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Towards Single Site Addressing in an Optical Lattice

Investigations of ultracold quantum gases in optical lattices are mostly restricted to access global information of the system. By contrast we are developing experimental techniques revealing the local distribution of the trapped gas. The main part of our experiment is an optical imaging system with a spatial resolution better than the lattice spacing of a near-infrared optical lattice. In addition the setup allows for manipulation of the atoms on a local scale. With an additional strongly focused laser beam single sites of the optical lattice can be addressed. To deflect this laser beam we are going to use an acousto-optical deflector, which combines a large deflection angle with a high deflection efficiency. Possible applications of single site addressability are e.g. single q-bit rotations via local microwave-resonance, perturbation of the many-body system on local scale or the creation of time-averaged potentials on top of the optical lattice.

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