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Coexistence of weak and strong wave turbulence in incompressible Hall MHD

Romain Meyrand (1), Khurom Kiyani (2), and Sebastien Galtier (3)

(1) Space Sciences Laboratory, UC Berkeley, LPP Ecole Polytechnique, Palaiseau, (2) LPP Ecole Polytechnique, Palaiseau, Centre for Fusion, Space and Astrophysics, University of Warwick, Coventry, (3) LPP Ecole Polytechnique, Palaiseau

We report a numerical investigation of 3D Hall Magnetohydrodynamic turbulence with a strong mean magnetic field. By using a helicity decomposition and a cross-bicoherence analysis, we observe that the nonlinear 3-wave coupling is substantial among ion cyclotron and whistler waves. By studying in detail the degree of nonlinearity of these two populations we show that ion cyclotron and whistler turbulent fluctuations belong respectively to strong and weak wave turbulence. The non trivial blending of these two regime give rise to anomalous anisotropy and scaling properties. The separation of the weak random wave and strong coherent turbulence component can however be effectively done using simultaneous space and time Fourier transforms. Using this techniques we show that it is possible to recover some statistical prediction of weak turbulent theory.