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Helical mode interactions and spectral transfer processes in magnetohydrodynamic trubulence MORITZ LINKMANN, ARJUN BERERA, MAIRI MCKAY, JULIA JÄGER, Univ of Edinburgh — Spectral transfer processes in magnetohydrodynamic (MHD) turbulence are investigated analytically by decomposition of the velocity and magnetic fields in Fourier space into helical modes. Steady solutions of the dynamical system which governs the evolution of the helical modes are determined, and a stability analysis of these solutions is carried out. The interpretation of the analysis is that unstable solutions lead to energy transfer between the interacting modes while stable solutions do not. From this, a dependence of possible interscale energy and helicity transfers on the helicities of the interacting modes is derived. The direction of energy transfer not only depends on magnetic and kinetic helicities but also on the ratio of magnetic to kinetic energy and on the cross-helicity. As expected from the inverse cascade of magnetic helicity in 3D MHD turbulence, mode interactions with like helicities lead to transfer of energy and magnetic helicity to smaller wavenumbers. However, some interactions of modes with unlike helicities also contribute to an inverse energy transfer. As such, an inverse energy cascade for nonhelical magnetic fields is shown to be possible.

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