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## **Electron Spectrum, Localization and Tunneling in Double Nanoscale Structures**

Igor Filikhin<sup>a</sup>, Sergei Matinyan and Branislav Vlahovic

Department of Physics, North Carolina Central University, 1801 Fayetteville Street, Durham,  
NC 27707, USA

**e-mail:** <sup>a</sup> ifilikhin@ncsu.edu

**Abstract.** We study electron localization and tunneling in double quantum dots (DQD) and rings (DQR). The wave function of a single electron may be localized in one of the QDs or be delocalized when is spread over the whole system. Spectral distributions of such states are considered. Electron transition between both states is possible if inter-dot distance or QD (QR) geometry is varied. The effect of violation of symmetry of DQDs geometry on the tunneling is studied in details. We show that a small violation of symmetry drastically affects localization of electron. The same symmetry violation effect happens if an electrical or magnetic field are applied. We consider anti-crossing of the levels as the mechanism of the tunneling between the localized and delocalized states.

**Keywords:** quantum rings and dots, electron states, single-electron tunneling

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