

Preface [TAGSS 2021—Trieste Algebraic Geometry Summer School]

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Contents

Foreword	1
Section 1	
JOHN KALLIONGIS AND RYO OHASHI Orientation reversing finite abelian actions on \mathbb{RP}^3	5
GABRIELE INGLESE AND ROBERTO OLMI A note about the well-posedness of an Initial Boundary Value Problem for the heat equation in a layered domain	49
SOUHEYB DEHIMI, MOHAMMED HICHEM MORTAD, AND AHMED BACHIR Unbounded generalizations of the Fuglede-Putnam theorem	59
PAOLO LIPPARINI Products of sequentially compact spaces with no separability as- sumption	69
SARBAST HUSSEIN AND SALAH BENYOUCEF Analysis of existence and non-existence of limit cycles for a family of Kolmogorov systems	79
HORST ALZER AND MAN KAM KWONG Monotonicity theorems and inequalities for certain sine sums	89
Section 2 - Proceedings of TAGSS School 2021 – Hy- perkähler and Prym varieties: Classical and New Results	
Preface	109
GIAN PAOLO GROSSELLI AND IRENE SPELTA Explicit analysis of positive dimensional fibres of $\mathcal{P}_{g,r}$ and Xiao conjecture	111
PAWEŁ BORÓWKA AND ANGELA ORTEGA Prym varieties and Prym map	129

ELHAM IZADI, SAMIR CANNING, YAJNASENI DUTTA, AND DAVID STAPLETON	
Hyperkähler manifolds.....	163
Section 3 - Proceedings of the Conference GO60 - Pure and Applied Algebraic Geometry celebrating Giorgio Ottaviani's 60th birthday	
Preface.....	209
CIRO CILIBERTO AND RICK MIRANDA	
Examples of non-effective rays at the boundary of the Mori cone of blow-ups of the plane	211
IREM PORTAKAL AND BERND STURMFELS	
Geometry of dependency equilibria	221
HIROTACHI ABO, ROBERT LAZARSEFELD, AND GREGORY G. SMITH	
Ramification and discriminants of vector bundles and a quick proof of Bogomolov's theorem	247
VLADIMIR LAZIĆ AND FRANK-OLAF SCHREYER	
Birational geometry and the canonical ring of a family of determinantal 3-folds	263
LUCA CHIANTINI	
On the study of decompositions of forms in four variables.....	279
JOSEPH M. LANDSBERG	
Secant varieties and the complexity of matrix multiplication	291
WAYNE NG KWING KING AND JEAN VALLÈS	
New examples of free projective curves.....	313
ADA BORALEVI AND EMILIA MEZZETTI	
Pencils of singular quadrics of constant rank and their orbits....	331
BENJAMIN BIAGGI, JAN DRAISMA, AND TIM SEYNNÆVE	
On the quadratic equations for odecotensors	353
MARIA LUCIA FANIA AND ANTONIO LANTERI	
Hilbert curves of quadric fibrations over smooth surfaces.....	375

Section 2

Proceedings of TAGSS School 2021
Hyperkähler and Prym varieties:
Classical and New Results

Preface

TAGSS (Trieste Algebraic Geometry Summer School) is an ongoing series of schools taught by outstanding women mathematicians, with the aim of bringing doctoral students, postdocs, and anyone interested, from a review of the basic constructions to current, state-of-the art research themes.

The previous successful editions featured programs on enumerative geometry (TAGSS I - Summer School in Enumerative Geometry, held at SISSA in 2017), geometry of moduli spaces of curves (TAGSS II - Summer School on Geometry of Moduli Spaces of Curves, held at ICTP in 2018), and applications of geometry to biochemical networks and data clouds (TAGSS III - Algebraic Geometry towards Applications, again at ICTP in 2019).

After a break in 2020 due to the pandemic situation, we reprised the series in July 2021 with the online event TAGSS 2021 - Hyperkähler and Prym Varieties: Classical and New Results, sponsored by ICTP (activity *smr 3609*, available at the page <https://indico.ictp.it/event/9610/overview>). It featured courses by Elham Izadi (Hyperkähler manifolds, an overview and some open problems) and Angela Ortega (Prym varieties). Following the same format as the previous editions, the Summer School lasted one week and included exercise sessions that complemented the lectures, as well as contributed talks delivered by young participants.

The topics of the school concerned the connection between Abelian varieties and algebraic curves, which has inspired algebraic geometers for more than a century, with each field helping to shed light on the other. With each (smooth projective) curve one can associate its Jacobian; however, most principally polarized abelian varieties cannot be obtained in this way. A more general construction associates with a finite morphism of curves its Prym variety; this construction leads to the concept of Prym-Tyurin variety. These associations work well in families, leading to the Torelli map from the moduli of curves (and the Prym map from the moduli of covers) to the moduli of principally polarized abelian varieties, and have led to the proof of numerous results on all these important moduli spaces. Other applications include Hodge theory, and in particular primal cohomology of the theta divisor, highlighting its connections to root lattices.

The main goal of the school was to provide a stimulating intellectual environment where all the participants could learn about some of these important

aspects of algebraic geometry, as well as the basic notions required for working in this field. In particular, we encouraged female students and researchers at the beginning of their career.

This volume contains the lecture notes of the two courses given at the school, as well as a contribution by one of the young speakers and her collaborator.

The lecture notes *Hyperkähler manifolds* contain contributions by Elham Izadi and some of her students and postdocs, who helped with the exercise sessions, namely Samir Canning, Yajnaseni Dutta, and David Stapleton. They give an elementary introduction to Hyperkähler manifolds, survey some of their interesting properties and some open problems.

The lecture notes *Prym varieties and Prym maps* have been co-authored by Angela Ortega and Paweł Borówka, who also led the exercise sessions of Ortega's course. They contain an introduction to the theory of Prym varieties, and a detailed analysis of the fibres of the Prym map for étale double coverings over genus 6 curves.

Finally, the article by Gian Paolo Grosselli and Irene Spelta concerns positive dimensional fibres of the Prym map $\mathcal{P}_{g,r}$. The authors present a direct procedure to investigate infinitely many examples of positive dimensional fibres.

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The guest Editors
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