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Above-threshold Ionization as Temporal Multi-slit Interference

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Above-threshold ionization as temporal multi-slit interference

W. BLAKE LAING, Department of Physics and Engineering, Southern Adventist University, Collegedale, TN 37315, B.D. ESRY, Department of Physics, Kansas State University, Manhattan, KS 66506 — When atoms are subjected to a laser pulse of sufficiently high intensity, electrons are ionized by absorbing multiple photons in excess of the ionization potential. The resulting sequence of peaks in the photoelectron spectrum separated by the energy of one photon is called “above-threshold ionization” (ATI). This time-independent description of ATI invokes the language of photons, even though calculations are performed using the time-dependent Schrödinger equation with a classical electric field. We demonstrate that the energy-periodic structure of ATI can be understood from the interference of ionized electron wavepackets produced periodically each half-cycle of the laser field. Using this simple picture, rather analytic expressions for the ATI spectrum can be derived.

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