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Attosecond multielectron dynamics in tunnel ionization

Tunneling of a particle through a barrier is a ubiquitous quantum process. The link between tunneling of an electron through the barrier and its dynamics outside, including the significance of complex times associated with tunneling and the possibility of tunneling time delays has been a long-standing issue since the early days of quantum mechanics. Can the interaction of tunneling particle with other degrees of freedom affect its dynamics in the classically forbidden region? When induced by an intense laser field, electron tunneling is usually described as an adiabatic process. It means that the interaction of the tunneling electron with other degrees of freedom is ignored. We show that correlation-induced coupling between the departing electron and core electrons results in complex attosecond dynamics of core rearrangement during tunneling. We also develop multidimensional high harmonic spectroscopy to time-resolve these dynamics.