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Rydberg Atoms in Ponderomotive Optical Lattices[1] KELLY YOUNGE, SARAH ANDERSON, GEORG RAITHEL, University of Michigan — Rydberg atoms in ponderomotive optical lattices present a unique platform to study properties and interactions of these highly excited atoms. Ponderomotive lattices tailored to trap Rydberg atoms will allow new experiments in quantum information physics and high-precision spectroscopy. Here, we have calculated the adiabatic potentials of Rydberg atoms in one-dimensional ponderomotive lattices for a variety of atomic states and lattice parameters. We have used these potentials to obtain ensembles of Rydberg-atom trajectories in the lattice, and to simulate the spectra of microwave transitions of Rydberg atoms moving through the lattice. We conclude that microwave spectroscopy presents a powerful technique to probe the motion and to verify trapping of the atoms in ponderomotive lattices. We further examine a novel optical lattice potential that provides a transverse trapping force in addition to the longitudinal trapping force normally provided by an optical lattice.

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