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Towards single site addressability in optical lattices MANUEL ENDRES, CHRISTOF WEITENBERG, JACOB SHERSON, IMMANUEL BLOCH, STEFAN KUHR, University of Mainz, Max Planck Institute of Quantum Optics Munich — Investigations of ultracold quantum gases in optical lattices are mostly restricted to access global information of the system. By contrasts we are developing experimental techniques revealing the local distribution of the trapped gas. Main part of the experiment will be an optical imagine system with a spatial resolution better than the lattice spacing of a near infrared optical lattice. In addition the setup will allow for manipulation of the atoms on a local scale. Collecting the fluorescence light of the trapped atoms, will enable us to observe the local dynamics of the many-body system. With an additional strongly focused laser beam single sites of the optical lattice can be addressed. Possible applications of single site addressability are e.g. single q- bit rotations via local rf-resonance or disturbance of the many- body system on a local scale. In principle the experimental setup will open new possibilities for the investigation and manipulation of strongly correlated atomic systems for the purpose of quantum simulation and quantum information processing.

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