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Lattices for lattice Boltzmann methods SHYAM CHIKATAMARLA, ILIYA KARLIN, ETH Zurich, Switzerland — The lattices widely used for lattice Boltzmann methods (LBM) viz., the 3 velocity lattice in 1D, 3^2 in 2D and 3^3 in 3D (including its prunes 15 and 19 velocity lattices) are simplest or lowest order approximations to the Boltzmann BGK equation. Although, these approximations (lattices) have been successful in simulating simple isothermal flows, they introduce significant errors for complex flows like compressible flows, multiphase flows, micro flows etc. The above mentioned lattices can be collected into order-3 or three velocity set approximations in a hierarchical approximation to the Boltzmann equation. Thus, higher order approximations to the Boltzmann equation are first derived in 1D and then extended to higher dimensions [Chikatamarla *et al.*,*Phys Rev Lett* 97 (19): No. 190601 (2006)]. The thermodynamic consistency and stability of these newly identified lattices is ensured via entropic construction of LBM [Karlin *et al.*, *Europhys. Lett.* 47 (2): 182 (1999)]. In this work, all possible lattices are identified, to any desired accuracy, in all three dimensions. Superiority of these new lattices and the entropic construction of LBM are demonstrated. Finally, a computationally efficient implementation of LBM models, via the product form of evaluation of equilibrium [Chikatamarla *et al.*, *Phys. Rev. Lett.* 97 (1): No. 010201 (2006)], is presented.

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