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Unconditionally Stable Explicit Quantum Lattice Representation of 1D MHD Turbulence, with Arbitrary Transport Coefficients JEFFREY YEPEZ, Air Force Research Lab., Hanscom, GEORGE VAHALA, William & Mary, LINDA VAHALA, Old Dominion University — 1D models give valuable insight into the complexities of turbulence – like the Burgers equation for Navier-Stokes turbulence. For MHD, a magnetic field generalization of Burgers equation has been considered by Yanase and Diamond et. al. This 1D MHD model exhibits Alfvenization – the interchange of fluid and magnetic energies. Here we present a quantum lattice representation that is an explicit unconditionally stable algorithm for any viscosity and resistivity. There are typically 4 steps in the quantum algorithm: (a) state preparation of the qubits whose excited state occupational probability are correlated to the velocity and magnetic fields, (b) local unitary collisional entanglement of the on-site qubits, (c) measurement of post-collision occupation probabilities, (d) unitary streaming to nearest neighbor nodes. The energy spectrum shows no bottleneck near the dissipative subrange, unlike the Yanase simulations that exhibit energy pile at the longest wave numbers. We discuss the interconnection between the microscopic Schrodinger, mesoscopic quantum Boltzmann, and the macroscopic 1D MHD equations.

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