Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Optical conditional gates in laterally coupled quantum dots: the role of electron-hole exchange interaction SOPHIA ECONOMOU, THOMAS REINECKE, Naval Research Lab — We propose a fast, optically induced two-qubit C-PHASE gate in laterally coupled quantum dots. We use a model potential with two asymmetric local minima to account for the difference in size and composition of the two dots. By making use of the excited bound states of the total potential, which extend over both dots and which gives rise to an effective coupling between the two resident electron spins, we avoid the need for an external bias, such as that typically used in vertically coupled dots. The electron-hole exchange interaction is shown to play an important role in our proposal. By lowering the symmetry of the eigenstates, it allows for a simple design of a fast (about 50 ps) C-PHASE gate. The dissipative dynamics of the excited states have been taken into account in our numerical simulation of the fidelity. The calculated fidelity depends on the values of the decay rates. Our proposal is consistent with the single qubit rotations we proposed [Phys. Rev. Lett. **99**, 217401 (2007)], and the combination of the two allows for universal quantum gates.

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Date submitted: 27 Nov 2007 Electronic form version 1.4