# Electronic Supplementary Information

## Photoinduced 2-way Electron Transfer in Composites of Metal Nanoclusters and Semiconductor Quantum Dots

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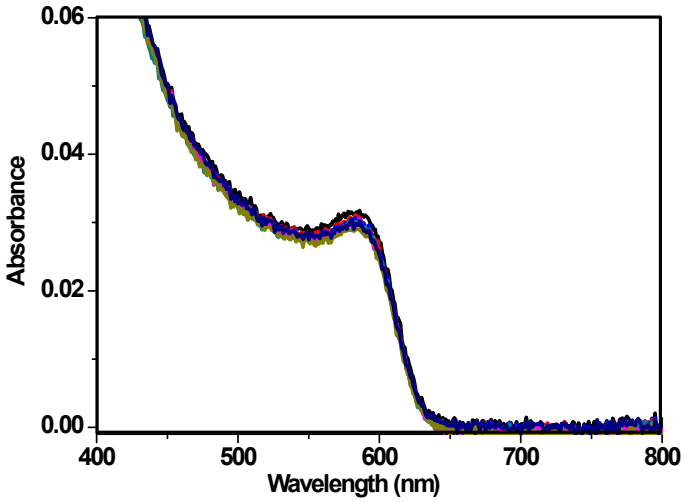


Figure S1. Changes in the absorption spectra of CdTe QDs (0.2 μM) on addition of $Au_{25}$(BSA) (0 to 10 μM)

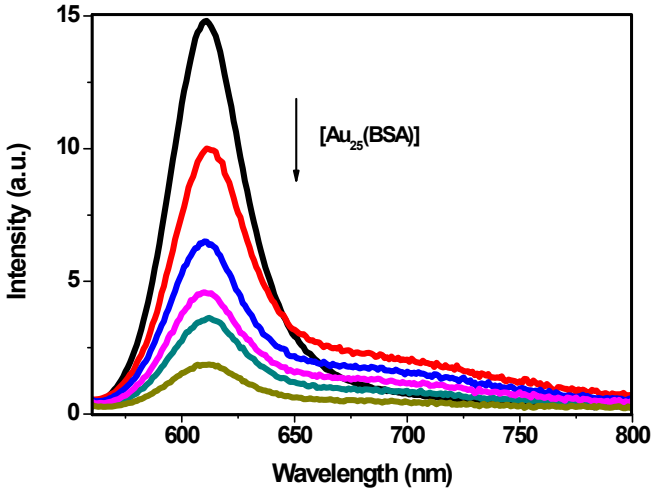


Figure S2. PL spectra ($\lambda_{ex}$ = 550 nm) of the QDs as a function of the concentration of $Au_{25}$(BSA) (0, 2.5, 5, 7.5, 10, 12.5 μM)

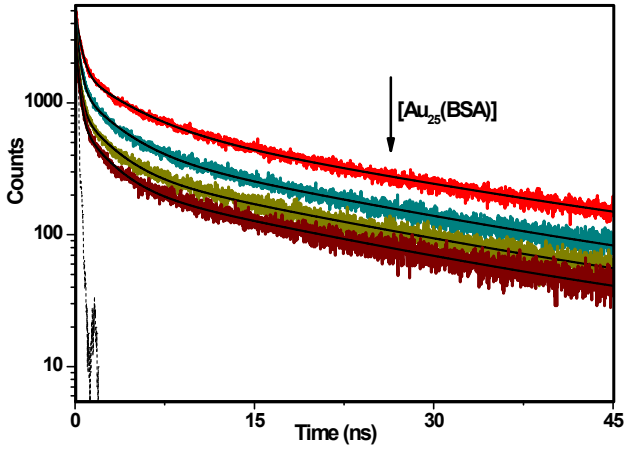


Figure S3. Emission ($\lambda_{ex}$ = 440 nm) decay profiles of CdTe QDs (0.2 μM) monitored at 609 nm for different concentration of $Au_{25}$(BSA) (0, 3.3, 6.6, 10 μM) at. Black dashed line represents the instrument response function.

