Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Electric-field control of exciton fine structure: atomic scale manipulation of exchange GARNETT BRYANT, NATALIA MALKOVA, JAMES SIMS, National Institute of Standards and Technology — Tremendous effort has been made recently to control excitons in semiconductor quantum dots using vertical and in-plane electric fields, magnetic fields, optical fields, strain fields, annealing and crystal symmetry to manipulate exciton phase, fine structure splitting and polarization. Such control enables entangled photon generation from biexciton cascade, coherent state manipulation, and transfer between flying photonic qubits and stationary solid-state qubits needed for quantum information processing. We use atomistic tight-binding theory with a configuration interaction description of Coulomb and exchange effects to describe excitons in quantum dots in a vertical electric field. We show that field-induced manipulation of exciton orientation and phase produces a drastic reduction of fine structure splitting, an anticrossing, and a 90 degree rotation of polarization, similar to the observed anticrossing. An *atomistic* analysis is needed to explain how exciton reorientation by the applied field modifies anisotropic exchance and fine structure splitting without significantly altering other splittings.

Garnett Bryant
National Institute of Standards and Technology

Date submitted: 09 Nov 2012 Electronic form version 1.4