Relaxation dynamics of isolated many-body systems

If an isolated quantum-mechanical many-body system is suddenly forced out of thermal equilibrium, does it relax to a new steady state or does it keep oscillating? How does the final state depend on the initial state? Recently it has become possible to investigate such fundamental questions in experiments with ultracold atomic gases. Here we study two models of interacting fermions, the Falicov-Kimball model in dynamical mean-field theory [1] and a Hubbard chain with long-range hopping [2]. We obtain the exact real-time dynamics after a sudden change of the Hubbard interaction, starting from a metallic or a Mott-insulating initial state. We observe relaxation to a new steady state, showing that the presence of the Mott gap does not inhibit relaxation. The steady-state properties are described by generalized Gibbs ensembles which take all constants of motion into account. We discuss under which conditions such ensembles provide the correct statistical description of integrable systems [2].

[1] M. Eckstein and M. Kollar, Phys. Rev. Lett. 100, 120404 (2008).
[2] M. Kollar and M. Eckstein, arXiv:0804.2254.