DAMOP17-2017-020159
Abstract for an Invited Paper
for the DAMOP17 Meeting of
the American Physical Society

Microscopy of atomic Fermi-Hubbard systems in new regimes

WASEEM A. BAKR, Princeton University

The ability to probe and manipulate ultracold fermions in optical lattices at the atomic level using quantum gas microscopes has enabled quantitative studies of Fermi-Hubbard models in a temperature regime that is challenging for state-of-the-art numerical simulations. Experiments have focused on spin-balanced gases of repulsively interacting atoms with the hope of elucidating phenomena in the high-temperature superconductors. In this talk, I will present experiments that explore the Hubbard model in two new regimes: repulsive gases with spin-imbalance and attractive spin-balanced gases. In the first regime, we observe canted antiferromagnetism at half-filling, with stronger correlations in the direction orthogonal to the magnetization. Away from half-filling, the polarization of the gas exhibits non-monotonic behavior with doping, resembling the behavior of the magnetic susceptibility of the cuprates. The attractive Hubbard model studied in the second set of experiments is the simplest theoretical model for studying pairing and superconductivity of fermions in a lattice. Our measurements on the normal state reveal checkerboard charge-density wave correlations close to half-filling. Compared to the paired atom fraction, we find the charge-density-wave correlations to be a much more sensitive thermometer in the low temperature regime relevant for future studies of inhomogeneous superfluid phases in spin-imbalanced attractive gases.