

Abstract Submitted
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Microscopic Observation of Pauli Blocking in Degenerate Fermionic Lattice Gases TIMON HILKER, AHMED OMRAN, MARTIN BOLL, GUILLAUME SALOMON, IMMANUEL BLOCH, CHRISTIAN GROSS, Max Planck Institute of Quantum Optics — Ultracold atoms in optical lattices provide a powerful platform for the controlled study of quantum many-body physics. We present here the first studies with a new generation quantum gas microscope, which allows to observe the full atom number statistics on every site. The common problem of light induced losses during imaging is avoided by an additional small scale "pinning lattice" used for Raman sideband cooling in the imaging process. We report the local observation of the Pauli exclusion principle in a spin-polarized degenerate gas of ${}^6\text{Li}$ fermions in an optical lattice. In the band insulating regime, we measure a tenfold suppression of particle number fluctuations per site compared to classical particles. From the remaining fluctuations we extract a local entropy as low as $0.3 k_B$ per atom. Our work opens an exciting avenue for studying local density and even magnetic correlations in fermionic quantum matter both in and out of equilibrium.

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