Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Laboratory Observation of Instabilities in Stratified Taylor-Couette Flow BRUCE RODENBORN, Centre College, RUY IBANEZ, HARRY L. SWINNEY, Center for Nonlinear Dynamics and Department of Physics, University of Texas at Austin — In 2001 Molemaker et al. (*J. Fluid. Mech.* **448**, 1) predicted a new class of instabilities in a system of concentric rotating cylinders that contains a fluid with a vertically varying density. Dubrulle et al. (*Astron. Astrophys.* **429**, 1, 2005) then showed that this phenomenon, which they named stratorotational instability (SRI), could be a source of instability and angular momentum transport in astrophysical accretion disks. Subsequent work by Shalybkov and Rüdiger (*Astron. Astrophys.* **438**, 411, 2005) hypothesized that such stratified flow is stable when the ratio of outer and inner cylinder rotation rates μ is less than the ratio of the inner and outer cylinder radii η. Previous laboratory measurements by Le Bars and Le Gal (*Phys. Rev. Lett.* **99**, 064502, 2007) confirmed this prediction for $Re < 1200$ with $Re \equiv (r_o - r_i)\Omega_i r_i/\nu$. However, we find SRI exists for $\mu > \eta$ when the density gradient is large. We also find that the onset of SRI is suppressed for Reynolds numbers $Re > 4000$, a region previously unexplored in experiments. For $Re > 8000$, we find that the fluid does not exhibit SRI but transitions to a previously unreported chaotic state that mixes the fluid.

Bruce Rodenborn
Centre College

Date submitted: 29 Jul 2015 Electronic form version 1.4