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Magnetorotational Instability in Multiple-fluid Plasmas H. JI, H. RINDERKNECHT, J. MCDONALD, M. NORNBERG, M. YAMADA, A. GURAK, Princeton Plasma Physics Laboratory, Princeton University, E.L. FOLEY, Nova Photonics — 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. Theoretical and experimental aspects of multiple-fluid effects of MRI will be discussed in this poster. Traditional two-fluid (electron and ion fluids) effects manifest as the Hall effect, which leads to qualitative differences between the cases when magnetic field is parallel and anti-parallel to the rotation axis. Including a third fluid of neutral particles leads to the so-called "ambipolar diffusion," adding further complexity in the dynamics of MRI. Experimentally, some of these effects can be studied in laboratory plasmas under some specific conditions. A newly constructed small-scale experiment using a helicon plasma has been used to explore these possibilities. The detailed analyses and experimental results will be presented.

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