# Laboratory Study of Magnetorotational Instability and Hydrodynamic Stability at Larger Reynolds Numbers

Hantao Ji*

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**Abstract**

Rapid angular momentum transport in accretion disks has been a long-standing astrophysical puzzle. Molecular viscosity is inadequate to explain observationally inferred accretion rates. Since Keplerian flow profiles are linearly stable in hydrodynamics, there exist only two viable mechanisms for the required turbulence: nonlinear hydrodynamic instability or magnetohydrodynamic instability. The latter, also know as magnetorotational instability (MRI), is regarded as a dominant mechanism for rapid angular momentum transport in hot accretion disks ranging from quasars and X-ray binaries to cataclysmic variables. The former has been proposed mainly for colder protoplanetary disks, whose Reynolds numbers are typically large. Despite their popularity, however, both candidate mechanisms have been rarely demonstrated and studied in the laboratory. In this talk, I will describe a laboratory experiment in a short Taylor-Couette flow geometry ongoing at Princeton intended for such purposes. Based on the knowledge leant through prototype experiments and simulations, the apparatus contains novel features for better controls of the boundary-driven secondary flows (Ekman circulation). Initial results on hydrodynamic stability have shown, somewhat surprisingly, robust quiescence of the Keplerian-like flows with million Reynolds numbers, casting questions on viability of the nonlinear hydrodynamic instability.

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*Princeton Plasma Physics Laboratory