Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Collisional Lattice Boltzmann Method for simulation of continuum through free molecular flow regimes PRAKASH VEDULA, University of Oklahoma, ABDELAZIZ ALIAT, None — The collisional Lattice Boltzmann Method (cLBM) involves a lattice based numerical solution of Boltzmann equation including the full collision operator (Green & Vedula, *J. Stat. Mech.*, 2013). Owing to accurate representation of important symmetries of the full collision operator (beyond collision invariants) and the lack of restrictive equilibrium based assumptions, this method could be particularly useful for efficient and accurate simulation of nonequilibrium flows. In the talk, we will discuss a generalization of cLBM using arbitrary lattices for description of two-dimensional flows. We will also discuss some physical and mathematical constraints that need to be considered for selection of lattices. Based on these considerations, we will demonstrate significant improvement in accuracy of simulations of selected flows in the continuum through free molecular flow regimes (up to Knudsen number, Kn O(100)). We will compare results (including the variation of velocity profiles, wall shear stress and mass flow rate with Kn) obtained from traditional LBM and DSMC with those obtained from cLBM using non-standard lattices. Using insights from these studies, we will also present techniques for significant improvement in accuracy of conventional LBM (based on BGK collision model).

Prakash Vedula
University of Oklahoma

Date submitted: 30 Jul 2014 Electronic form version 1.4