

Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Flow Irreversibility in Particle Suspensions with Non-Uniform Strain¹ J.S. GUASTO, A.S. ROSS, Haverford College, J.P. GOLLUB, Haverford College, University of Pennsylvania — Sheared particle suspensions are irreversible even in Stokes flows.^{2,3} Here, we extend this previous work to a system with spatially varying strain, an oscillatory, rectangular channel flow. The particle volume fraction is 40% and the Reynolds number is $\sim 10^{-3}$. Deviations from reversible behavior are parameterized by the mean square particle displacements sampled once per cycle, and are compared to the local strain obtained from measured velocity profiles. Strikingly, the particle motions across the entire channel become irreversible simultaneously, despite the non-uniform local strain, and the irreversibility increases roughly exponentially with the wall strain. Measured velocity profiles are plug-like near the channel center, which may indicate shear-induced particle migration. We examine the possibility that irreversibility is a mechanism for shear-induced migration.

¹Supported by NSF DMR-0803153.

²D.J. Pine, *et al.*, Nature **438**, 997 (2005).

³L. Corté, *et al.*, Nature Physics **4**, 420 (2008).

J.S. Guasto
Haverford College

Date submitted: 05 Aug 2009

Electronic form version 1.4