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Probing density and spin correlations in two-dimensional Hubbard model with ultracold fermions CHUN FAI CHAN, JAN HENNING DREWES, MARCELL GALL, NICOLA WURZ, Physikalisches Institut, Universitt Bonn, EUGENIO COCCHI, LUKE MILLER, Physikalisches Institut, Universitt Bonn; Cavendish Laboratory, University of Cambridge, DANIEL PERTOT, FERDINAND BRENNECKE, MICHAEL KOEHL, Physikalisches Institut, Universitt Bonn — Quantum gases of interacting fermionic atoms in optical lattices is a promising candidate to study strongly correlated quantum phases of the Hubbard model such as the Mott-insulator, spin-ordered phases, or in particular d-wave superconductivity. We experimentally realise the two-dimensional Hubbard model by loading a quantum degenerate Fermi gas of ^{40}K atoms into a three-dimensional optical lattice geometry. High-resolution absorption imaging in combination with radiofrequency spectroscopy is applied to spatially resolve the atomic distribution in a single 2D layer. We investigate in local measurements of spatial correlations in both the density and spin sector as a function of filling, temperature and interaction strength. In the density sector, we compare the local density fluctuations and the global thermodynamic quantities, and in the spin sector, we observe the onset of non-local spin correlation, signalling the emergence of the anti-ferromagnetic phase. We would report our recent experimental endeavours to investigate further down in temperature in the spin sector.

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