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Production of extremely high-lying states by 80-GHz microwave fields[1] ALEXANDR ARAKELYAN, THOMAS F. GALLAGHER, University of Virginia — It was previously reported that ionization of Rydberg atoms of Na and Li by strong microwave (MW) fields of 17 and 38 GHz yields a substantial fraction of population left in the high-lying states with n $>$ 250. This phenomenon was observed for any initial state at least fractionally ionized and was reported as a consequence of MW ionization of atoms. We present results of a similar experiment conducted with an 80-GHz MW field. The production of the high-lying states after the strong 80-GHz pulse is observed, but, in contrast to previous studies, not for any initial state. The high-lying states are only observed if atoms are excited to a zero-field state that is in a multiphoton resonance with the ionization limit (IL). We attribute the difference in the results of 80 and 17-GHz experiments to the fact that the ponderomotive shift is 4 and 90 GHz, respectively, at 100-V/cm. Consequently, we show that the high-lying states are produced if an initial state can be shifted in resonance with the IL. We also report MW ionization thresholds observed at 80 GHz to be much higher than those measured at 15 GHz: a transition to n+1 state occurs only when big static field is present. Moreover, unlike results of 15-GHz experiment, ionization thresholds depend strongly on the width of the MW pulse.

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