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Experimental investigation of the Fermi-Hubbard model in a 3D optical lattice of ^{6}Li atoms[1] T.A. CORCOVILOS, J.M. HITCHCOCK, P.M. DUARTE, R.G. HULET, Rice University — We present experiments on the three dimensional Fermi-Hubbard model at half-filling in an optical lattice of ^{6}Li atoms in an equal mixture of two hyperfine magnetic sublevels. The Fermi-Hubbard model of spins in a lattice predicts magnetically ordered phases and is suspected to support superconductivity in its two-dimensional form. In our experiment, ^{6}Li atoms are cooled to degeneracy in an optical trap and loaded into a simple cubic, far-red detuned optical lattice. By adjusting the s-wave scattering length of the atoms (via a magnetic Feshbach resonance) and the depth of the optical lattice, we tune the interaction and hopping terms of the Hubbard hamiltonian. In particular, we search for the Mott insulator phase predicted to occur at low temperature and the antiferromagnetic Néel phase predicted to occur at lower temperature and weak interaction strength. An overview of our experimental approach will be presented. In particular, we discuss our methods for cooling the atoms and for detecting the spatial and magnetic ordering of the atoms by Bragg scattering of near-resonant light off of the atoms in the lattice. We also present our progress in achieving the Mott and Néel states.

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