Understanding the Two-dimensional Electronic Spectra Peak Shapes of CdSe Quantum Dots

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CdSe nonacrystal Quantum Dots are studied by Two-dimensional Electronic Spectroscopic technique with a pump-probe geometry. Zero Line Slope analysis is performed to investigate the homogeneous and inhomogeneous broadening effects in the 2D Spectra.

Semiconductor nanomaterials are important to both fundamental and applied research and development due to its unique physical and chemical properties. We perform Two-dimensional Electronic Spectroscopy (2DES) using a pump-probe geometry with a programmable acousto-optic pulse shaper and 1 by 4 phase-cycling scheme [1,2] to retrieve clean purely 2D spectra of CdSe nanocrystal quantum dots (QDs). We seek to understand the peak shapes of various excitonic and biexcitonic transitions of the QDs. We observe and propose a Zero Line Slope (the line that 2D peaks transits from positive to negative) analysis to study the homogeneous and inhomogeneous and spectral diffusion contributions [3] to the 2D peak shape of QDs.

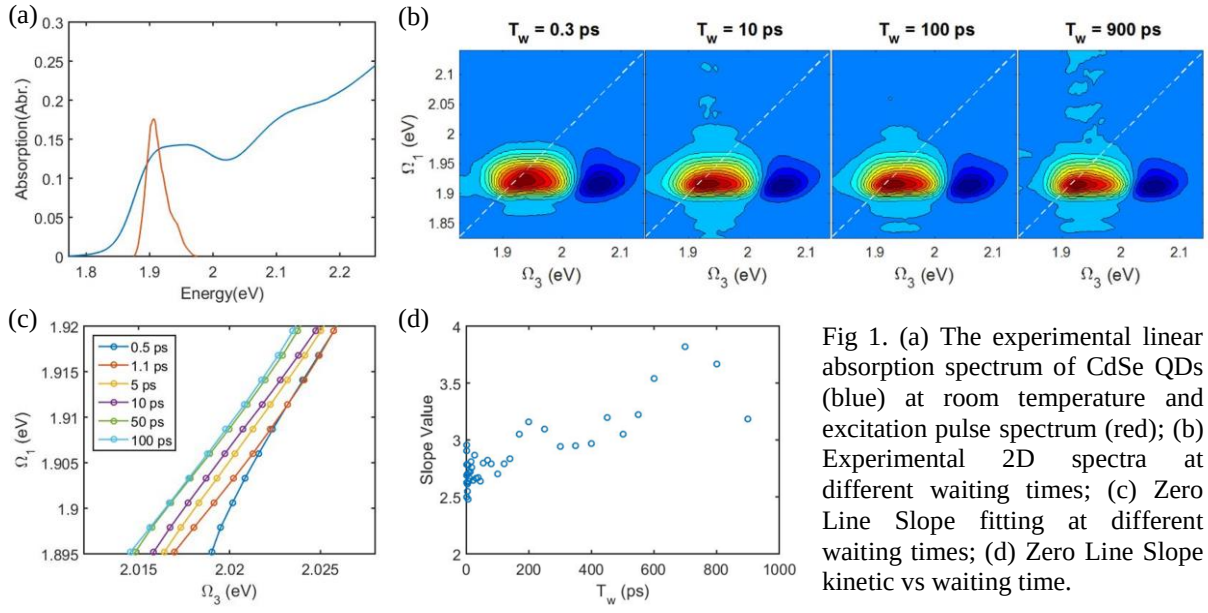

Fig 1. (a) The experimental linear absorption spectrum of CdSe QDs (blue) at room temperature and excitation pulse spectrum (red); (b) Experimental 2D spectra at different waiting times; (c) Zero Line Slope fitting at different waiting times; (d) Zero Line Slope kinetic vs waiting time.

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[2] Z. Zhang, K. L. Wells, E. W. J. Hyland and H. S. Tan, *Chem. Phys. Lett.* **550**, 159 (2012).

[3] M. Wolf and J. Berezovsky, *Appl. Phys. Lett.* **105**, 143105 (2014).