Electronic Supplementary Information

All-Inorganic Perovskite Nanocrystals Assisted Extraction of Hot Electrons and Biexcitons from Photoexcited CdTe Quantum Dots

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Ultrafast transient absorption measurements. Details of the pump-probe setup were described in elsewhere.[1] In brief, femtosecond laser pulses (centred at 800 nm) from a Ti:sapphire oscillator was directed to a regenerative amplifier to produce highly amplified output. The major part of the amplified output was passed through an optical parametric amplifier to generate a range of excitation sources which used as a pump beam. The other part of the beam was passed through an optical delay line followed by CaF_2 to generate white light in the visible range that used as a probe beam. Change in absorbance was measured through detection of transmitted probe beams by photodiode array at different time delay between pump and probe. All the TA measurements were performed with colloidal samples in a constant rotation mode ensuring negligible probability of photo-charging of QDs. TA measurements were performed at three different pump fluences and the average number of excitons were estimated following the equation $\langle N \rangle = J\sigma$ where J is the pump fluence in number of photons/cm^2 and σ is the absorption cross section at the excitation wavelength. The time-resolution of set-up was found to be ~ 80-100 fs.

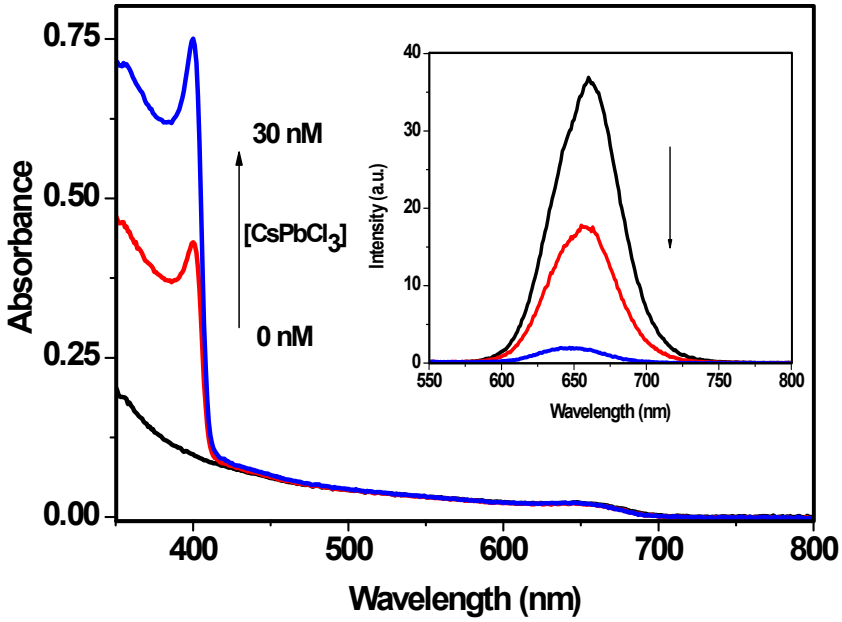


Figure S1. Change in absorption spectra of CdTe QDs in presence of $CsPbCl_3$ NCs. Inset shows the PL spectra of CdTe QDs at 530 nm excitation in presence of $CsPbCl_3$ NCs indicate PL quenching.

