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Lattice Boltzmann Representations of MHD Turbulence GEORGE VAHALA, William & Mary, LINDA VAHALA, Old Dominion Univerasity, MIN SOE, Rogers State University, CHRISTOPHER FLINT, William & Mary — Lattice Botlzmann algorithms are an ideally parallelized method for the solutions of macroscopic nonlinear equations of physics – like resistive MHD. In its simplest LB representation one introduces a scalar distribution for the density-velocity fields and a vector distribution for the magnetic field. An important feature is that gradients of certain macroscopic fields can be represented by local moments of the mesoscopic distribution functions. In particular, div B = 0 can be exactly enforced to machine accuracy, without any divergence cleaning. One of the problems facing the explicit LB code is numerical instabilities. Methods to permit strong turbulence simulations include: (a) moving from a single BGK to multiple collisional relaxation, (b) quasi-equilibria and central moment enhanced LB representations. The LB turbulence modeling of Ansumali et. al. to Navier-Stokes turbulence will be extended to MHD in which in its noted that filtering and Chapman-Enskog limits do not commute. In the NS-case, it leads to unique Samgorinsky closure scheme, with definite filter width.

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