The envelope Hamiltonian for electron interaction with ultrashort pulses

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For ultrashort VUV pulses with a pulse length comparable to the orbital time of the bound electrons they couple to we propose a simplified envelope Hamiltonian. It is based on the Kramers-Henneberger representation in connection with a Floquet expansion of the strong-field dynamics but keeps the time dependence of the pulse envelope explicit. Thereby, the envelope Hamiltonian captures the essence of the physics, -- light-induced shifts of bound states, single-photon absorption, and non-adiabatic electronic transitions. It delivers quantitatively accurate ionization dynamics and allows for physical insight into the processes occurring. Its minimal requirements for construction in terms of laser parameters make it ideally suited for a large class of atomic and molecular problems.

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