

ABSTRACT

High-order Harmonic Generation (HHG) process has been extensively used to generate attosecond pulses. The duration and intensity of the obtained pulses through this process mainly depend on the characteristics of the most energetic photons near the cutoff region of the HHG spectrum. Therefore, extension is required in the HHG spectrum to obtain intense single attosecond pulse generation. We observe the role of tailored carrier waves in the HHG process and find shapes of carrier waves significantly affect ionization/recombination times of the electron in the HHG process. Thus, shape optimization can be used for the extension in the HHG spectrum. Further, theoretical models predict, the extension can be made in the HHG spectrum by considering high ionization potential energy systems in intense short laser pulses having longer wavelengths. However, both these parameters decrease the conversion efficiency of the emitted harmonics. A balance between the target system and corresponding laser parameters can be found by applying scaling laws. We choose hydrogen-like ions (HLIs) to get an extended cutoff position using scaled laser field parameters. In hydrogen-like ions, nuclear pull towards a single electron increases with the increase in atomic number. Thus, during the recombination, electron wavefunction comes closer to a strong nucleus where it experiences several nuclear features. In general, for calculations of the HHG spectra, a single electron is considered in the vicinity of a point-like nucleus and does not accommodate all the features of the nucleus. We use modified Coulomb potentials to accommodate several nuclear features to observe the impact of nuclear properties on the HHG spectrum and obtained attosecond pulses. We particularly observe the role of size, nucleon distribution, and nuclear shape on the characteristics of attosecond pulse. We find these features significantly affect the properties of the obtained pulses.