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Electron localizations in binary InAs/GaAs quantum systems and their optical detection

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We studied the electron localization and spectral distributions of electron localized/delocalized states in binary InAs/GaAs quantum complexes. Such weakly coupled binary systems demonstrated perspectives for nano-sensor applications. Electron tunneling in double quantum dots (DQDs) and quantum wells (DQWs) was studied with dependence on distance between QDs. We showed that the tunneling between identical QDs in DQD goes consecutively from the higher energy levels to the ground state when the inter-dot distance is decreased. The case of non-identical QDs in DQD has an essential difference and the relation between these two cases is discussed. Generally, the violation of symmetry of the DQD geometry reduces tunneling. In particular, we found that electron tunneling is extremely sensitive on shape symmetry violations in binary systems, which can be potentially used for nano-sensing. To investigate the method of detection of the localized/delocalized states change we considered the electron tunneling in InAs/GaAs dot-well complex. Modeling of carrier transfer from the barrier in InAs/GaAs dot-well tunnel-injection structures was performed. A relation between the experiment and our calculations will be presented and perspectives to use the method for nano-sensor applications will be discussed.

Biography

I Filikhin is a Research Professor in the Department of Physics at North Carolina Central University. He received his Doctorate in Theoretical Physics from St. Petersburg State University in Russia (1993). His research includes nuclear low-energy physics, hyperphysics, nano-science and semiconductors physics, as well as computational physics. He is author/coauthor of more than 90 scientific papers. His current researches are related to the effective potential approach for electron structures in complexes of the quantum dots and rings, cluster models for light nuclei and hypernuclei.

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