

Quantum Entanglement in Electron Ballistic Transport and Jaynes-Cummings Model

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ABSTRACT

In our work we proposed a new approach to producing the qubits in electron ballistic transport in low-dimensional structures such as double quantum wells or double quantum wires (DQW). The qubit could arise as a result of quantum entanglement of two specific states of electrons in DQW-structure. These two specific states are the symmetric and antisymmetric (with respect to inversion symmetry) states arising due to tunneling across the structure, while entanglement could be produced and controlled by means of the source of non-classical light. We examined the possibility to produce quantum entanglement in the framework of Jaynes-Cummings model and have shown that at least in principle, the entanglement can be achieved due to series of 'revivals' and 'collapses' in the population inversion due to the interaction of a quantized single-mode EM-field with a two-level system.