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Driving Rydberg-Rydberg transitions with an amplitude-modulated optical lattice[1] KAITLIN MOORE, SARAH ANDERSON, GEORG RAITHEL, Univ of Michigan - Ann Arbor — We demonstrate a novel spectroscopic method that couples Rydberg states using an amplitude-modulated optical lattice. The method is fundamentally different from traditional microwave spectroscopy: it engages the A^2-term rather than the Ap-term of the atom-field interaction Hamiltonian. The method allows us to drive microwave transitions between Rydberg states with optical spatial resolution, and it is not subject to the usual electric-dipole selection rules. Both features are attractive for quantum computing and precision metrology, such as measuring an improved value for the dipolar polarizibility of the Rb ionic core. In the experiment, cold Rb Rydberg atoms are first excited and confined in an optical lattice of wavelength 1064nm [1]. Then, the electric-quadrupole transition $58S \rightarrow 59S$ is driven by modulating the intensity of the optical lattice using a tunable electro-optic fiber modulator. Maximum population transfer occurs at a lattice modulation frequency of 38.768610(30) GHz, in close agreement with calculations. We briefly explain the theoretical background of the new spectroscopic method, show experimental results and discuss applications.

[1] S.E. Anderson, K.C. Younge, and G. Raithel, Phys. Rev. Lett., 107, 263001 (2011)

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