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Low Noise Trapping and High Resolution Imaging of Fermions in an Optical Lattice ANTON MAZURENKO, FLORIAN HUBER, MAXWELL F. PARSONS, CHRISTIE S. CHIU, SEBASTIAN BLATT, MARKUS GREINER, Harvard Department of Physics — Single-site resolved imaging of fermions in an optical lattice is an area of interest due to the possibility of probing highly entangled many-body states with high fidelity. We will apply this technique to problems in condensed matter physics, such as ordering in magnetic systems and quantum phase transitions. We have successfully trapped fermionic 6-Li atoms in an optical lattice 10 micron below a high-quality reference surface. This surface is part of a high resolution imaging system (numerical aperture 0.85) including an interferometrically aligned commercial microscope objective. Trapping atoms in this configuration presents novel challenges and we have developed a highly stable optical lattice (-130 dBc relative intensity noise), that can be dynamically controlled over three orders of magnitude in intensity, with maximum trap frequency of 1 MHz. We have also developed a system for Raman state manipulation within this lattice. We have explored heating rates and lifetimes in this configuration and report the results.

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