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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.

[1] D. Rio Fernandes et al., EPL, 100 63001 (2012).
[2] D. Nath et al., PRA, 88 053407 (2013).
[3] G. Salomon et al., EPL, 104 63002 (2013).
[4] A. T. Grier et al., PRA 87 063411 (2013).

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