Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Imaging and addressing of individual fermionic atoms in an optical lattice STEFAN TROTZKY, GRAHAM EDGE, RHYS ANDERSON, PEIHANG XU, VIJIN VENU, DYLAN JERVIS, DAVE MCKAY, RYAN DAY, JOSEPH THYWISSEN, University of Toronto — The implementation of site-resolved imaging of atoms in short-period optical lattices constitutes a milestone achievement in the study of strongly correlated matter with these systems. Its realization with bosons six years ago has boosted progress in the field. In the last year, site-resolved imaging was demonstrated for fermions in five independent experiments. We present our newest results on site-resolved microscopy of ultracold ^{40}K in a 527nm-period optical lattice. Atoms remain pinned during imaging due to EIT cooling on the 770nm D1 transition. We observe pinning fidelities of up to 96% for an illumination time of 2.6s during which the atoms scatter >2000 photons. A 0.8NA objective collects the fluorescence light to be imaged onto a EMCCD camera, giving a 600nm -wide PSF. In conjunction with the known lattice geometry, this allows us to reconstruct the lattice-site occupations from the images. The imaging technique is implemented in an apparatus capable of simulating the Fermi-Hubbard model. The use of tomographic tools enables us to select single lattice planes for background free imaging. We also address in-plane patterns with straight and circular boundaries in order to eliminate inhomogeneity effects on the imaging fidelity, or for controlled entropy removal.

Rhys Anderson
University of Toronto

Date submitted: 29 Jan 2016 Electronic form version 1.4