Evolution of spectral properties, non-Gaussianity, and intermittency of plasma turbulence associated with magnetotail reconnection

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Abstract

Using measurements from the Magnetospheric Multiscale mission, we present a complete picture of the evolution of plasma turbulence associated with magnetotail reconnection from inertial to ion and electron dissipation scales. For the first time, the electric field fluctuations are analyzed together with fluctuations in the ion velocity and the magnetic field. We show that all three fields exhibit heavy-tailed fluctuations. We show a transition of turbulence towards a higher degree of non-Gaussianity at smaller scales. Multifractal analysis is performed to quantify the intermittency of field fluctuations. At electron scales, turbulent fluctuations exhibit signatures of equilibration indicating the late stages of energy dissipation. These observations highlight the key role of the non-ideal and highly non-Gaussian electric field at kinetic scales in facilitating energy dissipation in collisionless plasmas.

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