Interaction between MHD waves in compressively driven magnetohydrodynamics turbulence

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Plasma turbulence is ubiquitous in space and astrophysical flows. Discerning between structures and waves in turbulent flows has been one of the greatest challenges in the study of turbulence [1,2,3]. In recent years, multiple advances have been made in order to achieve a formal treatment of turbulence in the presence of waves [4]. Using direct numerical simulations (DNSs), the interaction between linear waves and turbulence under the compressible magnetohydrodynamic (CMHD) approach was studied. For a spatial resolution of 128^3 and 256^3 , a parametric study was carried out varying the sonic Mach number, the mean magnetic field and the compressibility amplitude of the forcing. Spatio-temporal spectra [5] of the magnetic energy and density fluctuation were built and analyzed, allowing for direct identification of all wave modes in a CMHD turbulent system and quantification of the amount of energy in each mode as a function of the wave number. Thus, linear waves were detected, that is Alfvén waves and fast and slow magnetosonic waves. Furthermore, different responses of the plasma were found according to whether the Mach number or the mean magnetic field was varied. Finally, making use of spatio-temporal spectra and two different integration methods, we accurately quantified the amount of energy present in each of the normal modes [5,6].

References:

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