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Quantum simulation of the 2D Hubbard model

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We experimentally study the emergence of antiferromagnetic correlations between ultracold fermionic atoms in a two dimensional optical lattice with decreasing temperature. We determine the uniform magnetic susceptibility of the two-dimensional Hubbard model from simultaneous measurements of the in-situ density distribution of both spin components. At half filling and strong interactions our data approach the Heisenberg model of localized spins with antiferromagnetic correlations. Furthermore, we study quantum criticality in the two-dimensional Hubbard model, observe universal scaling, and find the dynamical critical exponent of the metal-insulator transition.