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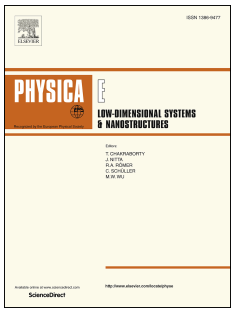

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Impurity-related optical properties of a laser-driven quantum dot

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Abstract

In this paper, we explore theoretically the effect of an on-center Gaussian impurity on the optical properties of a laser-driven parabolic quantum dot system under uniform magnetic field. Laser radiation with circular polarization has been treated within the framework of high-frequency Floquet approach. The linear and third-order nonlinear optical absorption coefficients and refractive index changes have been examined by means of the compact-density matrix approach. Numerical results reveal that the position and magnitude of the resonant peaks of absorption coefficients and refractive index changes are sensitively affected by magnetic field, the depth and the range of the impurity potential. Besides, the presence of intense laser field causes a red-shift in the positions and reduction in the amplitudes of the resonant peaks of optical characteristics.

Keywords: quantum dot, impurity, intense laser field, nonlinear optics

1. Introduction

In the past decades, owing to their potential applications in microelectronic and optoelectronic devices, the low-dimensional structures such as quantum wells, quantum wires and quantum dots (QDs) have been extremely investigated. QDs, where the motion of the charge carriers is restricted in all directions, have the formation of atomic-like discrete energy levels (subbands) which are adaptable for a specific need by changing the size, shape and compositional materials of the dot [1–5]. A number of research concerning the linear and nonlinear optical absorption coefficients and relative changes in refractive index have been broadcasted reporting the large dipole matrix elements and the small energy separation between subbands in QDs [6–8]. Intersubband related

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