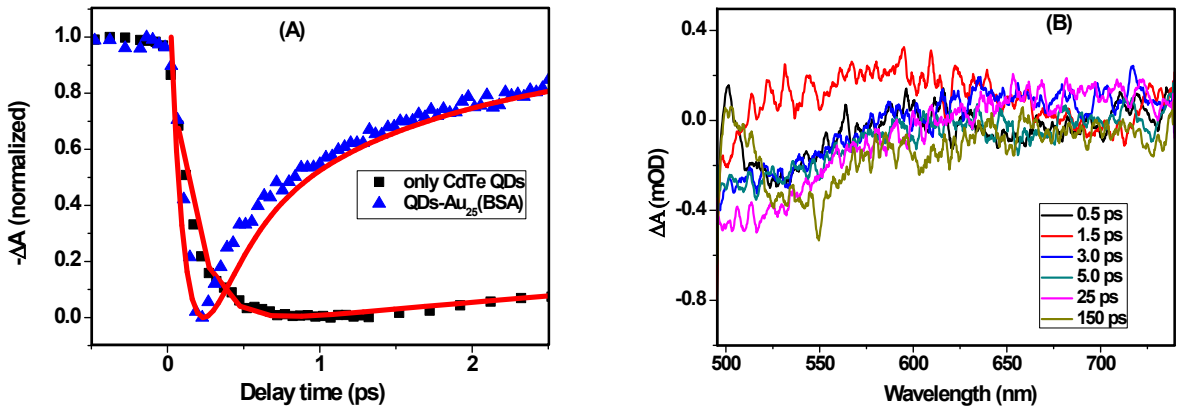


Figure S4. (A) Bleach formation dynamics (at 585 nm) of the QDs in the absence and presence of $Au_{25}$(BSA), and (B) Transient absorption spectra of $Au_{25}$(BSA) NC (0.3 mM) in aqueous medium at 480 nm excitation.

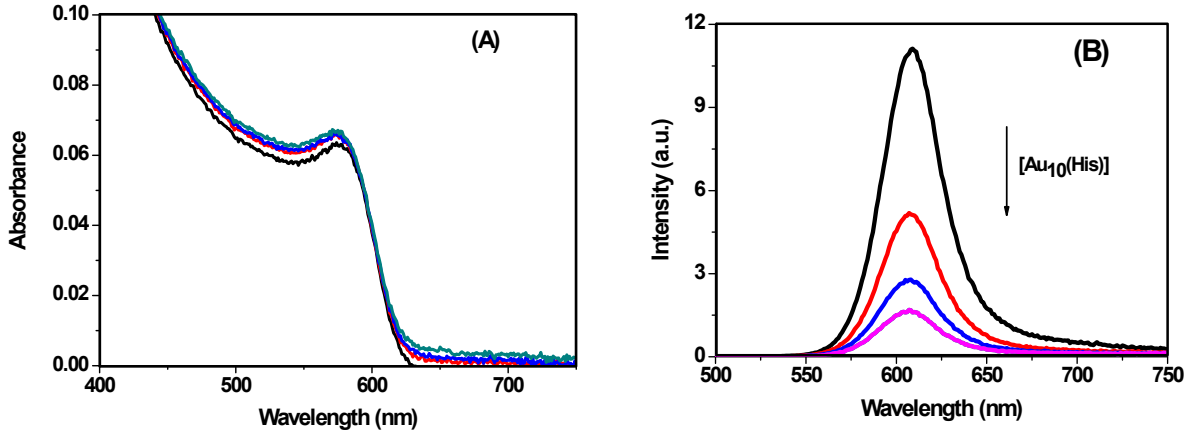


Figure S5. Absorption (A) and photoluminescence ($\lambda_{ex}$ = 440 nm) (B) spectra of CdTe QDs (0.45 μM) with increase in concentration of $Au_{10}$(His) (0, 4, 6, 8 μM).

