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Spin-orbit effect in multiphoton ionization

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Multiphoton ionization of atoms and molecules, involving one or more intermediate states, has been extensively studied for several decades and remains a topic of significant interest. With advancements in attosecond laser techniques, intrinsic timing information in ionization processes has become accessible. In this work, we revisit the role of spin-orbit effects in resonance-enhanced multiphoton ionization (REMPI). Although it was proposed nearly 40 years ago that spin-orbit coupling could substantially alter the angular distribution of final photoelectrons, direct experimental evidence has been limited. Here, we present the first direct observation of the subtle but impactful role of spin-orbit interactions in the dynamics of REMPI. Additionally, we report femtosecond-scale dynamics of the spin-orbit effect and uncover an unusual time-dependence in the phase evolution of the photoelectron partial waves. Explaining these phenomena requires further theoretical advancements.

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