IUPAP General Assembly that these impediments included the "denial of entrance and exit visas, restriction of travel, the delivery of visas after the beginning of conferences, the lateness of visa applications, [and] boycotts."[66] From then onward IUPAP took care of more cases, including the persecution of physicists in Argentina and Bangladesh opposing their countries' regimes following military takeovers. Kerwin collected the correspondence regarding these cases in separate archive folders.[67] The growing commitment to the free circulation of scientists also helped the Union to thrive, especially as evidence of the Union's non-discriminatory approach persuaded UNESCO to provide more funding for physics symposia. With thirty-eight countries as members and seventeen commissions, the Union now covered more aspects of the physical sciences than ever before.[68]

In contrast with IUPAP, NATO could not deflect the criticism of physicists calling for greater social responsibility. Those targeting the secret US advisory group JASON now viewed NATO as complicit, especially as the alliance invited some of group's members to international meetings in Europe during the summer of 1972. The Italian Physical Society even succumbed to the protesters' request that from that year the alliance no longer financed the Varenna summer school. The militants also disrupted a NATO-sponsored meeting organized at the ICTP of Trieste, and their criticism made European allies (especially France and Britain) wary about increasing the budget for the alliance's science program. In turn, this made NATO science schemes less relevant internationally, especially as inflation hit at the real value of endowments.[69]

The divergent paths and fortunes of NATO and IUPAP returned their relationship to the state of non-existence typifying the period before 1963. Scientists who displayed ignorance of their lack of dialog were promptly reminded. For instance, in 1979 a University of Salford (UK) biochemist informed IUPAP that NATO had just approved funding an ASI on time-resolved fluorescence spectroscopy. Robert Cundall dared asking Kerwin extra funds, and the IUPAP official replied coldly, recalling that "the Union *has never had* the resources to support [NATO] summer schools and study institutes [emphasis mine]."[70]

Profligacy aside, the two organizations increasingly divided over giving voice to what concerned the physicists they funded, especially with regards to the social and

[65] IUPAP Resolution on the Free Circulation of Scientists, September 1974 and amended IUPAP statutes, copy in IUPAP Kerwin, folder 1.4 "Assemblée générale 1975—Munich (Allemagne) 1973–1975."

[66] 15th IUPAP General Assembly, Summary Report, Munich, 24-28/9/1975, 1–2, copy in IUPAP Kerwin, folder 1.4 "Assemblée générale 1975—Munich (Allemagne) 1973–1975."

[67] This correspondence is currently in IUPAP Quebec, Series E1 "Larkin Kerwin's and Pierre Fleury's correspondence," vol. 9, folder "ICSU—Libre Circulation des scientifques," and folder "IUPAP Free Circulation of Scientists, 1981, 1982." Harassement cases also featured as an item of discussion in General Assemblies. See for instance 15th IUPAP General Assembly, Executive Committee meeting, 24/9/1975, item 17, copy in IUPAP Kerwin, folder 1.9 "Conseil exécutif 1975—Munich (Allemagne) 1975."

[68] Dufour, "Quantum Leaps for Peace. Physics at UNESCO," 108.

[69] Turchetti, *Greening the Alliance*, 115–20.

[70] R. B. Cundall and R. E. Dale to L. Kerwin, August 13, 1979, IUPAP Gothenburg, series E11 "Correspondence concerning Council meetings," vol. 2, folder "Council Meeting Varna 1979."

political implications of atomic energy and nuclear weapons. For instance, when in 1977 the Danish representative at the Science Committee called attention to "the approaching crisis of science," citing nuclear power as an example, the US representative (and JASON member) William Nierenberg belittled his pledge as aligned to the stances of "vociferous minority."[71] In contrast, while IUPAP never officially endorsed nuclear disarmament, organizations and individuals affiliated to the Union could voice their concerns at its meetings, as they did during the 1983 crisis that followed the deployment of Pershing II and Cruise missiles in Europe.[72] GDR physicists prepared a resolution for the IUPAP assembly calling upon "colleagues in other countries actively to make a stand against the deployment ..., and to do everything in their power in order to banish completely nuclear weapons from Europe."[73] The Soviet Academy of Sciences transmitted a similar appeal: "NATO decision to deploy medium range missiles ... caused particular alarm .... Scientists express their confidence that collective wisdom and united will of peoples are capable to stop the sliding of the world towards the Third World War."[74] The crisis also led to the ICSU statement "Scientists and Peace."[75] Unsurprisingly, appeals of this kind did not feature in the context of NATO ASIs.

