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Experimental realization of the ionic Hubbard model on a honeycomb lattice with ultracold fermions RÉMI DESBUQUOIS, MICHAEL MESSER, THOMAS UEHLINGER, GREGOR JOTZU, FREDERIK GÖRG, DANIEL GREIF, SEBASTIAN HUBER, TILMAN ESSLINGER, ETH Zurich —
Ultracold atoms in optical lattices constitute a tool of choice to realize the Fermi-Hubbard model. There, the on-site interaction energy opens a gap in the charge excitation spectrum, leading to a Mott insulating ground state. However, in the ionic Hubbard model, the addition of a staggered energy offset on each lattice site also leads to an insulating ground state with charge-density-wave ordering, even in the absence of inter-particle interactions. In our experiment we realize the Ionic Hubbard model on a honeycomb lattice by loading a two-component interacting Fermi gas into an optical lattice with a staggered energy offset on alternating sites. The underlying density order of the ground state is revealed through the correlations in the noise of the measured momentum distribution. For a large energy offset, we observe a charge density-wave ordering, which is suppressed as the on-site interactions are increased. To further elucidate the nature of the ground state, we measure the double occupancy of lattice sites and the charge excitation spectrum for a wide range of parameters.

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