Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

Equilibrium and out of equilibrium studies of ultracold fermions in an optical lattice DANIEL GREIF, LETICIA TARRUELL, THOMAS UEHLINGER, ROBERT JORDENS, NIELS STROHMAIER, HENNING MORITZ, TILMAN ESSLINGER, ETH Zurich — In our experiment we use a two component Fermi gas in a 3D optical lattice to realize the Fermi-Hubbard model. This clean approach offers the advantage of posing well defined questions and accessing clean probes. Here we present recent measurements of equilibrium and out of equilibrium properties of this model system. Tuning the interaction via a Feshbach resonance over a broad range we investigate the crossover from a metallic to Mott insulating state. This is signaled by a drastic reduction of double occupancy and the appearance of a gapped mode in the doublon spectrum probed by lattice modulation. The resolution in double occupancy of our most recent measurements allows for precise comparison with both DMFT calculations and high-temperature series expansions. If the lattice modulation is sufficiently weak, the increase of doublons with time is well captured by linear response theory. In this regime the buildup rate of doublons is a measure for equilibrium properties such as the temperature sensitive local spin ordering. For long modulation times the system is driven into a far from equilibrium state with many additional doublons. We show that the dominant decay mechanism is a high-order scattering process with many single particles.

Daniel Greif
ETH Zurich

Date submitted: 22 Jan 2010 Electronic form version 1.4