Abstract Submitted
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New Frontiers in Fermionic Quantum Gas Microscopy[1]

MUQING XU, CHRISTIE CHIU, GEOFFERY JI, ANTON MAZURENKO, MAXWELL PARSONS, MARTON KANASZ-NAGY, RICHARD SCHMIDT, FABIAN GRUSDT, ANNABELLE BOHRDT, EUGENE DEMLER, DANIEL GREIF, MARKUS GREINER, Harvard University — Quantum gas microscopy of fermionic atoms allows site-resolved studies of quantum many-body states and dynamics of strongly correlated particles in the Hubbard Model. In our experiment we use digital mirror devices (DMDs) to control optical potentials at the site-resolved level and to implement a new cooling scheme based on entropy redistribution. This has allowed us to observe long-range antiferromagnetic order in a repulsively interacting Fermi gas of Li-6 in a square optical lattice. The ordered state extends across the entire sample size of about 80 lattice sites and is detected from the spin correlation function and spin structure factor. We also hole-dope the system by adjusting the chemical potential and enter a regime where numerical methods become intractable. Furthermore, we create single holes on selected lattice sites with the DMDs to study hole dynamics in an antiferromagnetic environment. We will discuss our most recent progress towards the site-resolved detection of possible holon-holon and spinon-holon string configurations, which may emerge in the doped regime and could be a crucial ingredient for the mechanism of high-temperature superconductivity.

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Muqing Xu
Harvard University

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