Geophysical Research Abstracts, Vol. 8, 08991, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08991

Turbulent spectrum in magnetosheath and Alfvénic vortices

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Cluster observations in the magnetosheath, downstream of the bow-shock, shows that the spectrum of magnetic fluctuations seems to have a universal shape. In the vicinity of the protons cyclotron frequency f_{cp} (in the satellite frame) the spectrum has a break. In the lower frequency part, for $f < f_{cp}$, the spectrum varies like f^{-1} and for the higher frequencies, above the break, the spectrum is $\sim f^{-2.7}$. Frequently, spectra observed downstream of the quasi-perpendicular bow-shocks have a bump in the vicinity of the break. We show that this bump is responsible for the non-gaussian distributions of the magnetic fluctuations. This means that intermittency is present in the magnetosheath turbulence. Owing to the space resolution of the multi-satellite Cluster mission and to the time and scale wavelet resolution it was possible to show that the intermittency is due to coherent structures in form of Alfvén vortices. An Alfvén vortex is a non-linear cylindrical magnetic structure, parallel to the mean magnetic field. The presence of such structures in the magnetosheath can be a signature of a strong turbulence or a result of the filamentation of an Alfvén wave.