Intermittency and cascade rate of turbulent magnetic energy in the inner heliosheath and local interstellar medium from in-situ Voyager 1 and 2 measurements between 100 AU and 140 AU

Federico Fraternale[1], Nikolai Pogorelov[2], John D. Richardson[3], Daniela Tordella[1]

[1] Dipartimento di Scienza Applicata e Tecnologia, Politecnico di Torino, Italy.
[2] Space Science Department, University of Alabama in Huntsville, USA.
[3] Kavli Institute for Astrophysics and Space Research, Massachusetts Institute of Technology, USA.

In the inner and outer heliosheath (IHS and LISM), turbulence and magnetic reconnection are believed to be the major players in the processes responsible for particle transport and magnetic energy conversion into kinetic energy and heat.
State-of-art numerical simulations demonstrated that a transition to turbulence can occur in the inner heliosheath and also showed that instability and magnetic reconnection can occur in proximity of the heliopause. However, it is still unfeasible to resolve numerically scales smaller than the sector spacing, which makes it necessary to analyze *in-situ* data provided by the Voyager Interstellar Mission.
The present study builds on our recent works [Fraternale et al ApJ 2019, Fraternale et al JPCS 2019], where the spectral properties of the energy-injection range and of the inertial-cascade regime of magnetic field fluctuations have been shown for several periods within the IHS and LISM – for heliocentric distances up to 106 AU for Voyager 2 (2017.0) and 136 AU for Voyager 1 (2016.67).
In this work, we include in the analysis the data intervals 2017.0 - 2017.66 at Voyager 2 (115.2 AU, IHS) and 2017.1 - 2018.0 at Voyager 1 (140.7 AU, LISM).
We investigate the properties of scale-dependent intermittency, and provide the first analysis of magnetic-energy cascade rates. In particular, the magnetic energy flux is computed both from a power spectrum-based proxy and from the third-order moments of the field's temporal increments. In the inertial range of fluctuations, the different estimators yield values between 100 and 1000 m^2/s^3 in the IHS close to the heliopause, and around 0.01-0.1 m^2/s^3 in the latest LISM interval.

This research is framed within the project "Turbulence as Indicator of Physical Processes at the Heliospheric Interface", NASA's H-GI Open Program, 18-HGIO18_2-0029.