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Searching for a subcritical transition in quasi-Keplerian flows
E.M. EDLUND, Princeton Plasma Physics Laboratory, M. PRETKO, Princeton University, A. ROACH, P. SLOBODA, E.J. SPENCE, H. JI, Princeton Plasma Physics Laboratory — Angular momentum transport in hot accretion disks in binary star systems and in active galactic nuclei is likely governed by the presence of the magneto-rotational instability (MRI) which can be effective in the presence of very weak magnetic fields. Colder, proto-planetary accretion disks with negligible ionization may not be able to support the MRI and consequently, a hydrodynamic path to turbulence may be needed to enhance the frictional forces and the transport of angular momentum. Hydrodynamic experiments in Taylor-Couette devices with controlled boundary conditions have shown that quasi-Keplerian flows are quiescent with very low levels of fluctuations. Yet there remains the possibility that these prior studies either have not accessed a nonlinear or subcritical transition to turbulence. We report here on recent studies in the Hydrodynamic Turbulence eXperiment (HTX), an order unity aspect ratio Taylor- Couette device, at the Princeton Plasma Physics Laboratory where quasi-Keplerian flows at Reynolds numbers of order 10^6 are probed with active perturbations to search for a subcritical transition. The role and regulation of secondary circulation in these experiments will be discussed.

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