Physicists previously affiliated with IUPAP and NATO divided over these issues too. The former IUPAP President Edoardo Amaldi now campaigned for nuclear arms control through the disarmament organization Pugwash.[76] By contrast, in the early 1980s the (NATO-endowed) President of the European Physical Society Antonino Zichichi, busied himself with organizing (together with the JASON member Edward Teller) the International Seminars on Nuclear War in Erice (Sicily). Teller and Zichichi advocated, in line with NATO's stance, the deployment of more advanced technological systems, including the infamous Strategic Defense Initiative.[77] The opposite standpoints of Amaldi and Zichichi further amplified the already existing distance between IUPAP and NATO during the final years of the Cold War.

[71] Turchetti, *Greening the Alliance*, 121.

[72] On this see: S. Turchetti, "Trading Global Catastrophes: NATO's Science Diplomacy and Nuclear Winter," *Journal of Contemporary History*, 56/3 (2021): 543–562, on 551–52; Leopoldo Nuti, "The Origins Of The 1979 Dual Track Decision—A Survey," in *Crisis of Détente in Europe*, ed. L. Nuti (London: Routledge, 2009), 57–71.

[73] Executive committee of the GDR Physical Society to Kerwin, 1/6/1983 in IUPAP Gothenburg, Series E11 "Correspondence concerning Council meetings," vol. 4, folder "Council Meeting Ottawa 1983."

[74] Translated letter from P. N. Fedoseev (Vice-President), USSR Academy of Sciences, to IUPAP President K. Siegbahn, in IUPAP Gothenburg, series E1 "Presidents' correspondence with members of IUPAP," vol. 1, folder "Siegbahn, K. President 1981–1989."

[75] "Scientists and Peace," the ICSU Secretary General to Presidents and Secretary Generals of the International Scientific Unions and Scientific Committees, February 17, 1983, copy in IUPAP Gothenburg, series E11 "Correspondence concerning Council meetings," vol. 4, folder "Council Meeting Ottawa 1983."

[76] Carlo Rubbia, "Edoardo Amaldi. 5 September 1908-5 December 1989," *Biographical Memoirs of Fellows of the Royal Society* 37 (1991): 3–31, on 27. See also Lodovica Clavarino, "Italian Physicists and the Bomb: Edoardo Amaldi's Network for Arms Control and Peace during the Cold War," *Journal of Contemporary History* 56, no. 3 (2021): 665–92.

[77] Also known as Star Wars. See Turchetti, *Trading Global Catastrophes*, 554.

Conclusion

This article has explored, and attempted to explain, the lack of interactions between NATO and IUPAP resulting from diverging science diplomacy approaches. IUPAP's efforts to promote physics derived primarily from a search for international coordination sidestepping political divides. Instead, NATO invested in the promotion of physics as a way to strengthen the alliance politically, and to increase political homogeneity in international scientific exchanges. These diverging sponsorship strategies led to schemes with similar disciplinary goals but diametrically opposite in their ambitions.

If we accept that international scientific exchanges make space for the development of parallel diplomacy tracks in international relations, then this article makes plain to see that the two organizations operated very differently as diplomatic agents. While initially propagandized as a-political, IUPAP's quest for international coordination in physics eventually produced a clear diplomacy ambition not just sidestepping, but to also attempting to remove Cold War divides in the physical sciences. In particular, it stimulated the campaigning on the free movement of scientists as a long-term political goal for the Union to champion along with ICSU. The 1963 travel ban controversy framed this issue as one of contingence, primarily aiming to promote participation in the meetings taking place at the time, as shown especially by Fleury's negotiations with Allis and Hooper. Over the years, however, this advocacy placed IUPAP more firmly in the international affairs domain, allowing its officials in general, and Kerwin more specifically, to use the campaigning to spearhead the union's non-discriminatory approach and its social responsibility agenda. Hence, what initially appeared as a pragmatic request of significance to physicists alone, eventually influenced the administration of scientific (and even state) relations in powerful ways, especially when the free circulation principle went against the challenges that authoritarian regimes posed to the movement of scientists across borders.

By contrast, NATO instrumentalized the promotion of physics from the onset, as the diplomacy gains deriving from such an investment in the realm of its intergovernmental relations persuaded its executives to launch a sponsorship program. Hence, the diplomatic agenda of such an investment coincided with the intention of improving the synergies between its member states. Interestingly the fate of the program was also decided by its diplomacy returns. When, especially due to the internal and external criticism of NATO's sponsorship, it did not bear the expected political fruits in alliance relations, and lacked the funding needed through refusals to increase its budget, its visibility and international appeal contracted considerably.

