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Laser spectroscopy of Rydberg atoms in deep optical lattices[1]
YUN-JHIH CHEN, GEORG RAITHEL, The University of Michigan — We investigate the trapping of cold Rydberg atoms with a deep optical lattice. The light field of the lattice is established by coupling a 1064 nm laser into a near concentric field-enhancement cavity, which allows us to reach lattice depths up to about 1 GHz. In deep lattices Rydberg atoms exhibit a rich set of adiabatic trapping potentials that differ in many respects from those of trapped ground-state atoms. We have calculated the trapping potentials, the corresponding adiabatic states, and the associated photo-ionization rates as a function of center-of-mass position in a one GHz deep lattice. In view of ongoing experimental work, we also investigate the excitation spectra for experimentally accessible excitation schemes. We will review our theoretical results, describe the utilized experimental setup, and report on the current stage of our spectroscopic studies. We will also discuss the applications of concentric cavities in future optical lattices experiments.

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