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Optimal control of charge transfer in coupled quantum dots ESA RASANEN, ANTTI PUTAJA, Nanoscience Center, Department of Physics, University of Jyvaskyla, Finland — Theoretical design of an external field to drive a quantum system from an initial state to a given target state can be achieved within quantum optimal control theory. We aim at designing laser-driven quantum bits (qubits) by applying optimal control to models of semiconductor nanodevices such as quantum dots and quantum rigs. Here we have constructed a coherent and precise charge-switching scheme on coupled quantum dots. The charge transfer can be controlled in an arbitrary way by exploiting the superpositions of the eigenstates. For example, we are able to achieve 100 sequential charge-switch operations with more than 90 % fidelity in a few picoseconds. The fidelity is not dramatically affected by realistic filtering of the pulse frequencies. We also demonstrate a two-particle control schme in a one-dimensional model system with a soft-Coulombic interaction operator.

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