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In search of a subcritical transition to turbulence in rotating hydrodynamic flows E.M. EDLUND, A.H. ROACH, P. SLOBODA, E.J. SPENCE, H. JI, Princeton Plasma Physics Laboratory — Angular momentum transport in stellar accretion disks is likely governed by the magneto-rotational instability (MRI), an MHD instability which is active even with a very weak magnetic field. In addition to providing a direct path for angular momentum transport, the saturated state of the MRI is also a source of turbulence. Colder, proto-planetary accretion disks should not be subject to the MRI and a hydrodynamic path to turbulence is 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 stable 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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