Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Taylor-Couette flow instabilities in neutrally-buoyant suspensions MADHU MAJJI, SANJOY BANERJEE, JEFFREY F. MORRIS, City College of CUNY — Experimentally-determined instabilities and flow states of a neutrally-buoyant suspension are described. The flow is studied in a concentric-cylinder device with inner-to-outer cylinder ratio of 0.877 with inner cylinder rotating and outer stationary. The cylinder length to annular gap ratio is 20, while the gap to particle size ratio is approximately 30, for spherical particles of 250 μm diameter. Using a slowly increasing or decreasing Re ramp, the flow agrees with all expectations for the pure fluid, while a slowly decreasing (quasi-static) ramp is used for the suspension flow, which is found to be unstable at lower Reynolds number Re (based on the effective viscosity) than pure fluid, and exhibits spiraling and ribbon states not found for a pure fluid with only inner cylinder rotating. Strikingly, the suspension at solid fraction $\phi \geq 0.05$ goes unstable first to a nonaxisymetric state rather than axisymmetric Taylor vortices. At $0.1 \leq \phi \leq 0,2$, the flow exhibits numerous states during quais-static ramping of Re, while for $\phi = 0.3$, the base state Couette flow gives way to wavy spirals (WS) at $Re \approx 80$ and exhibits only the WS state up to $Re = 150$. Transient behavior on sudden change of Re and particle tracking will also be presented.

Jeffrey Morris
City College of CUNY

Date submitted: 01 Aug 2016 Electronic form version 1.4