Abstract Submitted
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Single site addressability in optical lattices CHRISTOF WEITENBERG, JACOB SHERSON, MANUEL ENDRES, MARC CHENEAU, RALF LABOUVIE, ROSA GLOECKNER, IMMANUEL BLOCH, STEFAN KUHR, Max Planck Institute of Quantum Optics, SINGLE ATOMS TEAM — Single site resolution in short-wavelength optical lattices, which have a significant tunnel coupling, is a challenging task. We prepare a BEC of rubidium atoms in a 3D lattice of 532 nm spacing. Using the 5S1/2 to 6P3/2 transition at 420nm, our imaging system (NA=0.7) will yield a resolution of 380nm and there-fore allow single site resolved detection and manipulation. So far we have taken in trap fluorescence images with a resolution of 700 nm using the 5S1/2 to 5P3/2 transition at 780nm and demonstrated the micro-manipulation of a few atoms with a tightly focused dipole trap. To extract one or a few slices and remove the atoms that are out of the depth of focus we use microwave transitions in a magnetic field gradient. The single site resolution will open up a new class of experiments in quantum simulation of strongly correlated systems - like the in-situ observation of the Mott insulator or the investigation of non-equilibrium phenomena - and in quantum information processing - like local spin manipulation or quantum gates with Rydberg atoms.

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