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Entropic Lattice Boltzmann Simulations of Turbulence[1] BRIAN KEATING, GEORGE VAHALA, William & Mary, LINDA VAHALA, Old Dominion University, MIN SOE, Rogers University, JEFFREY YEPEZ, Air Force Research Lab., Hanscom — Because of its simplicity, nearly perfect parallelization and vectorization on supercomputer platforms, lattice Boltzmann (LB) methods hold great promise for simulations of nonlinear physics. Indeed, our MHD-LB code has the best sustained performance/PE of any code on the *Earth Simulator*. By projecting into the higher dimensional kinetic phase space, the solution trajectory is simpler and much easier to compute than standard CFD approach. However, simple LB – with its simple advection and local BGK collisional relaxation – does not impose positive definiteness of the distribution functions in the time evolution. This leads to numerical instabilities for very low transport coefficients. In Entropic LB (ELB) one determines a discrete H-theorem and the equilibrium distribution functions subject to the collisional invariants. The ELB algorithm is unconditionally stable to arbitrary small transport coefficients. Various choices of velocity discretization are examined: 15, 19 and 27-bit ELB models. The connection between Tsallis and Boltzmann entropies are clarified.

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