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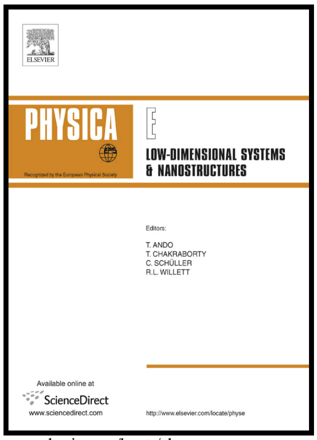

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Bound Magnetic Polaron in a Semimagnetic Double Quantum Well

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Abstract

The effect of different combinations of the concentration of Mn^{2+} ion in the Quantum well $Cd_{1-x_{in}}Mn_{x_{in}}Te$ and the barrier $Cd_{1-x_{out}}Mn_{x_{out}}Te$ on the Bound Magnetic Polaron (BMP) in a Diluted Magnetic Semiconductors (DMS) Double Quantum Well (DQW) has been investigated. The Schrodinger equation is solved variationally in the effective mass approximation through which the Spin Polaronic Shift (SPS) due to the formation of BMP has been estimated for various locations of the donor impurity in the DQW. The results show that the effect of the increase of Mn^{2+} ion composition with different combinations on SPS is predominant for On Centre Well (OCW) impurity when compared to all other impurity locations when there is no application of magnetic field ($\gamma = 0$), γ being a dimensionless parameter for the magnetic field, and the same is predominant for On Centre Barrier (OCB) impurity with the application of external magnetic field ($\gamma = 0.15$).

Keywords: Double Quantum Well; Dilute Magnetic Semiconductors; Bound Magnetic Polaron; Exchange interaction; Impurity Locations

1. Introduction

The Diluted Magnetic Semiconductors (DMS) have many unusual features like Zeeman Splitting [1], Bound Magnetic Polaron [2], Giant Faraday Rotation [3], magnetic field induced metal – insulator transition due to the exchange interaction between the magnetic Mn^{2+} ions and the confined carrier through sp-d exchange. The formation of spin – glass phase is possible for arbitrarily less concentration of Mn^{2+} ion ($x < 0.2$) at low temperatures which leads to the frustration of antiferromagnetic interaction between the Mn^{2+} ions resulting in a high magnetization of the material.

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