Abstract Submitted
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Strong field ionization in a single-cycle pulse[1] BAOCHUN YANG, FRANCIS ROBICHEAUX, Purdue Univ — We theoretically investigate the ionization of Rydberg atoms by a single-cycle pulse, and also its implications for the strong field ionization of ground state. The required threshold field amplitude (for 10% ionization probability) scales inversely with the binding energy of initial states and also the pulse-duration square when the pulse duration becomes much shorter than the classical Rydberg period. A simple model is introduced to understand this threshold behavior, where the nonzero displacement induced by a single-cycle pulse plays a critical role. By combining with the adiabatic-ionization threshold in the low-frequency limit, an ionization window is expected for the ionization of different states. The ionization-probability curve exhibits a "ripple" structure as a function of the pulse duration and the field amplitude, which is sensitive to the angular distribution of initial states. The observation of larger emitted-electron energy for the ionization of lower-lying Rydberg states in a recent experiment [S Li and R. R. Jones, Phys. Rev. Lett. 112, 143006 (2014)] is confirmed in our calculations for both sodium and hydrogen atoms. The differences between the ionization dynamics in a single-cycle pulse and that in a multi-cycle pulse are also discussed and presented.

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