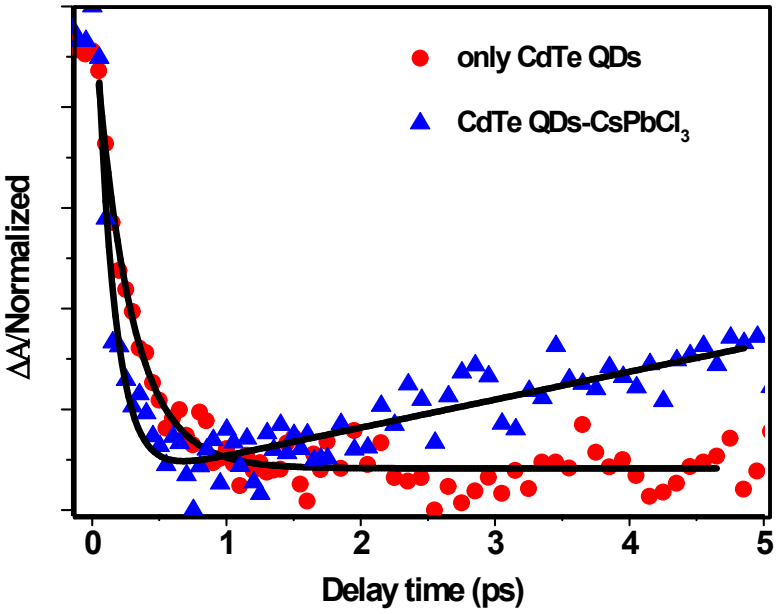
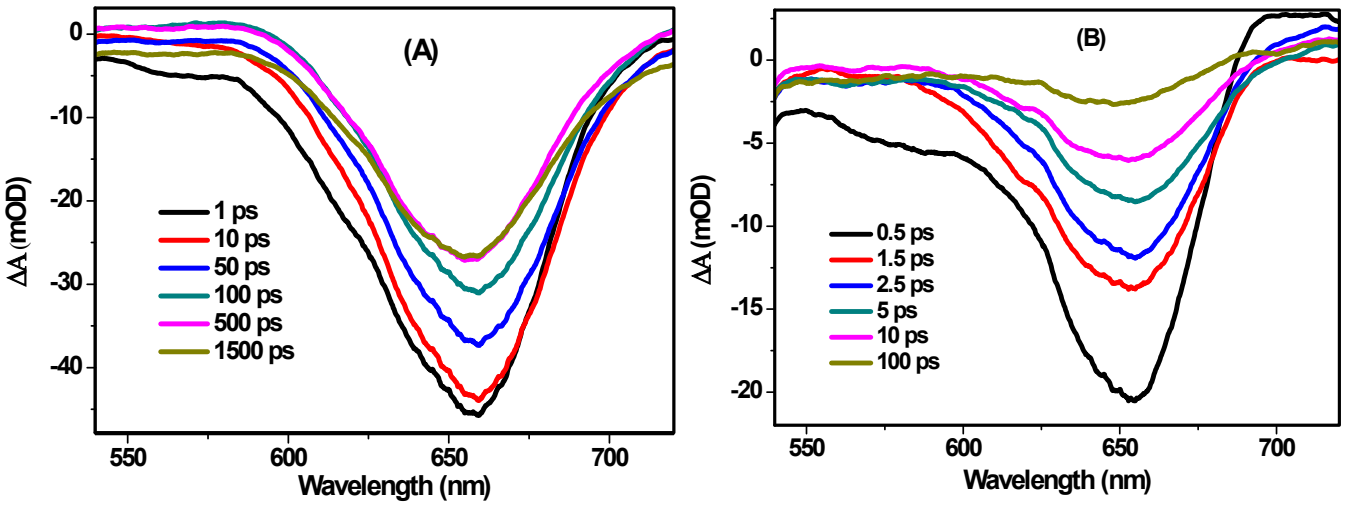


Figure S2. Comparison of bleach formation dynamics of CdTe QDs in absence and presence of $CsPbCl_3$ NCs.



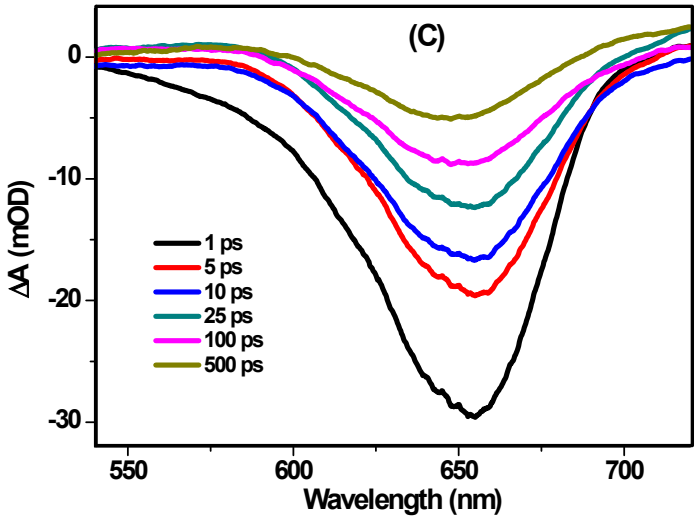


Figure S3. TA spectra at 520 nm excitation with a fluence of ~ 139 μJ/cm^2 of CdTe QDs (A), CdTe-$CsPbBr_3$ (B) and CdTe-$CsPbCl_3$ (C).

