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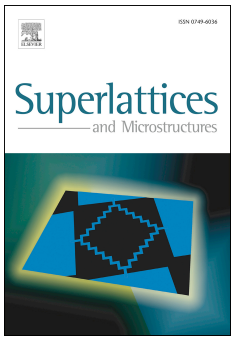

Group velocity of light in a three level ladder-type spherical quantum dot with hydrogenic impurity

Vladan Pavlović, Ljiljana Stevanović

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Group velocity of light in a three level ladder-type spherical quantum dot with hidrogenic impurity

Vladan Pavlović, Ljiljana Stevanović

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Abstract In this paper we analyzed the group velocity of light and slow light in the spherical quantum dot with on-center hydrogenic impurity. To do this, we considered a ladder like system which consist of three energy levels of hydrogen impurity $1s_0$, $2p_{-1}$, and $3d_{-2}$, together with the probe and control laser fields, which induce σ^- transitions. The Scrödinger equation is solved in order to obtain eigenfunctions, eigenvalues and dipole transition moments. Optical Bloch equations are than solved in a stationary regime, and the group velocity of probe laser field examined in detail. Dependence of the group velocity of light is discussed as a function of the spherical quantum dot radius, probe field frequency, control laser field intensity and control laser field detuning.

Keywords Group velocity · Spherical quantum dot · Hydrogenic impurity · Three level ladder configuration

1 Introduction

The optical phenomena based on quantum interference and atomic coherent effects has attracted a lot of attention in recent years. Electromagnetically induced transparency (EIT) [1, 2], lasing without inversion [3, 4], superluminal light propagation [5, 6] and optical bistability [7, 8] are some of the phenomena that have wide applications in the fields such as quantum optics and quantum informatics [9, 10], optical memory [11, 12], optical switches [13, 14], magnetometry [15, 16] and optical microscopy [17, 18].

The possibility to control the velocity of propagation of light pulses through different atomic vapors has been active research field during the last decades. It was firstly suggested by Scully and Harris [17, 19] that quantum interference effects can be used for enhancement of refractive index and therefore for reducing the velocity of light. As a result, extremely slow propagation of light has been observed.

V. Pavlović
Department of Physics, Faculty of Sciences and Mathematics, University of Niš, 18000 Niš, Višegradska 33
Tel.: +381-18-533015
Fax: +381-18-533015
E-mail: vladan.pavlovic@pmf.edu.rs