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Momentum Transport in Accretion Disks[1]

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The most energetic phenomena in the universe are systems powered by gravity through accretion. Magnetic fields are unstable to the magnetororational instability (MRI) in a differentially rotating system. The MRI, operating in an accretion disk system, leads to magnetic turbulence which, in turn, accounts for the internal stresses that drive the accretion process. MHD turbulence is thus fundamental to the system. The governing equations are those of compressible magnetohydrodynamics (MHD). Accretion disk dynamics can thus be investigated using three-dimensional MHD simulations, both in the local and global domain. The difficulties associated with numerical simulations of MHD turbulence are increased by the action of the MRI which stirs the turbulence on multiple scales. The challenge is to gain a sufficient understanding of the transport properties of MRI-driven turbulence to model accretion systems and jets from a basis that is closer to first-principles.

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