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Exploring the Saturation of the MRI via Weakly Nonlinear Analysis

Tuesday, 5 August 2014 14:00 (30 minutes)

Understanding the mechanism by which the magnetorotational instability (MRI) saturates is key to understanding the process by which it drives anisotropic MHD turbulence and transports angular momentum. Previous work has laid down the framework necessary to perform a weakly nonlinear analysis of the MRI near onset (that is, when the background magnetic field is just weak enough for the MRI to be unstable to its most unstable mode). Such analyses have been essential in understanding the turbulent transport of heat by convection in the Rayleigh-Benard problem, and we seek to extend those successes to the transport of angular momentum by the MRI. We derive the equation for perturbation growth in the weakly non-linear case, correcting an error in the literature, and then solve the equation using the general-purpose spectral code Dedalus. One major advantage to analytic studies such as these is that we can capture the behavior despite the scale separations caused by large ratios of molecular viscosities and resistivities (magnetic Prandtl numbers). We will present our initial results on the saturation properties of the MRI for a variety of dimensionless parameters.

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