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Microscopic studies of cold-atom Fermi-Hubbard antiferromagnets CHRISTIE CHIU, GEOFFREY JI, MUQING XU, ANTON MAZURENKO, DANIEL GREIF, MARKUS GREINER, Harvard University — Quantum gas microscopy of ultracold fermionic atoms in optical lattices allows studying strongly correlated low-temperature phases in the Hubbard model. Through an entropy redistribution technique we have demonstrated long-range antiferromagnetic order extending over our entire sample, a disk spanning ten sites across filled with a two-component spin mixture of ultracold fermionic Li-6 atoms in a square lattice. Our microscope provides access to quantities such as the site-resolved spin correlation function, spin structure factor, and full counting statistics of the staggered magnetization. By hole doping the system away from half-filling we explore regimes of the Hubbard model phase diagram where precise numerical studies become challenging. We study the interplay between hole motion and the antiferromagnetic order: when a hole tunnels in an antiferromagnet, it distorts the surrounding order and may form a spinon-holon string of distorted spin order. This could be an essential aspect of high-temperature superconductivity in cuprates, and the readout of our microscope allows us to directly address this question. We discuss our progress in the search for signatures of these string configurations and study the dynamics of mobile holes in an antiferromagnet.

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