To sum up, the parallel diplomacy tracks that IUPAP and NATO initiatives instigated never intersected one another, aside from when the 1963 travel ban controversy forced their officials to confront each other for the first and only time in Cold War history. Indeed one might argue that the event contributed to making their diplomacy tracks even more divergent. The 1963 controversy made IUPAP officials aware of the importance of championing the free circulation of scientists. It contingently revealed the NATO limitations in the promotion of physics (and science more generally) in that it could only reach out politically homogeneous cohorts hence stifling scientific exchanges with a broader participation. More could actually be uncovered on these opposite science diplomacy trajectories, but unfortunately some of the key pieces of correspondence, and especially Bhabha's letter, are no longer available to allow us to probe further into. In 1977, Kerwin sent IUPAP archival documents to the University of Montreal, where a study on these holdings revealed its significance. Sadly, while described as "magnificent," Bhabha's letter appears to have since then vanished.[78]

Therefore, we can only surmise the importance of this piece of correspondence. Bhabha's decision to write directly to the NATO science adviser represented the first moment when an IUPAP official acknowledged the existence of NATO's own science set up. This action reversed IUPAP's previous stance, in that the organization had that far deliberately not commented on NATO science to avoid discussing its controversial ambition to align scientific exchanges to Cold War alliances. By agreeing to write an open letter to its science adviser, Bhabha also tested the alliance's commitment to international scientific collaboration. In other words, he must have implicitly alluded to a contradiction between applying travel restrictions to the free circulation of scientists and, at the same time, promoting international scientific exchanges. This paper also shows that the letter had great resonance across various domains in the international science community energizing ICSU's action and paving the way to the championing of the free circulation principle that the council enacted through the setting up of a committee devoted to this issue.

To sum up, the letter, and the later exchanges that Fleury instigated, played a constitutive role in the evolution of IUPAP as a science diplomacy organization, and, likely, a decisive role in the trajectory of NATO science too. But these exchanges are also the only instances of engagement between IUPAP and NATO that have been officially recorded. Interestingly, only the end of the Cold War has materialized as an opportunity for more. Correspondence of the American Physical Society shows that by 1998, with the Cold War then ended, new procedures enabled it to transfer NATO grants to work with IUPAP.[79] Moreover, a IUPAP *Physics at 2000* report widely publicized a recent project including experiments carried out at NATO's Undersea Research Centre of La Spezia to advance further acoustics studies sponsored by the relevant IUPAP commission.[80] These collaborations have happened too recently to allow a comment on their significance. Yet, in concluding this article, it is appropriate to stress the dramatic transitions marked by the end of the Soviet Union, and the reconfiguration of NATO as a transnational organization extending beyond Western Europe. Surely, these changes have set an opportunity for collaboration that had never existed before. In other words, they have removed the deliberate silence between the two organizations that—with one notable exception—had prevented them from interacting for more than thirty years.

[78] Charles Davis, "Report on the materials in the IUPAP dossiers," Institute D'Histoire et the Sociopolitique des Science, Universitè de Montrèal, 1980. Copy in IUPAP Quebec, Series E1, "Larkin Kerwin's and Pierre Fleury's Correspondence," vol. 5, folder "Correspondence re: archives."

[79] Email from Cleary Person to Judy Franz, American Physical Society, in IUPAP Gothenburg, Series E12 "General Assemblies," vol. 4, folder "IUPAP General Assembly, Atlanta 1999."

[80] Lawrence A. Crum, "Acoustics in the New Millennium," in *Physics as it Enters a New Millennium* eds. Paul Black, Gordon Drake, Leonard Jossem 40–4 at 42. Copy in IUPAP Gothenburg, Series B2aa "General Reports," vol. 3B.

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APPENDIX

National Membership and Fees, 1919–1947

Danielle Fauque and Robert Fox

Adhering Countries

1. Countries

Until 1931, a country could become a member of the union, provided it was a member of the International Research Council (IRC).[1] Thereafter, unions were free to admit any country they wished, independently of the International Council of Scientific Unions (ICSU).

2. Rules for Membership

Within each union, the rules for membership followed those set out for the IRC and, from 1931, for ICSU, and they were the same for all countries. A country could be represented by a disciplinary research committee, generally under the auspices of a scientific academy, or by some other representative group, even in some cases a government. A number of countries responded by founding a National Research Council (NRC), which brought together the national bodies in the various disciplines.

