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Energy Transfer in Compressible Magneto-hydrodynamic Turbulence

Compressibility, magnetic fields and turbulence are all thought to be important factors to varying degrees in many astrophysical processes and terrestrial experiments. However, our understanding of their joint effect even in its simplest description, i.e. compressible magnetohydrodynamic turbulence, is still scarce. One step towards a more comprehensive picture is a better understanding of the governing energy dynamics – looking at the interplay between kinetic and magnetic energy via different mediators such as advection, magnetic tension or magnetic pressure. In this talk, we present an extension of established shell-to-shell energy transfer analysis methods to the compressible MHD regime. We apply this analysis to numerical simulations in the subsonic and supersonic regime. These methods allow us to illustrate how varying degrees of compressibility influence the energy dynamics within and between kinetic and magnetic energy reservoirs. For example, we show that compression acts against a magnetic energy cascade (scale-local magnetic to magnetic energy transfer). Moreover, we present how magnetic tension becomes overall less important with increasing sonic Mach number.

About the Speaker: After receiving a B.Sc. in Computer Science in 2008 from the University of Cooperative Education in Stuttgart, Germany, Philipp Grete worked for Hewlett-Packard before studying Physics (B.Sc.) and Computer Science (M.Sc.) at the University of Göttingen, Germany, from 2010 to 2013. In his Ph.D. thesis (2014-2016, University of Göttingen, Germany) he worked on subgrid-scale modeling of compressible magnetohydrodynamic turbulence. Since October 2016, he has been a postdoctoral research associate at Michigan State University working on analyzing and quantifying energy transfer in compressible MHD turbulence.