A Fermi Gas Microscope with Lithium-6  

MAXWELL PARSONS, SEBASTIAN BLATT, CHRISTIE CHIU, FLORIAN HUBER, ANTON MAZURENKO, MARKUS GREINER, Harvard University — We demonstrate atom-resolved imaging of fermionic lithium-6 in an optical lattice. Lithium, with its fast dynamics and tunable interactions, is an ideal species for studying quantum many-body physics with ultracold atoms. However, lithium’s large recoil energy and its unresolved excited state hyperfine structure make sub-Doppler laser cooling challenging. To solve this challenge, we have extended the technique of Raman sideband cooling to lithium in a very deep optical lattice. We load atoms into a single layer of a three-dimensional optical lattice with 566 nm lattice spacing, approximately 10 μm below a super-polished substrate that forms the last element of an imaging system with 0.85 numerical aperture. The lattice is then ramped to a depth of approximately 3 mK, where trap frequencies are on the order of 1 MHz. In this deep lattice we perform an alternating sequence of imaging and Raman sideband cooling pulses to image the atoms while keeping them pinned to their lattice sites.