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Study of Magnetorotational Instability in a Swirling Plasma HANTAO JI, KYLE KREMER, ERIC EDLUND, ERIK SPENCE, Princeton Plasma Physics Laboratory, Princeton U. — Fast angular momentum transport in accretion disks has been an outstanding problem in astrophysics for more than three decades. The magnetorotational instability (MRI) has been identified as a powerful mechanism to transport angular momentum. Experiments using liquid metal are underway to study the MRI in incompressible MHD limit. A new frontier in accretion disk research is to explore physics beyond incompressible MHD. Possible new effects include compressibility, multiple-fluid effects, kinetic effects, ion-neutral collisions, radiation pressure, and dust grains. A swirling gas flow with quasi-Keplerian profiles, which are characterized by radially increasing angular momentum with decreasing angular velocity, is set up by an injection-pumping system. Spiral antennas are used to transmit RF power into the experiment through the helicon mode of discharge to ionize the gas with a desirable degree of ionization. A wide range of outstanding issues can be studied in such device, including: nonlinear hydrodynamic instability, baroclinic instability with axial or azimuthal temperature gradient, MRI in weakly ionized plasmas with Hall effect and ambipolar diffusion. Theoretical analyses and experimental explorations will be presented.

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