Two-path Transport Measurements with Bias Dependence on a Triple Quantum Dot

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We present transport measurements on a lateral triple quantum dot with a star-like geometry and one lead attached to each dot. [1]

Technical and scientific improvement allow the fabrication of triple quantum dots and their detailed analysis. [2] The research on triple quantum dots is motivated by fundamental physics and by the fact that it can work as a single qubit. [3] It also is the smallest system with quantum dots being part of a qubit chain, which are needed for quantum computers.

Our sample design allows to simultaneously measure the conductance along two different paths with two quantum dots in each path. The structure is made with local anodic oxidation by AFM on a GaAs/AlGaAs heterostructure. By controlling the potentials via the four gates of the device triple points with two dots in resonance and quadruple points with all three dots in resonance can be established. [4,5] Using two of the leads as source contacts and one lead as a drain contact, signatures of three dots can be detected in both transport paths. This setup also provides the possibility of applying different bias voltages to the sources of the two transport paths and detecting excited states of the dots. Transport measurements in one path while varying the source-drain voltage on the other path show interesting features and prove the interaction between the transport paths. The measurement result is compared with a simulation of the electrostatics of the triple dot system.

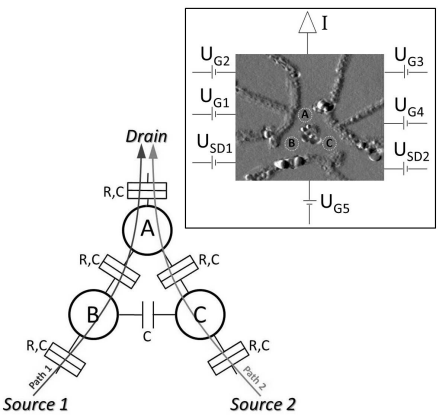

Figure 1: Schematic of the triple dot setup. Each of the dots is coupled to the other two and to one lead via tunneling barriers. The coupling between Dot B and C is of capacitive nature only.
Insert: AFM image of the triple dot structure defined by oxide lines. The applied gate voltages are labled U_{G1} - U_{G5} and the bias voltages U_{SD1} and U_{SD2}.

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