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Intensity-dependent nonlinear optical properties in an asymmetric Gaussian potential quantum well-modulated by external fields

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Abstract

In this paper, the effects of external electric, magnetic and non-resonant intense laser fields on the nonlinear optical rectification (NOR), second-harmonic (SH), and third harmonic (TH) generation in a GaAs quantum well with asymmetrical Gaussian potential are theoretically investigated. Firstly, the energy eigenvalues and eigenfunctions of a single electron confined in the structure are obtained by using the diagonalization method within the framework of the effective-mass and parabolic band approaches. Then, using these energy eigenvalues and eigenfunctions, expressions derived within the compact density matrix approximation have been employed to calculate the coefficients of the nonlinear optical response in the structure. The obtained simulation results show that the influence of the external fields leads to significant changes in the coefficients of nonlinear optical rectification, second and third harmonic generation in the system. As a result, it has been seen that the amplitude and position of the peaks of nonlinear optical rectification, second and third harmonic coefficients can be controlled by changing the applied external fields.