Turbulence in the terrestrial magnetosheath: space-time correlation using the Magnetospheric Multiscale mission

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Abstract

Spatiotemporal correlation of magnetic field fluctuations is investigated using the Magnetospheric Multiscale mission in the terrestrial magnetosheath. The first observation of the turbulence propagator emerges through analysis of more than a thousand intervals.
Results show clear features of spatial and spectral anisotropy, leading to a distinct behavior of relaxation times in the directions parallel and perpendicular to the mean field.
The full space-time investigation of the Taylor hypothesis presents a scale-dependent anisotropy of the magnetosheath when compared to characteristic flow propagation time and with Eulerian estimates.
The turbulence propagator reveals that the amplitudes of the perpendicular modes decorrelate according to sweeping or Alfvénic mechanisms. The decorrelation time of parallel modes instead does not depend on the parallel wavenumber which could be due to resonant interactions.
This study provides unprecedented observations into the space-time structure of turbulent space plasmas, also giving critical constraints for theoretical and numerical models.

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