POLARON EFFECTS IN QUANTUM DOTS

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There has been a considerable amount of investigations on polaron effects in quasi-two-dimensional semiconductor systems such as heterostructures, quantum wells and superlattices made of polar crystals. Especially interesting are the modified electronic and optical properties that result from electron-phonon interaction in these low-dimensional semi-conductor structures. This feature makes these quantum confined semiconductors very promising for possible device applications in microelectronics, nonlinear optics, and many other fields.

Stimulated by the encouraging results in quantum wells, researchers have intensified the investigation of optical and electronic excitations of systems with lower dimensionality. Even though a large number of theoretical and experimental studies of the last years have investigated the properties of excited carriers in completely confined semiconductor quantum dot systems, to our knowledge, the polaronic effects in a quantum dot (Q0D) has not yet drawn much attention.

In this paper, we will investigate systematically the properties of a polaron in a (Q0D). The ground state energy of a polaron in a (Q0D) will be studied using Green functions. Typical absorption spectra of a quantum dot for fixed ground state energy would be evaluated. In addition, the problem involving the presence of an external electric field will be considered. The effective mass of a polaron will be calculated as a function of the electric field. The binding energy of a bound polaron in a magnetic field is also of interest in this work. Thus, magneto-optical effects originating from the electron-lattice coupling will be discussed. We will present the results emanating from our calculations and conclude with discussions.