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Saturation of the Magnetorotational Instability at Large Elssaser Number KEITH JULIEN, BENJAMIN JAMROZ, University of Colorado at Boulder, EDGAR KNOBLOCH, University of California at Berkeley — The MRI is believed to play an important role in accretion disk physics in extracting angular momentum from the disk and allowing accretion to take place. The instability is investigated within the shearing box approximation under conditions of fundamental importance to astrophysical accretion disk theory. The shear is taken to be the dominant source of energy, but the instability itself requires the presence of a weaker vertical magnetic field. Dissipative effects are suffiently weak that the Elsasser number is large. Thus dissipative forces do not play a role in the leading order linear instability mechanism. However, they are sufficiently large to permit a nonlinear feedback mechanism whereby the turbulent stresses generated by the MRI act on and modify the local background shear in the angular velocity profile. To date this response has been omitted in shearing box simulations and is captured by a reduced pde model derived from the global MHD fluid equations using multiscale asymptotic perturbation theory. Results from simulations of the model indicate a linear phase of exponential growth followed by a nonlinear adjustment to algebraic growth and decay in the fluctuating quantities. Remarkably, the velocity and magnetic field correlations associated with these growth and decay laws conspire to achieve saturation of angular momentum transport.

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