Abstract Submitted
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Magnetorotational instability in magnetized Taylor-Couette flows[1] WEI LIU, PPPL, JEREMY GOODMAN, Princeton University, HANTAO JI, PPPL — We present non-ideal magnetohydrodynamic simulations of MRI in the geometry of the Princeton MRI experiment. 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 hardly depends on resistivity. Separately, we have studied MRI in the presence of a current-free combination of toroidal and axial magnetic field. The new mode (HMRI) persists to smaller magnetic Reynolds number and Lundquist number than standard MRI, which relies on axial field alone. In vertically infinite or periodic cylinders, resistive HMRI is a weakly destabilized hydrodynamic inertial oscillation propagating axially along the background Poynting flux. Growth rates are small, however, and require large axial currents. Furthermore, highly resistive HMRI is stabilized in finite cylinders with insulating endcaps, and also in keplerian flow profiles regardless of end conditions. Comparison of models and measurements is used to validate our theoretical tools, which we will apply to nonlinear saturation of resistive MRI in astrophysical systems. Theoretical modeling has already played a major role in the design of the MRI experiment, and the physics of these modes may be of interest for fluid dynamics and geophysics as well as astrophysics

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