SES19-2019-000023

Abstract for an Invited Paper
for the SES19 Meeting of
the American Physical Society

Probing dynamical properties of Fermi-Hubbard systems with a quantum gas microscope

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The normal state of high-temperature superconductors exhibits anomalous transport and spectral properties that are poorly understood. Cold atoms in optical lattices have been used to realize the Fermi-Hubbard model, widely believed to capture the essential physics of these materials. The recent development of fermionic quantum gas microscopes has enabled the study of Hubbard systems with single-site resolution. Most studies have focused on probing equal-time spin and density correlations. In this talk, I will report on using a quantum gas microscope to probe response functions associated with unequal-time correlations relevant for understanding the pseudogap and strange metal regimes of Fermi-Hubbard systems. First, I will describe the development of a technique to measure microscopic diffusion, and hence resistivity, in doped Mott insulators. We observed T-linear resistivity and a violation of the Mott-Ioffe-Regel limit, two signatures of strange metallic behavior. Next, I will report on the development of angle-resolved photoemission spectroscopy (ARPES) for Hubbard systems and its application to studying pseudogap physics in an attractive Hubbard system across the BEC-BCS crossover, setting the stage for future studies of the pseudogap regime in repulsive Hubbard systems.