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Multiple ionization bursts in laser-driven hydrogen molecular ion[1]

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The emission of an electron from an atom or molecule is presumably one of the simplest but most central processes in physics and chemistry. The release of an electron induced by an intense laser pulse is often understood in terms of the quasistatic tunnel ionization picture. According to this picture it is assumed that the electron leaves the parent ion with largest probability at the peaks of the oscillating electric field, when the tunnel barrier is thinnest. But, results of numerical simulations for the hydrogen molecular ion interacting with an intense infrared laser field reveal multiple bursts of ionization within a half-cycle of the laser field. These bursts are found to be induced by a sometimes counter-intuitive dynamics of the electron inside the molecule. The dynamics is due to a phase difference of the wave function between the two potential wells induced by the laser electric field and accumulated over time. Two experimental schemes to probe the intramolecular electron dynamics on the attosecond time scale will be discussed.

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