



STORM: a new FP7 project devoted to solar system plasma turbulence, intermittency and multifractals

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In this project we investigate space plasma turbulence from in-situ data gathered over more than 15 years by spacecraft launched by the European Space Agency (ESA). By using large sets of data instead of focusing on particular events, we advance the understanding on the energy transfer, intermittent turbulence and multifractals in space plasmas. Moreover, since the data cover different phases of the solar cycle, we investigate how the features of space plasma turbulence vary with the solar activity and discriminate between effects specific to solar maximum and minimum. We use electromagnetic field and plasma data provided by three core ESA spacecraft: Ulysses, Venus Express and Cluster, as well as other solar system missions (e.g. Giotto, Cassini, Rosetta, Mars Global Surveyor). We also study the fluctuations of ground based geomagnetic time-series as a measure of the global magnetospheric state whose statistical properties may reveal trends linked to the turbulence properties observed in-situ at higher altitudes. A powerful package of nonlinear analysis methods are applied to all data sets: (i) Power Spectral Densities (PSD) and Probability Distribution Functions (PDF), (ii) higher-order methods of analysis for intermittent data, like the partition function multifractal analysis, the Rank Ordered Multifractal analysis; (iii) the wave telescope, (iv) the multi-spacecraft methods adapted to investigate anisotropic turbulence, (v) discriminating statistics for nonlinearity and nonstationarity. The expertise of the Consortium members is complementary and therefore the synergy within them provides a large spectrum of techniques and models, never applied in a coherent approach over the same datasets. STORM is expected to make advancements in understanding and modeling space plasma turbulence in the solar system and to add value to existing data bases collected from decades by space missions of the major national and international space agencies, in particular by the European Space Agency.