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Quantum magnetism of ultracold fermions in an optical lattice DANIEL GREIF, THOMAS UEHLINGER, GREGOR JOTZU, LETICIA TARRUELL, TILMAN ESSLINGER, ETH Zurich — Quantum magnetism describes quantum many-body states with spins coupled by exchange interactions. At low temperatures this leads to short- and long-range magnetic ordering, which is for example the case in spin-liquids, valence-bond solids and antiferromagnets. We report on the observation of magnetic spin correlations on neighboring sites of a Fermi gas in an optical lattice. The key to obtaining and detecting the short-range magnetic order is an entropy redistribution technique in a tunable-geometry optical lattice. We load a low-temperature two-component gas with repulsive interactions into either a dimerized or anisotropic simple cubic lattice. The correlations manifest as an excess number of singlets as compared to triplets consisting of two atoms with opposite spins. For the anisotropic lattice, we determine the transverse spin correlator from the singlet-triplet imbalance and observe antiferromagnetic correlations along one spatial axis.

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