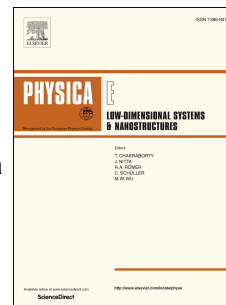


Accepted Manuscript

Decoherence of spin states induced by Rashba coupling for an electron confined to a semiconductor quantum dot in the presence of a magnetic field

A. Poszwa



PII: S1386-9477(17)31640-5

DOI: [10.1016/j.physe.2018.01.011](https://doi.org/10.1016/j.physe.2018.01.011)

Reference: PHYSE 13020

To appear in: *Physica E: Low-dimensional Systems and Nanostructures*

Received Date: 25 October 2017

Revised Date: 13 January 2018

Accepted Date: 17 January 2018

Please cite this article as: A. Poszwa, Decoherence of spin states induced by Rashba coupling for an electron confined to a semiconductor quantum dot in the presence of a magnetic field, *Physica E: Low-dimensional Systems and Nanostructures* (2018), doi: 10.1016/j.physe.2018.01.011.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Decoherence of spin states induced by Rashba coupling for an electron confined to a semiconductor quantum dot in the presence of a magnetic field

A. Poszwa

Faculty of Mathematics and Computer Science, University of Warmia and Mazury in Olsztyn, ul. Słoneczna 54, 10-710 Olsztyn, Poland.

Abstract

We investigate quantum decoherence of spin states caused by Rashba spin-orbit (SO) coupling for an electron confined to a planar quantum dot (QD) in the presence of a magnetic field (B). The Schrödinger equation has been solved in a frame of second-order perturbation theory. The relationship between the von Neumann (vN) entropy and the spin polarization is obtained. The relation is explicitly demonstrated for the InSb semiconductor QD.

Keywords: quantum decoherence, spin-orbit coupling, quantum dot

1. Introduction

Properties of QDs resulting from their electronic structure have been the subject of extensive theoretical and experimental investigations during last few decades [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]. In particular, many studies have been performed on the spin-dependent phenomena induced by an external magnetic field [11, 12, 13, 14, 15, 16]. A well known example is a sequence of spin-singlet and spin-triplet phase transitions observed in the B-field dependence of levels for two-electron systems [17, 18, 19]. The two-dimensional Hilbert space of a single electron spin states is a natural realization of a qubit, based on the spin states. However, in the presence of SO coupling, the spin magnetic moment couples to the inner magnetic field and even the effect is small the spin quantum number is no longer a good quantum number, which means that the spin operators do not commute with the Hamiltonian of the system. The spin states should be therefore properly redefined. To illustrate the problem we can consider, without lose a generality, the two-dimensional

Download English Version:

<https://daneshyari.com/en/article/7933459>

Download Persian Version:

<https://daneshyari.com/article/7933459>

[Daneshyari.com](https://daneshyari.com)