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Phase dependent excitation of Rydberg atoms in non-zero average fields.[1] ERIC MAGNUSON, Univ of Virginia, VINCENT CARRAT, Northwestern University, TOM GALLAGHER, Univ of Virginia — The final energy of an electron excited to a high lying Rydberg state in the presence of a microwave (MW) field shows a dependence on the phase of the field at which the excitation occurs. This phase dependence is comparable to that seen in strong field experiments using attosecond pulses to probe systems perturbed by intense infrared (IR) fields. In zero average field, final energies exhibit a phase dependence at twice the frequency of the MW field. We show a phase dependence at the same frequency as the MW field emerges in the presence of a non-zero average field, parallel to the MW polarization. To isolate phase dependence at the MW frequency, we amplitude modulate the IR excitation laser and phase lock this modulation to the MW field. Li atoms are excited to states near the ionization limit in the presence of a MW field, and bound Rydberg states (n¿150) are detected. In an applied average field, we observe modulation of the Rydberg signal at the MW frequency. This modulation vanishes as the average field is zeroed, but persists even in fields large enough to ionize most of the population. We compare these results to symmetry arguments and a model of classical Rydberg orbits. An experiment to determine the absolute phase of the modulation relative the MW field is discussed.

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