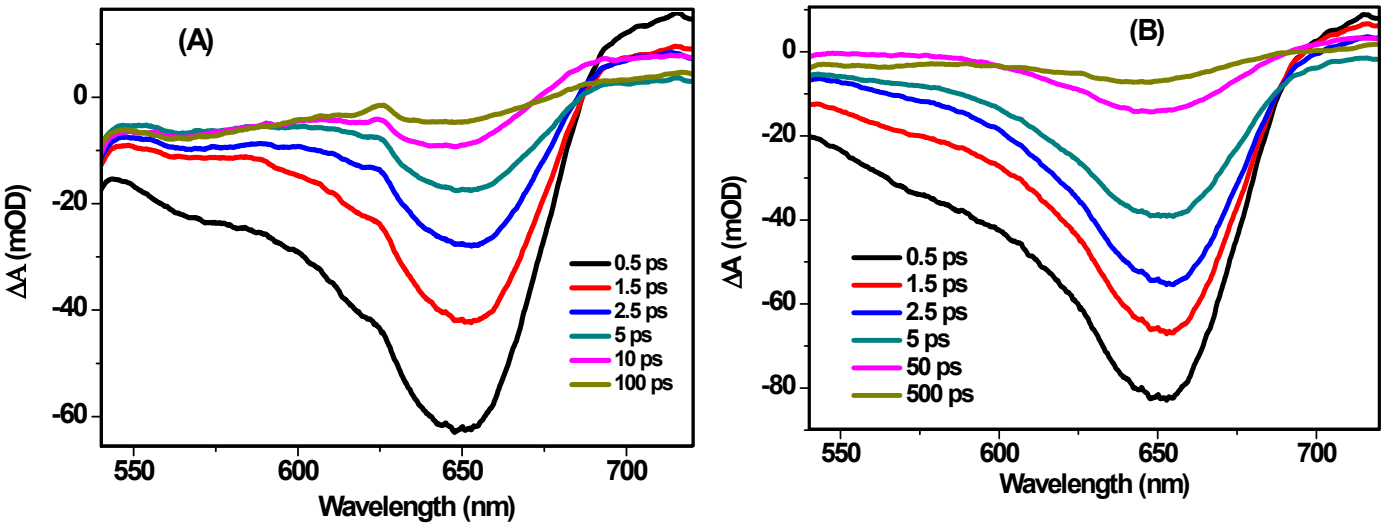


Figure S4. TA spectra at 520 nm excitation with a fluence of ~ 478 μJ/cm^2 of CdTe-$CsPbBr_3$ (A) and CdTe-$CsPbCl_3$ (B)

Table S1. Kinetic parameters of bleach recovery dynamics of CdTe QDs at different pump fluences.

System	Pump fluence ($\mu J/cm^2$)	$\tau_{decay1}(a_1)$ in ps	$\tau_{decay2}(a_2)$ in ps	$\tau_{decay3}(a_3)$ in ns
Only CdTe QDs	22	---	68.5±6.6 (0.30)	>1 (0.70)
	139	8.2±0.2 (0.10)	72±5.8 (0.35)	>1 (0.55)
	478	7.5±0.5 (0.34)	75.6±9.8 (0.26)	>1 (0.40)

Table S2. Kinetic parameters of bleach recovery dynamics of CdTe QDs in presence of $CsPbBr_3$ NCs at different pump fluences.

System	Pump fluence ($\mu J/cm^2$)	$\tau_{decay1}(a_1)$ in ps	$\tau_{decay2}(a_2)$ in ps	$\tau_{decay3}(a_3)$ in ps
CdTe-$CsPbBr_3$	22	----	1.7±0.3 (0.60)	29.6±7 (0.40)
	139	---	1.9±0.1 (0.75)	29±5.6 (0.25)
	478	----	1.86±0.1 (0.85)	28.5±6.9 (0.15)
CdTe QDs	478	7.5±0.5 (0.34)	75.6±9.8 (0.26)	>1000 (0.40)

Table S3. Kinetic parameters of bleach recovery dynamics of CdTe QDs in presence of $CsPbCl_3$ NCs at different pump fluences.

System	Pump fluence ($\mu J/cm^2$)	$\tau_{decay1}(a_1)$ in ps	$\tau_{decay2}(a_2)$ in ps	$\tau_{decay3}(a_3)$ in ps
CdTe-$CsPbCl_3$	22	----	4.6±0.4 (0.58)	95±12 (0.42)
	139	---	4.0±0.2 (0.64)	91±9 (0.36)
	478	----	3.06±0.1 (0.80)	92.9±8.8 (0.20)
CdTe QDs	478	7.5±0.5 (0.34)	75.6±9.8 (0.26)	>1000 (0.40)

References

1. Mondal, N.; Samanta, A., J. *Phys. Chem. C* **2016**, 120, 650-658.