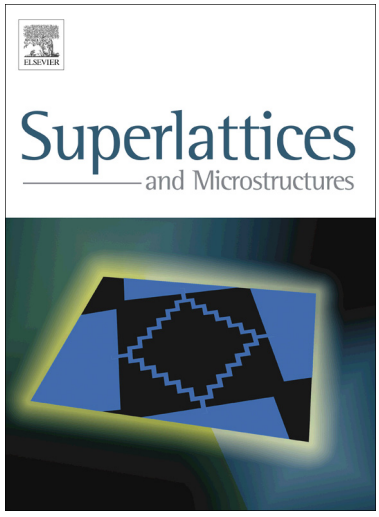

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Nonlinear optical rectification and second-harmonic generation in a semi-parabolic quantum well under intense laser field: Effects of electric and magnetic fields

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Abstract

The effects of electric and magnetic fields on the nonlinear optical rectification and second harmonic generation coefficients related with intersubband transitions in a semi-parabolic quantum well under intense laser field are theoretically studied. The energy levels and corresponding wave functions are obtained by solving the conduction band Schrödinger-like equation in the parabolic approximation and the envelope function approach. Numerical calculations are presented for a typical GaAs/$Ga_{1-x}Al_xAs$ quantum well. The results show that both the non-resonant intense laser field and the static external fields have significant influences on the magnitude and resonant peak energy positions of the coefficients under study.

Keywords: Quantum well, Nonlinear optics, Intense laser field, Second-harmonic generation

PACS: 73.21.Fg, 78.66.Fd, 78.67.De

1. Introduction

In the last decades, the nonlinear optical properties related to intersubband transitions in the low-dimensional semiconductor quantum systems, such as quantum wells (QWs), quantum well wires (QWWs), and quantum dots (QDs) have attracted much attention, looking for the understanding of the fundamental physics as well as of their prospective practical applications in electronic and optoelectronic devices. The nonlinear effects in these low-dimensional quantum nano-structures are much stronger than the bulk materials characterized by a small energy separation between subband levels, large values of electric dipole matrix elements and the possibility of achieving resonance conditions. Furthermore, these nonlinear properties have become the physical foundations for many optoelectronic devices, such as far-infrared laser amplifiers [1], far-infrared photodetector [2], high-speed electro-optical modulators [3], and all

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