STRONG FIELD DC STARK EFFECT IN BULK SEMICONDUCTORS AND HETEROSTRUCTURES (QUASI 1-D QUANTUM WIRES): ADVANCED THEORY AND NEW APPLICATIONS

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At present, an intensive studying semiconductor quantum wells, quantum wires, and quantum dots is provided by a set of factors, including a great progress in ultrashort-pulse spectroscopy methods together with increasing effectiveness in crystal-growth techniques of various quantum confined systems. Above very complex and actual problems of modern nano-electronics one could note the optical Stark effect, of quantum beats, and of the photon echo in the bulk and quantum well semiconductors. The recent discovery and construction of the semiconductor quantum dots laser system of the arbitrary wavelength of emission has confirmed a great perspectives of using new semiconductor systems in quantum electronics, sensorics and other fields of science and technique. Their electronic properties, mostly due to the nanometer scale of the confinement potential, have attracted increasing interests especially from the viewpoint of carried out physical studies and perspective device applications (semiconductor-based optical modulators, quantum electronics, sensor devices etc). The ultimate n-dimensional (n=1-3) confinement structures of carriers can be considered as artificial atoms, with discrete energy levels and reduced density of states. The influence of an electric field on the electron-hole states and on the confined excitonic states is referred to the quantum confined DC Stark effect has received intensive discussions in quantum well structures and few studies in quantum wire and in quantum dot systems. This work goes on our investigations on a strong field excitonic DC Stark effect in the semiconductors, including heterostructures (3D-, 2D-structures, quasi-1-D semiconductor quantum wires). New advanced theory is presented and based on the quantum operator perturbation theory [1] and stationary motion equation formalism with the Hartree-Fock approximation for description density operators for electrons in the conduction and valence bands [2]. Quantitative comparison of the level shifts, total oscillator strengths for quasi-1-D system with corresponding results for 2-D and 3-D systems is presented. New features have been discovered in a case of the strong field DC Stark effect.

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