High-order multiphoton processes in intense laser fields: time-dependent non-Hermitian Floquet methods

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High-order above-threshold detachment of H^- and high-order harmonic generation of H_2^+ in intense laser fields are studied non-perturbatively using time-dependent non-Hermitian Floquet methods recently developed. The procedure involves the extension of the *complex-scaling generalized pseudospectral* method for non-uniform spatial discretization of the Hamiltonian and non-Hermitian time propagation of the time-evolution operator. The approach is designed for effective treatment of multiphoton processes in very intense and/or low-frequency laser fields, which are generally more difficult to treat using the conventional *time-independent* Floquet matrix techniques.

The electron energy and angular distributions in high-order above-threshold detachment of H^- [1] are presented for the laser field with the wavelength 10.6 μm and intensities 10^{10} – 10^{11} W/cm^2. The results of the calculations are in accordance with the qualitative semiclassical predictions: the electron energy spectrum exhibits a plateau region in the higher energy part. The electron angular distributions in the plateau region show dramatic transformation and appearance of additional maxima.

Precision calculations of high-order harmonic generation rates of H_2^+ in intense 532 nm laser fields are performed [2] at the equilibrium internuclear separation ($R = 2.0$ a.u.) and several laser intensities, as well as at the laser intensity 5×10^{13} W/cm^2 and various internuclear distances in the range between 3.0 and 17.5 a.u. At some internuclear separations R, the harmonic productions are strongly enhanced and this phenomenon can be attributed to the resonantly enhanced multiphoton ionization at these R.

[1] D. A. Telnov and S. I. Chu, J. Phys. B **37**, 1489 2004).

[2] D. A. Telnov and S. I. Chu, Phys. Rev. A **71**, 013408 (2005).