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A new theoretical method to describe nonequilibrium cold atoms in optical lattices KARLIS MIKELSONS, JIM FREERICKS, Georgetown University, H. R. KRISHNAMURTHY, Indian Institute of Science, Bangalore — We use perturbation theory in the hopping (strong-coupling expansion) to describe the nonequilibrium dynamics of strongly correlated fermions. Our expansion is a self-consistent expansion for the self-energy which goes beyond the RPA and allows for damping and relaxation effects. We apply this method to solve the homogeneous Fermi - Hubbard model driven by an external field. We investigate the damping of Bloch oscillations (for a uniform dc field) and show results for the current, the nonequilibrium density of states and the momentum distribution. We carefully benchmark the technique using the exact sum rules to determine its accuracy and we discuss regions of parameter space where the method no longer converges. This technique is quite competitive with other methods (such as DMFT) in the regions where it converges.

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