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Formation and dynamics of anti-ferromagnetic correlations using ultracold fermions MICHAEL MESSER, DANIEL GREIF, GREGOR JOTZU, FREDERIK GÖRG, RÉMI DESBUQUOIS, TILMAN ESSLINGER, ETH Zurich —
Ultracold fermions in optical lattices are an ideal toolbox for studying quantum magnetism in the Hubbard model. In this model many questions on the low-temperature phase diagram still remain open, both for simple cubic and square configurations, as well as for more complex lattice geometries. Besides a highly controlled approach to studying the thermodynamic properties cold atoms can also give insight into the dynamic properties of the system. In our experiment we load a two-component, repulsively interacting fermionic quantum gas into a tunable-geometry optical lattice. We observe anti-ferromagnetic spin correlations on neighboring sites in both isotropic 3D cubic and 2D square lattices for very low temperatures. In addition we study the strength of the spin correlations in more complex lattice geometries, such as honeycomb, 1D-dimerized and spin-ladder lattice configurations. Furthermore, we demonstrate first experimental results on the dynamics of spin correlations by measuring their characteristic formation time.

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