

Interaction of the solar wind with the Earth's magnetosphere, theory and observations

The Earth's magnetosphere and solar wind environment is a laboratory of excellence for the study of the physics of collisionless, magnetized plasmas. Here we focus on the low latitude magnetopause region where the velocity shear between the solar wind and the magnetosphere plasma generates vortex-like structures via the Kelvin-Helmholtz instability. These structures, observed by satellite in-situ measurements, generate favorable conditions for the development of secondary fluid and magnetic instabilities eventually leading to a full turbulent state. The combination of spacecraft data and simulations is the most effective way to study complex plasma phenomena, such as transport across frontiers and/or fundamental plasma processes where electromagnetic and plasma fluctuations can be measured in-situ with strong accuracy. The research activity on this problem, pursued by the plasma physics group in Pisa, is the outcome of longstanding collaborations with several International research groups (in particular Ecole Polytechnique, Observatory of Paris, Oxford University, Max Planck Institute, University of Marseille, Observatory of Cote d'Azur), as well as of a European FP7 funded network project. Several Master and PhD Thesis, some of which in partnership with International Universities, have been developed on this problem and have strongly contributed to the achievement of new, original results presented in International Conferences and published on International peer-reviewed Journals.

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