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The Spiral-like Structure in Strong-Field Ionization: Unwinding Holographic Interference[1] ANDREW MAXWELL, University College London, XUANYANG LAI, RENPING SUN, XIAOJUN LIU, State Key Laboratory of Magnetic Resonance and Atomic and Molecular Physics, Wuhan Institute of Physics and Mathematics, CARLA FIGUEIRA DE MORISSON FARIA, University College London — Photoelectron holography has proven itself as a powerful tool for imaging molecular dynamics on an attosecond time scale. Electrons undergoing strong-field ionization take many paths to the detector, some of which will interact strongly with the core and others that will not, the interference between these trajectories can be used to image the target. This is known an photoelectron holography. We identify, in experiment and theory, an overlooked holographic interference structure in strong-field ionization, dubbed "the spiral", deriving from two electron paths for which both the binding potential and the laser field are equally important. We show the spiral is the true origin of interference carpets that were previous associated with direct above-threshold ionization trajectories, which we show can not properly replicate the inteference pattern. Through an analytical derivation in multiple models we link the formation of the interference carpets to a fundamental symmetry of the laser field. The two trajectories that make up the spiral are sensitive to structural phases from the binding potential. In addition, the symmetry of the bound-state is shown to be encoded in the spiral. All this makes the spiral an ideal structure for photoelectron holography and imaging.

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