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# Non-equilibrium dynamics of ultracold fermions in optical lattices

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Ultracold atomic gases provide an ideal playground for studying the non-equilibrium dynamics of quantum many-body systems. On one hand, key models for strongly correlated materials can be implemented with an unprecedented level of tunability and control. On the other hand, the dilute nature and exceptionally low temperatures of these gases result in long timescales for dynamical effects (on the order of milliseconds or longer), allowing for time-resolved studies. Furthermore, they exhibit a remarkably high degree of isolation from the environment and can therefore be regarded as closed quantum systems.

In our experiment we take advantage of these unique features to explore the non-equilibrium dynamics of the repulsive Fermi-Hubbard model, which is realized by trapping a repulsively interacting two-component Fermi gas in an optical lattice. Starting from a system in the metal-Mott insulator transition, we generate additional doubly occupied sites by a periodic modulation of the lattice depth. The decay of these high energy excitations is then monitored in a time-resolved manner. Over two orders of magnitude it shows an exponential dependence on the ratio of interaction energy to kinetic energy. We show that the dominant mechanism for the relaxation is a simultaneous many-body process involving several single fermions as scattering partners.

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