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Strong correlation and multi-phase solution in nonequilibrium lattice systems coupled to dissipation medium[1] JONG HAN, JIAJUN LI, SUNY at Buffalo, CAMILLE ARON, GABRIEL KOTLIAR, Rutgers University — How does a strongly correlated electronic solid evolve continuously out of equilibrium when an electric field is applied? While this question may seem deceptively simple, it requires rigorous understanding of dissipation. We formulate the nonequilibrium steady-state lattice coupled to fermion baths in the Coulomb gauge. We demonstrate that the Hubbard model solved using the iterative perturbation theory within the dynamical mean-field approximation recovers the DC conductivity independent of the Coulomb interaction in a very narrow linear response regime. Due to the singular dependence of the effective temperature on the damping in the steady-state [2], systems with damping have dramatic field-dependent effect, very different from dissipationless systems. We conclude that the dominant physics in lattice nonequilibrium is not the field vs quasi-particle energy, but rather the Joule heat vs the quasi-particle energy. Furthermore, we show that, in the vicinity of the Mott-insulator transition, the solution supports mixed-phase state scenario which indicates that the electron transport in solids under high-field can be spatially inhomogeneous leading to filamentary conducting paths, as suggested by experiments.

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[2]J. E. Han and Jiajun Li, Phys. Rev. B **88**, 075113 (2013)

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