Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Fine Structure of Charged Excitons and Multiexcitons in Self-Assembled InGaAs/GaAs Quantum Dots VLADAN MLINAR, JUN-WEI LUO, GABRIEL BESTER, ALEX ZUNGER, National Renewable Energy Laboratory, 1617 Cole Blvd., Golden, Colorado 80401 — As a quantum-dot is loaded with Ne electrons and Nh holes, complex charged excitons and multiexcitons are formed. Their fingerprint is the splitting of each exciton line into a set of multiplets separated by "fine structure" splitting, whose calculation [1] poses a serious test to many-body theories. Previously, such fine-structure splittings were calculated and measured for charged excitons with (Ne,Nh) of (2,1), (1,2), (3,1), and (1,3), demonstrating good agreement with experiment. Here, we extend the calculation to both charged and neutral multi-excitons with (Ne,Nh) of (2,2), (3,2), (2,3), (3,3), (4,3), (3,4), and (4,4). The energy splittings, oscillator strength, and polarizations of the optical emission are obtained from many body pseudopotential calculations. We present here predictions for the optical emission from negatively and positively charged biexcitons which reveal fine structure splittings in the order of 100 micro-eV, within the experimental accuracy of single dot micro photoluminescence. We will discuss the evolution of the patterns of multiplet lines, their spacings, and regularities vs. the number of particles (Ne,Nh). [1] M. Ediger, G. Bester, et al., Phys. Rev. Lett 98, 36808 (2007).

Vladan Mlinar
National Renewable Energy Laboratory

Date submitted: 12 Dec 2007 Electronic form version 1.4