3. The NRC as a Model

In 1916, at the suggestion of George Ellery Hale, the President of the United States founded the NRC, a body seen as potentially important in the event of America's entry into the European conflict. The NRC was conceived as a way of bringing together all the human and productive forces of the country and thereby contributing to the national effort, should war come. This first NRC, which included civilian and military representatives, was discussed in the Allied countries, where committees were created to consider the adoption of a similar model.[2] But it was above all during the inter-allied conferences of 1918 (London, then Paris) that the idea was incorporated into the statutes of the IRC, now with all traces of the military dimension eliminated. This squared with the objectives of the IRC, a non-governmental organization concerned exclusively with civil society.

France and Great Britain already had disciplinary bodies that lent themselves to this type of national organization (in astronomy and chemistry, in particular), and these were adapted to meet the criteria of a national committee. Other countries, such as Italy and Japan, seized the

[1] Resolution 7 of the 1922 IRC assembly; see Arthur Schuster, ed., *International Research Council. Second Assembly held at Brussels, July 25th to July 29th, 1922: Reports of Proceedings* (London: Harrison & Sons, April 1923), 89.

[2] See Danielle Fauque and Robert Fox, "Binding the Wounds of War: Internationalism, National Interests, and the Order of World Science, 1919–1931," in Blockades of the Mind: Science, Academies, and the Aftermath of the Great War [Acta Historica Leopoldina, no. 78], ed. Wolfgang U. Eckart and Robert Fox (Halle: Deutsche Akademie der Naturforscher Leopoldina, 2021), 41–68, 64.

opportunity of creating national research councils of their own, which they saw as assets for subsequent scientific and industrial development.[3]

4. Science and Industry

The ideal of an alliance between science and industry was prominent in the rhetoric of the war years and on into the early 1920s. Traces can be seen not only in the conception of the US NRC but also in the creation of an industrial science section at the Paris Academy of Sciences and a Department of Scientific and Industrial Research in Great Britain. The names of two unions, too, are significant: International Union of Pure and Applied Chemistry (IUPAC) and International Union of Pure and Applied Physics (IUPAP). The US NRC, with both Millikan and Hale as powerful voices, marshalled support within the nation's leading learned societies, such as the American Chemical Society (ACS) and the American Physical Society (APS), while also appointing engineers, technicians, and other experts as members of the NRC to their national committees. In May 1918, President Wilson made the NRC permanent.[4]

5. Within IUPAP

In 1922, the physicists present in Brussels modified the draft statutes of 1919, though only slightly. Sixteen countries were now represented, six of which had already paid their financial dues (see Table A.1). By 1925, there were eighteen adhering countries, though only sixteen were up to date with their contributions.[5]

The column for 1930–31 shows that of the thirteen countries represented at the 1931 General Assembly, only eleven were fully paid-up members. Denmark had stopped paying in 1929; the Netherlands in 1926; and Spain sent a delegation, without being a member. Canada had ceased in 1925, Mexico in 1927, and Australia in 1929.[6]

One cause of the profile of irregular payments may well have been the IRC's refusal to admit the former enemy countries to membership of the council itself and hence of the unions. The repercussions of the financial crisis, which began in 1929, were only apparent some years later.

After 1931, some countries returned to the Union. A notable exception was Spain, so affected by political tensions that it seems to have been in no position to establish a formal link.

At the 1934 General Assembly, in London, sixteen delegations were present, thirteen of which had been present in 1931, now joined by Australia, Italy, and China. Only Switzerland was up to date with its dues, seven were almost so, while several were in arrears by between one and three years. Even so, IUPAP was not in deficit. Its assets in May 1931 were approximately 97,000 French francs (the Union standard unit of currency). The expenditure on the General Assembly and congress slightly exceeded this sum, but the costs were roughly matched by the income from those attending, and its assets were 48,000 French francs.

[3] See Yoshiyuki Kikuchi, "World War I, international participation and reorganisation of the Japanese chemical community," *Ambix* 58 (2011), 136–49; Angelo Guerraggio and Giovanni Paoloni, *Vito Volterra* (Berlin-Heidelberg: Springer, 2012); Giovanni Paoloni, "Nuovi modelli di organizzazione della ricerca," in *Atti del convegno La Grande Guerra rivoluziona la comunità scientifica: Il ruolo dell'Itali*a, *Roma, 10–11 dicembre 2014* (Rome: Accademia Nazionale delle Scienze detta dei XL, 2015), 82–96.

