

Spontaneous Magnetic Fluctuations and Collisionless Regulation of Turbulence in the Earth's Magnetotail

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Abstract:

Space and astrophysical plasmas are rarely in thermal equilibrium, as injection of energy from astrophysical sources can be common and the relaxation processes are slow. The evolution of nearly collisionless plasmas toward quasi-stationary states is a challenging problem in plasma physics. It has been shown that the plasma beta and temperature anisotropy observed in the solar wind may be regulated by kinetic instabilities, such as the ion-cyclotron, mirror, electron-cyclotron, and firehose instabilities; and that magnetic fluctuation observations are consistent with the predictions of the Fluctuation-Dissipation theorem. We will describe in-situ magnetic field and plasma measurements by the THEMIS satellite mission, and show that similar regulation of the anisotropy occurs also in the Earth's magnetotail plasma sheet. Our results indicate that spontaneous fluctuations and their collisionless regulation are fundamental features of space and astrophysical plasmas.

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References:

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