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Classical Monte-Carlo simulation for Rydberg states ionization in strong field.[1] VINCENT CARRAT, Northwestern University, ERIC MAGNUSON, THOMAS GALLAGHER, University of Virginia — The resilience of Rydberg states against ionization has fascinated physicists for a long time. One might expect that the loosely bound electron would be ionized by modest electromagnetic field. However, experiments show that a notable fraction of neutral atoms survive in Rydberg states when exposed to strong microwave or laser fields. Energy transfer between the field and the photoelectron occurs when the electron is close to the ionic core and depends on the phase of the field. Since those states have orbital times that can be larger than the field pulse duration, these energy exchanges will only occur a few times. While we can experimentally control the initial time when we create the Rydberg states and as a consequence the initial energy transfer from the field, our classical calculation suggests that the phase when the electron is returning to the ionic core on the next orbit is chaotic. Statistically the electron only has a 50% chance to gain energy which may lead to ionization. Additionally the population tends to accumulate in very high n states where ionization is less likely due to fewer rescattering events. Though incomplete, this classical Monte-Carlo simulation provides useful insights for understanding the experimental observations.

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