Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Lattice Boltzmann Simulation of the Sedimentation of Elliptic Particles KEVIN CONNINGTON, Johns Hopkins University, ZHENHUA XIA, Peking University, SHIYI CHEN, Johns Hopkins University/Peking University, QINJUN KANG, Hydrology and Geochemistry Group, Los Alamos National Laboratory — The Lattice Boltzmann Method (LBM) has recently become a popular tool for simulating solid particle suspensions. Due to the method's affinity for handling complex boundary conditions on a stationary Cartesian grid, the LBM presents a promising alternative to more computationally expensive methods. We analyze the effectiveness of this method by comparing the LBM results to those of a finite element method for the case of elliptic particle sedimentation. Due to the moving geometry, the finite element method necessitates mesh regeneration, and projection of fluid variables from the old mesh to the new one at each time step. The LBM avoids these complications by virtue of its fixed grid. We examine several methods to implement the boundary conditions on the surface of the moving complex geometry. We also investigate the benefits and detriments of two methods to calculate the total force exerted by the fluid on the particle, i.e., the method of Momentum Exchange, unique to the LBM, and the method of Stress Integration. Then we implement the LBM to study some interesting phenomena associated with elliptic particle sedimentation. We analyze settling orientation, terminal Reynolds number, and frequency effects associated with shed vortices.

Shiyi Chen
Johns Hopkins University/Peking University

Date submitted: 03 Aug 2007 Electronic form version 1.4