Abstract Submitted
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Studying Quantum Many-Particle Systems on the Single-Atom Level M. ENDRES, C. WEITENBERG, J. SHERSON, M. CHENEAU, P. SCHAUSS, T. FUKUHARA, I. BLOCH, S. KUHR, Max Planck Institute of Quantum Optics, Hans-Kopfermann-Str. 1, D- 85748 Garching — The reliable detection of single quantum particles has revolutionized the field of quantum optics and quantum information processing. For several years, researchers have aspired to extend such detection possibilities to larger-scale, strongly correlated quantum systems. We report on fluorescence imaging of bosonic Mott insulators in an optical lattice with single-atom and single-site resolution.[1] From our images, we fully reconstruct the atom distribution on the lattice and identify individual excitations with high fidelity. Furthermore we will present progress towards in-situ thermometry and the detection of coherent particle-hole excitations across the superfluid-to-Mott-insulator transition. We plan to use our detection technique to study one dimensional quantum systems. In the Tonks-Girardeau regime, their strongly interacting nature can be revealed by the density-density correlation function, which should show a distinct anti-bunching of the particles.

[1]J. Sherson et al., Nature 467, 68 (2010)

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