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Probing the spectral and temporal structures of macroscopic high-order harmonic generation of He in intense ultrashort laser pulses[1]
PENG-CHENG LI, I-LIN LIU, National Taiwan University, CECIL LAUGHLIN, University of Nottingham, SHIH-I CHU, University of Kansas — We present an accurate study of macroscopic high-order harmonic generation (HHG) from He atoms in intense ultrashort laser pulses. An accurate one-electron model potential is constructed for the description of the He atoms low-lying and Rydberg states. The macroscopic high-order harmonic spectra from He atoms are obtained by solving Maxwell's equation using macroscopic single-atom induced dipole moment. Macroscopic single-atom induced dipole moment can be obtained by solving accurately the time-dependent Schrödinger equation (TDSE) using the time-dependent generalized pseudospectral method (TDGPS). This method allows accurate and efficient propagation of the wave function with a modest number of spatial grid points, leading to the efficient treatment of the macroscopic propagation effects for HHG. Our results show fine structure and significant enhancement of the intensities of the lower harmonics due to the resonance transitions between bound states. We explain the temporal and spatial characteristics of HHG by means of the wavelet time-frequency analysis. These analyses help to understand the detailed HHG mechanisms from He atoms.

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Shih-I Chu
University of Kansas

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