Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Inertia in Suspension Flows: Bulk Properties and Recirculating Wakes JEFFREY MORRIS, HAMED HADDADI, Levich Institute and ChE, City College of New York — The influence of suspensions in which the particle scale inertia is non-negligible is considered by examining the inertial effects upon two distinct aspects of suspension flow through numerical simulations using the lattice-Boltzmann method. In one case, we consider the dependence of the bulk flow properties on the particle-scale Reynolds number, $Re = \rho\dot{\gamma}a^2/\mu$, where ρ and μ are, respectively the density and viscosity of the suspending fluid, $ga\dot{m}ma$ is the shear rate and a is the radius of a spherical suspended particle. We describe briefly the influence of solid fraction for $0 < \phi \leq 0.35$, and Re on the viscosity and normal stresses, showing how the microstructure induced by the flow plays a role in setting these properties. In the second case, we consider the flow of a suspension of $\phi < 0.1$ past a cylinder of radius large relative to the suspended particles at bulk Reynolds numbers yielding a recirculating wake. It is observed experimentally that the resulting wake is largely depleted of particles. The basis for this observation is explored by LB simulation and is found to be due to a two-part mechanism in which particle migrate to a limit cycle and are then displaced by fluctuations from particle interaction.

Jeffrey Morris
Levich Institute, City College of New York

Date submitted: 01 Aug 2014 Electronic form version 1.4