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Implementation of a Quantum Gas Microscope for Fermions RHYS ANDERSON, VIJIN VENU, PEIHANG XU, GRAHAM EDGE, DYLAN JERVIS, DAVE MCKAY, RYAN DAY, STEFAN TROTZKY, JOSEPH THYWISSEN, University of Toronto — We discuss the technical development of a quantum gas microscope for ^{40}K. We load a degenerate Fermi gas into a cubic optical lattice of period 527 nm, which is capable of simulating the Fermi-Hubbard model. The sample is prepared in UHV below a 200 μm-thick sapphire window, at the focus of a 5 mm focal length objective located outside the chamber. To isolate a single plane for imaging, we perform spectroscopic selection in a 210 G/cm gradient, which separates the hyperfine transition frequencies of adjacent vertical planes by 28 kHz. We actively suppress variations in the transition frequency due to fluctuations in the ambient magnetic field to less than 3 kHz via a feed-forward stabilization system. EIT cooling on the 770.1 nm D_1 transition facilitates fluorescence imaging of our atoms with long exposures. Atoms remain pinned in a 200 μK-deep lattice, with a $1/e$ lifetime of 67(9) s, while scattering $\sim 10^3$ photons per second. Collection of fluorescence photons onto an EMCCD via a 0.8 NA objective results in a PSF of FHWM 600 nm, and 94(2)% of atoms identified in the first frame remain pinned in successive frames, enabling reconstruction of the lattice-site occupancy. We present ongoing progress in obtaining lower entropy samples.

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