[4] *Proceedings of the National Academy of Sciences* (PNAS), 5/5 (2019), 188 available at https://www.pnas.org/content/by/year.

[5] Report of the second General Assembly (1925), 9, series B2aa, vol. 1 "1923–1960," IUPAP Gothenburg, and Schuster, *International Research Council: Third Assembly held at Brussels, July 7th to July 9th, 1925. Reports of Proceedings* (London: Harrison & Sons, 1926), 41.

[6] Report of the third General Assembly (1931), 6, series B2aa, vol. 1 "1923–1960," IUPAP Gothenburg.

Table A.1

	Nation ∗: sent delegation to the GA X: up to date with dues	**National Adhering Body** (NAB)	**Fees** 1923	**Fees** 1924–1925	**Fees** 1925–1929	**Fees** 1930–1931	**Fees** 1931–1934
1	Australia	?		X*	X		0*
2	Belgium	Académie royale de Belgique	X	X*	X	X*	0*
3	Canada	Comité de physique canadien		X*			
4	China	?					X*
5	Czechoslovakia	Conseil national tchécoslovaque de recherche		0*	X	X*	X*
6	Denmark	Kongelige Danske Videnskabernes Selskab		X*	X	0*	X*
7	France	Académie des sciences	X	X*	X	X*	X*
8	Great Britain	Royal Society	X	X*	X	X*	X*
9	Italy	Accademia dei Lincei		X∗	X (1927)		X∗
10	Japan	National Research Council	X	X*	X	X*	X*
11	Mexico	Government		0*	X (1927)		
12	Netherlands/ Holland	Académie des sciences d'Amsterdam		X*	X (1926)	0*	X*
13	Norway	Académie des sciences de Christiana/Oslo		X*	X	X*	X*
14	Poland	Académie polonaise des sciences et lettres	X	X*	X	X*	X*
15	South Africa	Government		X*	X	X	
16	Spain	Académie de Madrid		0*		0*	0*
17	Sweden	Académie des sciences de Stockholm		X*	X	X*	X*
18	Switzerland	Société helvétique des sciences naturelles		X*	X	X*	X*
19	United States	National Research Council	X	X*	X	X*	X*
	Total X		6	15	16	11	13

Units of Contribution

1. How Were they Determined?

During the inter-allied conferences of 1918, discussion of national contributions was particularly lively. As Schuster saw it, every system contained an element of absurdity, but a choice had to be made, and this had to be approved by the IRC and applied identically to each union. Clauses about dues in the statutes of international disciplinary bodies existing before the war served as examples. A correlation between a nation's contribution and the number of its inhabitants was common, and that principle was adopted by the IRC and its unions.

2. Number of Units by Country

Here two aspects were central: on the one hand, the number of fee units by country, and on the other, the definition of a country in a world where colonial empires (especially those of France and Great Britain) were powerful and territories under colonial rule were subject to different administrative structures. France had colonies and protectorates. For Britain, with its mixture of dominions, colonies, and protectorates, it was decided that each dominion (South Africa, Australia, Canada, and New Zealand) would be considered as an independent country, whereas colonies and protectorates would be part of the occupying country if the latter so desired.[7]

3. Voting Power and Units of Contribution

The correlation between the number of votes and the units of contribution, as summarized in Table A.2, was adopted from the start and was retained unchanged on the passage from the IRC to ICSU in 1931 and during the reform of 1947.

Table A.2 [a]

Population	No. of votes	No. of units of contribution
Less than 5 million	1	1
Between 5 and 10 million	2	2
Between 10 and 15 million	3	3
Between 15 and 20 million	4	5
Over 20 million	5	8

[a] See IUPAP Statutes: Schuster 1920, International Union of Physical Sciences, 255; Schuster 1923, 110; Henry Lyons, ed., *Fifth Assembly of the International Research Council and the First Assembly of the International Council of Scientific Unions, held at Brussels, July 11th, 1931. Reports of Proceedings* (London: Harrison & Sons, Ltd, [1932]), Union internationale de physique (sic), 62; IUPAP Report of the fifth General Assembly (1947), 2, series B2aa, vol. 1 "1923–1960," IUPAP Gothenburg.

[7] Schuster, *International Research Council. Constitutive Assembly held at Brussels, July 18th to July 28th 1919. Reports of Proceedings* (London: Harrison & Sons, 1920), 158.

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