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Linear Analysis of Oscillations in Free Surface Taylor-Couette Flows[1] M. PRETKO, Princeton University, E.M. EDLUND, E. SPENCE, A.H. ROACH, H. JI, Princeton Plasma Physics Laboratory — Determining the mechanism of angular momentum transport in accretion disks is a long-standing problem in astrophysics. In addition to the magnetorotational instability, another possible mechanism is hydrodynamic turbulence. Previous experimental work made use of a bounded Taylor-Couette system and found no transition to turbulence even at Reynolds numbers of order 10^6. However, a free surface adds another degree of freedom and allows for modes which are absent in the bounded case. Therefore, a free surface may lead to instabilities which could not be observed in previous experiments. As preparations for experiments with a free surface Taylor-Couette device are made, we perform a linear analysis of oscillations in such a system and search for unstable modes. As a first approximation, surface tension is neglected and effects of viscosity are dealt with as small corrections. The experimental apparatus has a split endcap in order to minimize Ekman circulation. Thus, in this analysis, it is assumed that the background flow is strictly azimuthal. Analytic and numerical work is currently in progress and will ultimately be compared with experiment.

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