Geophysical Research Abstracts
Vol. 12, EGU2010-1822-1, 2010
EGU General Assembly 2010

Global scale-invariance of kinetic-scale magnetic fluctuations in solar wind turbulence as seen by CLUSTER

K. H. Kiyani (1), S. C. Chapman (1), A. Turner (1), Yu. V. Khotyainstev (2), M. W. Dunlop (3), F. Sahraoui (4,5)

(1) University of Warwick, CFSA, Physics Dept., Coventry CV4 7AL, United Kingdom (s.c.chapman@warwick.ac.uk), (2) Swedish Institute of Space Physics, Uppsala, Sweden, (3) Rutherford Appleton Laboratory, Didcot, United Kingdom, (4) NASA Goddard Space Flight Center, Code 673, Greenbelt, Maryland 20771, USA, (5) Laboratoire de Physique des Plasmas, CNRS-Ecole Polytechnique, Velizy, 78140, France

Spacecraft measurements of magnetic fluctuations of collisionless plasma turbulence in the solar wind typically show an 'inertial range' of MHD turbulence with a power-law power spectra. At higher frequencies a spectral break is seen around the ion-gyroscale with a subsequent steeper power-law, indicating a cross-over to spatial-temporal scales to a 'kinetic range' of scaling (dissipation/dispersion range) where kinetic effects become important. We will present results from very high-frequency magnetic field data from the four Cluster II spacecraft in intervals where the spacecraft were in quasi-stationary ambient solar wind and where the instruments were operating in burst mode. The magnetic field data are from the fluxgate and search-coil magnetometers from the Cluster FGM experiment ($\sim$67Hz), and the STAFF experiment ($\sim$450 Hz). These data sets provide observations of the kinetic range range over approximately two decades in frequency. We present a robust multiscale statistical analysis focusing on power spectra, probability density functions of field fluctuations and higher-order statistics to quantify the scaling of fluctuations; as well as describing the degree of anisotropy in the fluctuations parallel and perpendicular to the average magnetic field.

Both neutral fluid and MHD turbulence share a "classic" statistical signature – namely an intermittent multifractal scaling seen in the higher-order statistics. MHD turbulence in the solar wind is also anisotropic due to the presence of a background field. We find that the kinetic range in contrast exhibits monoscaling behavior, i.e., a global scale invariance, and anisotropy properties distinct from that of the inertial range. This provides a strong discriminator for the physics and phenomenology of the kinetic or dissipation range in collisionless plasmas.