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Angular Momentum Transport Studies Relevant to Astrophysical Accretion Disks with the Princeton MagnetoRotational Instability Experiment ETHAN SCHARTMAN, MARK NORNBERG, HANTAO JI, PPPL, CMSO, MICHAEL J. BURIN, California State University, San Marcos, JEREMY GOODMAN, Princeton University — Observationally-inferred rates of angular momentum transport in accretion disks are too large to be explained by a non-turbulent viscosity. Investigation of vertically-thin disks has focused on two sources of instability to drive a turbulent viscosity: the MagnetoRotational Instability (MRI) and Subcritical Hydrodynamic Instability (SHI). In MRI, a weak ambient magnetic field linearly destabilizes otherwise neutral hydrodynamic displacements. In SHI, transient amplification of linear disturbances by the differential rotation allows access to non-linearly unstable modes. The Princeton MRI experiment investigates both instabilities. It consists of a Couette-Taylor apparatus which uses water or liquid Gallium alloy to reliably generate rotating flows with linear stability properties analagous to astrophysical disks. In contrast to previous claims, we find no evidence of SHI in water at Reynolds numbers of order one million. We argue that SHI cannot provide astrophysically relevant rates of angular momentum transport. Our hydrodynamically stable flows provide an opportunity to make a conclusive detection of the MRI. The first results of our search for the MRI will be presented. Supported by DOE, NSF and NASA.

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