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Progress toward observation of AFM ordering of ultracold fermions in an optical lattice[1] RUSSELL A. HART, PEDRO M. DUARTE, TSUNG-LIN YANG, RANDALL G. HULET, Rice University — We present progress toward the observation of antiferromagnetic (AFM) ordering of fermionic atoms in an optical lattice. We first laser cool on the $2S_{1/2} \rightarrow 2P_{3/2}$ transition and then further cool using the narrow $2S_{1/2} \rightarrow 3P_{3/2}$ transition to T $\sim$ 59 μK.[2] The second stage of laser cooling greatly enhances loading to an optical dipole trap where a two spin state mixture of atoms is evaporatively cooled to degeneracy. We then adiabatically load $\sim 10^6$ degenerate fermions into a 3D optical lattice formed by three orthogonal standing waves of 1064 nm light. Each of the three lattice beams is overlapped with a non-retrorelected green beam at 532 nm, which offsets the harmonic trapping caused by the lattice light. This offset can extend the number of lattice sites over which a Mott insulator phase can exist and facilitates evaporative cooling in the lattice. By adjusting the s-wave scattering length and the depth of the lattice, we tune the interaction and hopping terms of the Hubbard Hamiltonian. We will use Bragg scattering of light off of ordered spin planes to detect the AFM state.[3]

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[2]P. M. Duarte et al., Phys. Rev. A **84**, 061406 (2011).
[3]T. A. Corcovilos et al., Phys. Rev. A **81**, 013415 (2010).

Russell A. Hart
Rice University

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