Geophysical Research Abstracts
Vol. 21, EGU2019-8706, 2019
EGU General Assembly 2019

Three dimensional turbulent spectra in the Earth's magnetosheath MMS-Observations

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Turbulence in the Earth's magnetosheath at ion kinetic scales is investigated with the magnetospheric multiscale spacecraft. The multi-point measurements allow the three dimensional power spectra in wave-vector space to be determined. Previously the three dimensional structure of fluctuations in the magnetic field and density (using spacecraft potential as a proxy) were possible with Cluster. However, using the excellent time resolution data set provided from both the fluxgate magnetometer and the Fast Plasma Instrument on MMS the spectra can be determined for a number of different parameters such as velocity, temperature, as well as compound spectra (e.g. Elsasser variables, Residual energy and the Alfven Ratio). The spectra for different fluctuations show similar features to one another such as a strong power anisotropy with respect to the mean magnetic field direction, and agyrotropy in the direction of the bulk velocity, similar to what has been seen in magnetic field fluctuations with Cluster at ion scales in the solar wind.