EVOLUTION OF THE ELECTRON SPECTRUM OF SPHERICALLY SYMMETRIC STATES UNDER THE TRANSITION FROM A CLOSED DOUBLE-WELL DOT TO A SIMPLE OPEN SPHERICAL QUANTUM ONE

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S u m m a r y

The theory of the electron spectrum of spherically symmetric states in a double-well spherical quantum dot (SQD) is proposed and used to study the evolution of the spectrum, provided that the dimensions Δ_2 of the external well vary from zero to infinity. The spectrum is shown to coincide, at $\Delta_2 \to 0$, with the stationary spectrum of a closed single-well SQD and to pass, at $\Delta_2 \to \infty$, to the quasistationary spectrum of an open SQD with the decay of quantum states. A mechanism responsible for the decay of quasistationary states in an open SQD is proposed for the first time. It has been found that the redistribution of the probabilities for a quasiparticle to occupy energy levels in the vicinity of the resonance energy levels is the reason for the electron to exist in an open SQD for a finite time interval. The "memory" of closed double- and open single-well nanosystems with respect to the locations of resonance levels on the energy scale is originated from the anti-crossing ("bottle-neck") effect. The way how the mathematical tool of the theory of excitons and electron-phonon interactions in open SQDs can be built on the basis of the proposed theory is demonstrated.