Read-out of Dynamics of Qubit Built on Three Quantum Dots

Jakub Łuczak, Bogdan R. Buka

Institute of Molecular Physics, Polish Academy of Sciences, ul. M. Smoluchowskiego 17, 60-179 Poznań, Poland

We present theoretical investigations of a qubit built of three coherently coupled quantum dots (TQD) in a triangular geometry. Each dot is occupied by one electron, and the qubit states are encoded in a doublet subspace according to Di Vincenzo *et al.* scheme [1]. The qubit operates in the decoherence-free subspace (DFS), which is immune to decoherence processes [2]. The other advantage of the scheme is purely electrical control of qubit operations by the gate potential applied to the quantum dots or by changing the tunnel barrier between them.

In our proposal the full control of the qubit operations can be preformed by a symmetry breaking effect. We show that by proper sequences of the gate potentials one can obtain the Pauli X-gate and Z-gate operations. Rotations around these two axes on the Bloch sphere give any single qubit operation. To read-out the qubit states we propose to use the doublet blockade effect. For some specific symmetry of TQD one can observed a blockade of the current flowing through the system, which is related with an asymmetry of tunnel rates between the doublet states and electrodes. The studies are performed within an effective Heisenberg Hamiltonian and Master equation in the Lindblad form [3]. We show that the qubit dynamics can be observed in time dependent transport. Moreover, our research presents relaxation and decoherence processes which can be seen in the current transport measurements. For the read-out of the qubit state one also needs to take into account leakage processes from the doublet subspace.

Our studies are motivated by recent experiments which were undertaken to perform coherent spin manipulations in a TQD system [4] according to the DiVincenzo *et al* scheme.

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