Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Micro-scale flow simulation and colloid transport modeling in saturated porous media[1] QUEMING QIU, HUI GAO, JIE HAN, YAN JIN, LIAN-PING WANG, University of Delaware — Adequate understanding of the mechanisms governing colloid retention by soil porous media is essential to the prediction and monitoring of the transport of contaminants through groundwater in the subsurface environment. In this talk, we focus on the representation of micro-scale flow and colloid-grain surface interactions in a computational approach. First, micro-scale viscous flows in a model porous media with different domain sizes and geometric configurations are simulated by the mesoscopic lattice Boltzmann method. A Lagrangian colloid tracking model is then used to study the dynamics of colloidal particles under the action of Brownian force, hydrodynamic forces, and physicochemical forces. The modeling and analysis of colloid transport will incorporate the effects of flow speed, solution ionic strength, collector surface roughness, and blocking effect, etc. Simulation results are used to study the unique nature of retention by the secondary energy minimum. Comparisons are made with parallel experimental results obtained from confocal microscopy. To speed up our colloid tracking modeling, parallel implementation using Message Passing Interface (MPI) is performed and the related scalability results will also be presented.

[1]Work supported by USDA and NSF.

Lian-Ping Wang
University of Delaware

Date submitted: 01 Aug 2011 Electronic form version 1.4