Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Local measurements of turbulent angular momentum transport in Taylor-Couette flow. MICHAEL BURIN, CSU San Marcos, ETHAN SCHARTMAN, HANTAO JI, Princeton Plasma Physics Laboratory — We report on velocity fluctuations and the fluctuation-driven radial transport of angular momentum in turbulent wide-gap Taylor-Couette flow (2x10^3 < Re <2x10^5). Fluctuation r.m.s. levels and the mean specific angular momentum are found to be nearly constant over radius, in accordance with previous studies featuring narrower gaps. Synchronized dual beam Laser Doppler Velocimetry (2D LDV) is used to directly measure the r-θ Reynolds stress component, revealing an approximate power-law scaling in the non-dimensional angular momentum transport: $G \quad \propto Re^{1.77\pm0.07}$. The local exponent between 1.7 and 1.8 confirms previous measurements of torque in similar flows at high Reynolds numbers; its constancy over two decades differs from previous work however, and is attributed to the wide-gap geometry of our apparatus (ratio of cylinder radii $\eta \sim 0.35$). 2D LDV allows for decomposition of the turbulent transport to assess the relative roles of fluctuation intensity and cross-correlation. We find that the increasing transport with Re is solely due to intensifying fluctuations; changes in cross-correlation for these Reynolds numbers are insignificant.

Michael Burin
Dept. of Physics, CSU San Marcos

Date submitted: 06 Aug 2007 Electronic form version 1.4