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Interpreting global behavior of quasi-Keplerian flows as a response to boundary forcing E. M. EDLUND, Massachusetts Institute of Technology, H. JI, Princeton Plasma Physics Laboratory — A series of experiments conducted in the Hydrodynamic Turbulence Experiment (HTX), a modified Taylor-Couette device, have explored the response of the azimuthal flows to the forcing imposed by the boundaries. The HTX device has rings on the axial end-caps that can take speeds different from that of the inner and outer cylinders. This extra degree of freedom allows us to tune the mean flow profiles, with the possibility of achieving flows remarkably close to the ideal Couette profile that are expected in the absence of axial boundaries. These "optimized" cases have the interesting property that the azimuthal velocity profiles are effectively independent of Reynolds number. In contrast, non-optimized cases show progressive departure from ideal Couette as the Reynolds number is increased. We present a model that captures this Reynolds number dependence and interpret this from the perspective of angular momentum flux across the boundaries. By varying the boundary components, we also show that optimized flows can only be achieved when there exists pressure balance between the boundary and the bulk. These observations have important implications for the design of Taylor-Couette experiments that attempt to make connections to astrophysics at large Reynolds numbers.

Eric Edlund
Massachusetts Institute of Technology

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