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Axisymmetric Simulation of the Magnetorotational Instability in a Magnetized Taylor-Couette Flow[1] WEI LIU, PPPL, JEREMY GOODMAN, Princeton University, HANTAO JI, PPPL — The magnetorotational instability (MRI) is probably the main cause of turbulence and accretion in sufficiently ionized astrophysical disks. Despite much theoretical and computational work, however, the nonlinear saturation of the MRI is imperfectly understood. We present non-ideal magnetohydrodynamic simulations of the Princeton MRI experiment. In vertically infinite or periodic cylinders, MRI saturates in a resistive current-sheet with significant reduction of the mean shear, and with poloidal circulation scaling as the square root of resistivity. Angular momentum transport scales as the reciprocal square root of viscosity but only weakly depends on resistivity. For finite cylinders with insulating end caps, a method to implement full insulating boundary condition is introduced. MRI grows with a clear linear phase from small amplitudes at rates in good agreement with linear analysis. In the final state one inflowing "jet" opposite to the usual Ekman "jet" is found near the inner cylinder. Angular momentum transport has a weaker scaling with Reynolds number and is dependent hardly on Lundquist number. Under proper condition our experimental facility is a good testbed to show that MRI could be suppressed by a strong magnetic field.

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