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Observation of antiferromagnetic correlations in the Fermi-Hubbard model R.A. HART, P.M. DUARTE, T.L. YANG, X. LIU, Department of Physics and Astronomy and Rice Quantum Institute, Rice University, Houston, TX 77005, R.G. HULET[1], Department of Physics and Astronomy and Rice Quantum Institute, Rice University, Houston, TX 77005, T.C.L. PAIVA, Instituto de Fisica, Universidade Federal do Rio de Janeiro Cx.P. 68.528, 21941-972 Rio de Janeiro RJ, Brazil, D. HUSE, Department of Physics, Princeton University, Princeton, New Jersey 08544, R.T. SCALETTAR, Department of Physics, University of California, Davis, California 95616, N. TRIVEDI, Department of Physics, The Ohio State University, Columbus, Ohio 43210 — The physics of high temperature superconductors is not well understood, although it is known that the undoped parent compounds of many of them are antiferromagnetic (AF) insulators. The Fermi-Hubbard model at half filling (one atom per lattice site) is known to exhibit a phase transition to an antiferromagnetic insulator at a low temperature. We realize the Fermi-Hubbard model by loading ultracold ^{6}Li atoms into a three-dimensional red-detuned optical lattice. We have compensated the confining potential of the lattice with blue-detuned laser beams in order to evaporatively cool the atoms. We have cooled sufficiently to observe AF correlations using spin-sensitive Bragg scattering of near-resonant light. Comparison with Quantum Monte Carlo (QMC) calculations indicates that the temperature is between 2-3 T_N, where short-range correlations begin to develop. Bragg scattering combined with QMC provides sensitive thermometry in a previously unexplored regime.

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