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System Size Dependence of Finite-Amplitude Thresholds for Transition to Turbulence in Taylor-Couette Flow[1] DANIEL BORRERO-ECHEVERRRY, BENJAMIN MORRISON, EVAN PEAIRS, Department of Physics, Reed College — Despite centuries of study, fluid dynamicists are still unable to explain why a large class of flows, including pipe flow and plane Couette flow, become turbulent. Hydrodynamic stability theory predicts these flows should be stable to infinitesimal perturbations, which means finite-amplitude perturbations need to be applied to destabilize them. We present the results of a series of experiments studying such subcritical transitions to turbulence in linearly-stable configurations of Taylor-Couette flow. In particular, we discuss how the stability of these flows depends on the size and duration of the applied perturbation as the aspect ratio of the experimental apparatus is varied. We show that for experimental configurations where the end caps rotate with the outer cylinder, the stability of the flow is enhanced at small aspect ratios. We find that at sufficiently high Reynolds numbers, perturbations must exceed a critical amplitude before the transition to turbulence can be triggered. The scaling of this threshold with Re appears to be different than that which has been reported for other linearly-stable shear flows.

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