Spectral entropy of turbulence in numerical simulations of astrophysical plasmas, and plasma propulsion devices

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Observational studies show that rare, large-amplitude coherent structures in turbulent plasmas are responsible for non-Gaussian fluctuations [1], multifractality [2], synchronization among scales [3], low entropy and high complexity [4]. We demonstrate the role of coherent structures detected by in-situ experiments in the interplanetary magnetic field turbulence. Then, we describe numerical simulations of magnetohydrodynamic turbulence in a Keplerian shear flow, in a regime of on-off intermittency [5]. By computing the Shannon entropy in the spectral space we show that large-scale coherent structures are characterized by low values of the spectral entropy. We will also present particle-in-cell numerical simulations of a two-dimensional model of a plasma propulsion device known as the Hall thruster. We demonstrate that the plasma in a Hall thruster displays turbulence and coherent structures arising from the ExB electron drift instability, which can affect the thruster efficiency.

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