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The influence of lattice geometry on anti-ferromagnetic correlations and their dynamics in the Fermi-Hubbard model GREGOR JOTZU, DANIEL GREIF, MICHAEL MESSER, RÉMI DESBUQOIS, FREDERIK GÖRG, TILMAN ESSLINGER, Institute for Quantum Electronics, ETH Zurich, 8093 Zurich, Switzerland — It is well known that in the thermodynamic limit, quantum effects hinder the formation of true long-range order in lower dimensions. However, on shorter length-scales correlations can actually be enhanced by reducing the connectivity of a lattice. Here we report on the observation of anti-ferromagnetic correlations of ultracold fermions in a variety of optical lattice geometries that are well described by the Hubbard model, including dimers, 1D chains, ladders, isolated and coupled honeycomb planes, as well as square and cubic lattices. The dependence of total correlations and their distribution on the specific geometry is experimentally probed by measuring the spin correlator along different lattice tunnelling bonds. We study distinct geometries as well as continuous crossovers between them, and find a strong dependence on the specific configuration. By dynamically changing the lattice geometry and studying the time-evolution of the system, we determine the time required for the formation and redistribution of spin correlations. Timescales ranging from a sudden quench of the lattice geometry to an adiabatic evolution are probed.

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