Grey-molasses cooling of an optically trapped Fermi gas

RYAN DAY, DYLAN JERVIS, GRAHAM EDGE, RHYS ANDERSON, STEFAN TROTZKY, JOSEPH THYWISSEN, University of Toronto — Robust sub-Doppler cooling has recently been demonstrated at the D1 ($nS_{1/2}$ to $nP_{1/2}$) transition of potassium [1-3] and lithium [4], atoms that are challenging to cool on the D2 cycling transition. Two mechanisms are at work: first, Sisyphus cooling in the standing-wave dipole potential, at least partially due to polarization gradients [1]; second, velocity-selective coherent population trapping (VSCPT) in a superposition of the two hyperfine ground states [2-4]. We extend this technique to the cooling of dense clouds in optical traps. Since the VSCPT dark state relies only on ground-state coherences, it is insensitive to optical shifts from far-detuned optical traps. We also observe that the molasses has sufficient cooling power to withstand light scattering on the 4S-5P transition. Together these observations indicate that D1 cooling is a promising approach to fluorescent imaging of single fermions in an optical lattice.