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# Nano-Sensors: Search for New Features

**Authors :** I. Filikhin, B. Vlahovic

**Abstract :** We focus on a novel type of detection based on electron tunneling properties of double nanoscale structures in semiconductor materials. Semiconductor heterostructures as quantum wells (QWs), quantum dots (QDs), and quantum rings (QRs) may have energy level structure of several hundred of electron confinement states. The single electron spectra of the double quantum objects (DQW, DQD, and DQR) were studied in our previous works with relation to the electron localization and tunneling between the objects. The wave function of electron may be localized in one of the QDs or be delocalized when it is spread over the whole system. The localizing-delocalizing tunneling occurs when an electron transition between both states is possible. The tunneling properties of spectra differ strongly for “regular” and “chaotic” systems. We have shown that a small violation of the geometry drastically affects localization of electron. In particular, such violations lead to the elimination of the delocalized states of the system. The same symmetry violation effect happens if electrical or magnetic fields are applied. These phenomena could be used to propose a new type of detection based on the high sensitivity of charge transport between double nanostructures and small violations of the shapes. It may have significant technological implications.

**Keywords :** double quantum dots, single electron levels, tunneling, electron localizations
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