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Title:
Looking at condensed matter physics with quantum gases

Abstract:
Fermionic quantum gases in optical lattices make it possible to physically construct and study key models of condensed matter physics. The riddle of high temperature superconductivity, or the beauty of graphene, are becoming accessible to experiments, in which the Hamiltonian is a direct result of the optical lattice potential created by interfering laser fields and short-ranged collisional interaction between ultracold atoms. I will give an introduction to quantum gas experiments and report on our most recent results. We have been able to create a honeycomb lattice structure and identify Dirac points, move them within the Brillouin zone and make them appear or disappear. We have recently reached the regime of quantum magnetism in an atomic Fermi Hubbard model, using a dimerized and an anisotropic cubic lattice to locally engineer the entropy distribution of the gas. This allowed us to observe short-range antiferromagnetic correlations.