Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

DSMC-LBM hybrid scheme for flows with variable rarefaction conditions GIANLUCA DI STASO, Technische Universiteit Eindhoven, SAURO SUCCI, Istituto per le Applicazioni del Calcolo - Consiglio Nazionale delle Ricerche - Roma, FEDERICO TOSCHI, HERMAN CLERCX, Technische Universiteit Eindhoven — The kinetic description of gases, based on the Boltzmann equation, allows to cover flow regimes ranging from the rarefied to the continuum limit. The two limits are traditionally studied by numerically approximating the Boltzmann equation via Direct Simulation Monte Carlo (DSMC) method or the Lattice Boltzmann Equation method (LBM). While DSMC is suitable for rarefied flows, its computational cost makes it unpractical to study hydrodynamic flows. The LBM has instead proved itself to be an efficient and accurate method in the hydrodynamic limit even though simulation of rarefied flows requires additional modeling. Here, results on the development of a hybrid scheme capable of coupling the LBM and the DSMC methods and able to efficiently simulate flows with variable rarefaction conditions are presented. The coupling scheme is based on Grad's moment method approach and the local single particle distribution function at a given order of truncation is built by using the Hermite polynomials expansion approach and Gauss-Hermite quadratures. The capabilities of the hybrid approach for simulating flows in the transition regime are illustrated in the case of planar Couette and Poiseuille flows.

Gianluca Di Staso
Eindhoven Univ of Tech

Date submitted: 20 Jul 2015 Electronic form version 1.4