Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

GPU-based multi-resolution direct numerical simulation of multiphase flows with phase change CHRISTOPHER J. FORSTER, MARC K. SMITH, Georgia Institute of Technology — Nucleate pool boiling heat transfer can be enhanced in several ways to increase the critical heat flux (CHF) and delay the transition to film boiling. Changes to the heated surface geometry using open microchannels and direct forcing of the vapor bubbles using acoustic interfacial excitation are being investigated for their effects on the CHF. The numerical simulation of boiling with these effects lends itself to multi-resolution techniques due to the multiple length and time scales present during evolution of the bubbles from initial nucleation in the microchannels to forming a bubble cloud above the heated surface. To this end, a wavelet multi-resolution boiling simulation based on a parallel GPU architecture is being developed to solve the compressible Navier-Stokes equations using a dual time stepping method with preconditioning to alleviate the stiffness problems associated with the liquid phase. Interface tracking is handled by the level-set method with a prescribed interface thickness based on the maximum amount of local grid refinement desired, which can approach the physical interface thickness. Initial cases to validate the simulation will be demonstrated, including the rising bubble test problem.

Marc Smith
Georgia Institute of Technology

Date submitted: 30 Jul 2014 Electronic form version 1.4