Anisotropic energy cascade rate in Earth's magnetosheath

Victor Montagud-Camps*(1), Petr Hellinger(2), Andrea Verdini(3)(4), Sergio Toledo-Redondo(1), Emanuele Papini(5), Julia Stawarz(6), Luca Sorrizo-Valvo(7)(8), Inmaculada F. Albert(1), and Aida Castilla(1)
(1) University of Murcia, Department of Electromagnetism and Electronics, Murcia, Spain
(2) Astronomical Institute, CAS, Bocni II/1401,CZ-14100 Prague, Czech Republic
(3) INAF—Osservatorio Astrofisico di Arcetri, Largo E. Fermi 5, I-50125 Firenze, Italy
(4) Dipartimento di Fisica e Astronomia, Università degli Studi di Firenze Largo E. Fermi 2, I-50125 Firenze, Italy
(5) INAF—Istituto di Astrofisica e Planetologia Spaziali, via del Fosso del Cavaliere 100, I-00133 Roma, Italy
(6) Department of Mathematics, Physics, and Electrical Engineering, Northumbria University, Newcastle upon Tyne NE1 8ST, United Kingdom
(7) CNR/ISTP – Istituto per la Scienza e Tecnologia dei Plasmi, Via Amendola 122/D, 70126 Bari, Italy
(8) Space and Plasma Physics, School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm, SE-100 44, Sweden

1 Extended Abstract

The different contributions to the energy cascade rate in a turbulent plasma can be computed by evaluating the terms of the Karman-Howarth-Monin (KHM) equation. However, assumptions on turbulence anisotropy are usually required to compute the terms of the KHM equations. Recent theoretical developments [1,2] provided a new way to evaluate the non-linear and compressible contributions of the energy cascade that allow to measure them with the data gathered by multi-spacecraft missions, such as the Magnetospheric Multiscale Mission (MMS). We present the results of evaluating the energy cascade rate in Earth's magnetosheath under different plasma conditions and taking into account the effects of turbulence anisotropy and compressibility down to sub-ion scales.

References

[1] Banerjee, S. and Galtier, S., "An alternative formulation for exact scaling relations in hydrodynamic and magnetohydrodynamic turbulence", *Journal of Physics A Mathematical General*, vol. **50**, no. 1, 2017. doi:10.1088/1751-8113/50/1/015501.

[2] Hellinger, P., "Ion-scale Transition of Plasma Turbulence: Pressure-Strain Effect", *The Astrophysical Journal*, vol. **930**, no. 1, 2022. doi:10.3847/1538-4357/ac5fad.