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Unconditionally Stable Lattice Boltzmann Schemes for 3D MHD BRIAN KEATING, GEORGE VAHALA, William & Mary, JONATHAN CARTER, NERSC, LBL, MIN SOE, Rogers State University, LINDA VAHALA, Old Dominion University, JEFFREY YEPEZ, AFRL, Hanscom Field — Thus, there are several fundamental advantages to using a kinetic representation (like the Lattice Boltzmann scheme) over the standard coarse-grained macroscopic representation. First, simple trajectories in a high-dimensional space can be accurately followed in time, and yet these trajectories can appear chaotic and space-filling when projected onto a lower dimensional space. Second, at the kinetic level, one is treating turbulent and thermodynamic fluctuations concurrently, leading to a more systematic coarsegraining procedure. Moreover, in LB research (A) we have an extremely powerful yet simple simulation code for turbulence that scales almost ideally with the number of PEs, and (B) we have a kinetic model that can yield conceptually better turbulence closure models when DNS cannot be used due to the limitations on PE memory due to the exceptationally large grids required. Here we extend our 3D MHD-LB code, that ran over 26 TFlops on 4800 PEs on the Earth Simulator, to handle significantly lower transport coefficients using the renormalized relaxation parameter technique of Li et. al. [1]. We then discuss how to incorporate boundary conditions into the model. [1] Y. Li, et. al. J. Fluid Mech **519**, 273 (2004).

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