Ultra Long-Lived Radiative Trap States in CdSe Quantum Dots

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Photoluminescence excitation (PLE): The scanning of the photon energy is done in the range of 430–570 nm (2.18–2.85 eV). The PL at 522 nm (2.38 eV) falls within this window, which raises the possibility of the scattered excitation light at 522 nm reaching the detector and contributing to the signal as a false peak. Independent measurement of the light scattered from the cuvette shows that the intensity of the scattered light is about 400 times weaker (Figure 1) than the intensity of the PL, hence the peak observed at 490 nm (2.53 eV) (Figure 4 in the main text) for the PLE of 2.3 nm CdSe QDs observed at 522 nm is not an artifact due to the scattered excitation light.
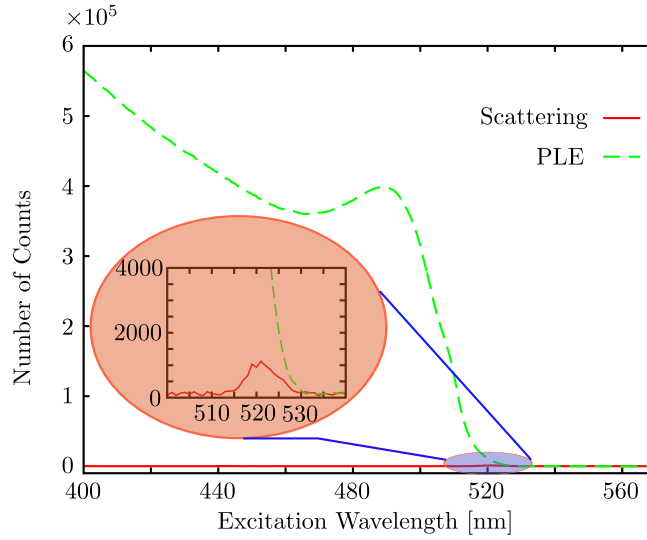

Figure 1: Comparison of the PLE observed at 522 nm from CdSe QD with that of the scattered excitation light.

We have used sharp edge filters to separate the PL contributions of the trap states from the band-edge PL. The PL recorded without any filters is the sum of the PL from the band edge as well as the PL from the surface. We have used a long-pass filter with the edge at 2.18 eV to isolate the surface PL. The average transmission efficiency of the filter below 2.18 eV is 76%. We have calculated the time-resolved PL signal from the band edge (Figure 5(B) in the main text) by subtracting the contribution from the surface PL. The transmission efficiency of the filter is taken into account in the subtraction. The time-resolved long-lived component of the PL from the surface differs when different filters are used to separate the photons with

different energies. Figure 2 shows the decay when two different filters at 1.49 and 2.18 eV are used. The PL decay kinetics show that contribution from the long component increases when the cut-off energy of the filter decreases. The dependence of the PL kinetics on the photon energy indicates that more than one trap state are contributing to the PL.
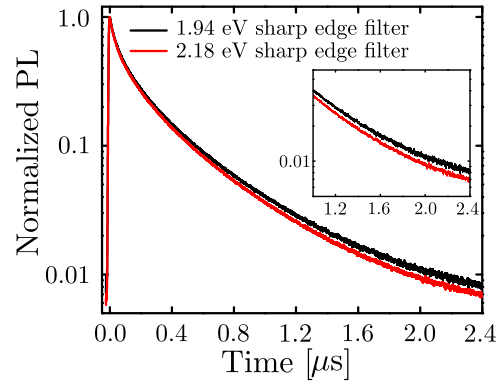

Figure 2: The PL decay kinetics using 1.94 and 2.18 eV filters showing different long-lived components, inset: magnification of the long-lived components.