Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Quantum Dots' Photo-luminescence Line Shape Modeling
MUCHUAN HUA, RICARDO DECCA, Physics department of Indiana University-Purdue University Indianapolis — Two usual phenomena observed in quantum dots (QDs) photo-luminescence (PL) spectra are line broadening and energy shift between absorption and emission peaks. They have been attributed to electron-phonon coupling and surface trapping during the PL process. Although many qualitative work describing these phenomena has been carried out, quantitative results are far less common. In this work, a semi-empirical model is introduced to simulate steady state QDs' PL processes at room temperature. It was assumed that the vast majority of radiative recombination happens from surface trapped states. Consequently, the PL line shape should be highly modulated by transition rates between states in the conduction band and between them and surface trapping states. CdSe/ZnS (core/shell) colloidal QD samples with different sizes were used to examine the model. The model was able to successfully reproduce the PL spectra of these samples even when the excitation happens within the emission spectra, giving raise to up-conversion events. This model might help understand and make more precise predictions of QDs' PL spectra and could also aid on the design of QDs' optical devices.

Muchuan Hua
Indiana University- Purdue University Indianapolis

Date submitted: 10 Nov 2016 Electronic form version 1.4