Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Qubit identification and entanglement in tunneling and Förster coupled quantum dots JUAN E. ROLON, SERGIO E. ULLOA, Ohio University — We investigate the possibility of qubit coherent manipulation using the multi-excitonic optical spectrum features of a quantum dot molecule (QDM), a system of two vertically coupled InAs/GaAs self-assembled quantum dots. The spectrum is modeled using a Hamiltonian that incorporates coupling dependence on several experimental parameters, such as gate voltage, optical excitation intensity and its detuning. We use realistic structure parameters to describe the important coupling constants, including electron and hole tunneling, and Coulomb correlations that depend on the QDM strain field, and interdot distance [1]. We also incorporate the role of the Förster-Dexter resonant energy transfer processes, as well as, exciton oscillator strengths extracted from available PL spectroscopy data. The dynamics given by the time evolution of the density matrix and the qubit-qubit entangling interaction is monitored by calculations of the entanglement of formation [2] for the suitable excitonic molecular states. We discuss how to optimize Rabi flops and entanglement via gate-controlled adiabatic passage through a level anticrossing [3].
[1] G. Bester, A. Zunger, PRB 71 075325 (2005) [2] W.K. Wootters, PRL 80(10) 2245 (1998) [3] K. Bergmann, Rev. Mod. Phys. 70(3) (1998)

Juan E. Rolon
Ohio University

Date submitted: 13 Dec 2006 Electronic form version 1.4