Abstract Submitted
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Tuning quantum entanglement in InGaAs/GaAs dot molecules with electric fields[1] GABRIEL BESTER, ALEX ZUNGER, National Renewable Energy Laboratory, Golden, Colorado 80401 — Self assembled quantum dots may provide a physical representation of a quantum bit (qubit) that supports a superposition of "0" and "1". In one possible realization, two qubits A and B are represented by a hole and an electron. The two different states of the qubits are given by their occupation probability, either occupying the top (T) or the bottom (B) dot of a self-assembled dot-molecule. The use of this system as a quantum register requires the ability to store *entangled* exciton states but entanglement was recently shown [1] to be small, unless a very specific interdot distance is chosen. Furthermore, this specific distance depends on detail of the dots geometry [1]. We present here an atomistic theory of a pair of vertically stacked InGaAs/GaAs dots and propose to tune the entanglment of the molecule using an electric field, applied in growth direction. We find that the entanglment can be maximized, using a field of -5.4 kV/cm in our case, and that at this field a specific spectroscopic signature is expected: the first 2 bright excitonic peaks merge. We suggest this feature as an identification of entangled states.

[1] G. Bester, J. Shumway and A. Zunger, Phys. Rev. Lett. **93**, 047401 (2004).

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