

Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Statistical Mechanics of the Fluctuating Lattice Boltzmann Equation BURKHARD DUENWEG, ULF SCHILLER, Max Planck Institute for Polymer Research, Mainz, Germany, ANTHONY J.C. LADD, Chemical Engineering, University of Florida, Gainesville, USA — The statistics of the occupation variables of a stochastic lattice Boltzmann simulation is analyzed in terms of a generalized lattice gas. We show that the most probable state of this model corresponds to the equilibrium distribution of the lattice Boltzmann equation. Stochastic collision rules are described in terms of a Monte Carlo process satisfying detailed balance. This allows a straightforward derivation of the discrete Langevin equation for the fluctuating modes. Detailed balance requires to thermalize all non-conserved modes. A Chapman–Enskog analysis shows that the approach is fully consistent with macroscopic fluctuating hydrodynamics.

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Date submitted: 08 Nov 2007

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