Abstract Submitted
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Initial results from the Princeton Magnetorotational Instability Experiment using liquid metal M.D. NORNBERG, E. SCHARTMAN, H. JI, CMSO and PPPL, M.J. BURIN, California State-San Marcos, W. LIU, CMSO and PPPL, J. GOODMAN, Princeton University — The Magnetorotational Instability (MRI) is regarded as the dominant mechanism for accretion disk turbulence and its associated angular momentum transport. A series of experiments using both water and liquid metal in a novel wide-gap Taylor-Couette apparatus are conducted to elucidate the relative importance of sub-critical hydrodynamic turbulence to the MRI. Reynolds stress measurements using two-component laser Doppler velocimetry in water demonstrate that keplerian-like flows have extremely weak angular momentum transport even at Reynolds numbers up to 10^6 when end effects are suppressed by differentially rotating end caps. By switching the working fluid to a liquid Gallium alloy (Ga-In-Sn), this quiescent flow can be destabilized by applying an axial magnetic field of up to 5 kG. The growth rate of the MRI is determined from external magnetic field measurements using radially-aligned induction coils and Hall probes. Secondary circulation induced by the MRI, which is a local instability, is distinguished experimentally from magnetically-induced Ekman circulation generated by the boundary layers through comparisons between flows which are stable and unstable to the MRI. This work is supported by DOE, NASA, and NSF.

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