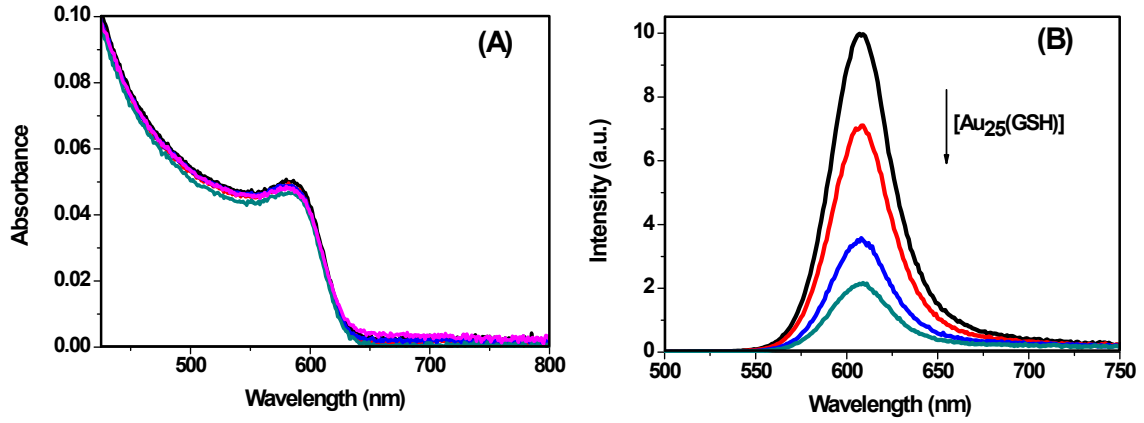


Figure S6. Absorption (A) and photoluminescence ($\lambda_{ex}$ = 440 nm) (B) spectra of CdTe QDs (0.35 μM) with increase in concentration of $Au_{25}$(GSH) (0, 7.5, 25, 45 μM).

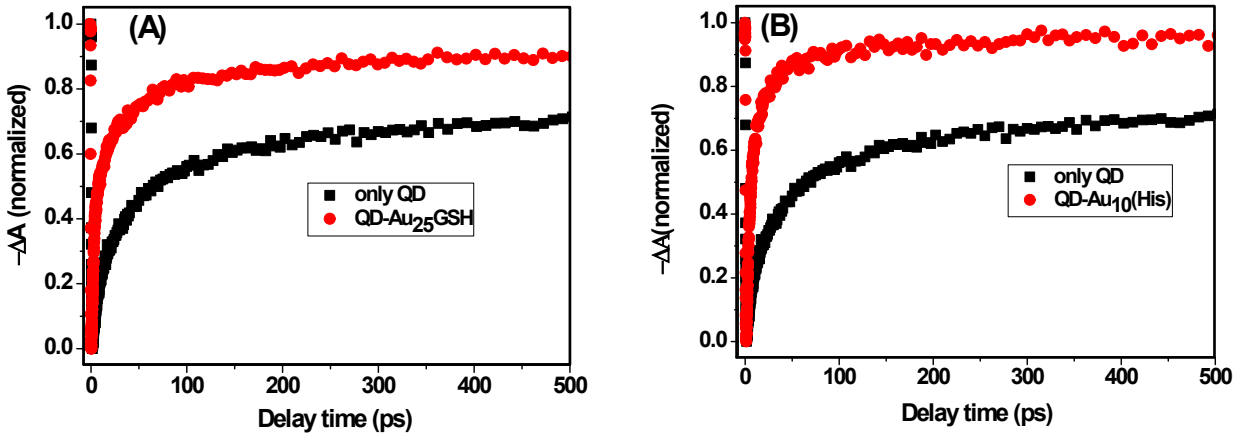


Figure S7. Comparison of the bleach recovery kinetics monitored at 585 nm of (A) QDs and QD-$Au_{25}$(GSH), and (B) QDs and QDs-$Au_{10}$(His) (concentration of Au NC was used 0.3 mM in both cases) ($\lambda_{ex}$ = 480 nm).

Table S1. PL decay parameters of the CdTe QDs as a function of the concentration of $Au_{25}$(BSA).

| $Au_{25}$(BSA) [μM] | $\tau_1(a_1)$ [ns] | $\tau_2(a_2)$ [ns] | $\tau_3(a_3)$ [ns] | $<\tau_{int}>^{\dagger}$ [ns] | $<\tau_{amp}>^{\P}$ [ns] |
|---|---|---|---|---|---|
| 0 | 4.03 (0.18) | 24.50 (0.12) | 0.44 (0.69) | 18.88 | 4.01 |
| 3.3 | 3.07 (0.12) | 22.80 (0.06) | 0.34 (0.82) | 15.96 | 2.00 |
| 6.6 | 2.59 (0.10) | 22.30 (0.05) | 0.29 (0.85) | 15.42 | 1.53 |
| 10 | 2.34 (0.09) | 21.20 (0.04) | 0.29 (0.87) | 13.91 | 1.27 |

$^{\dagger}$ $<\tau_{int}> = (a_1\tau_1^2+a_2\tau_2^2+a_3\tau_3^2)/ (a_1\tau_1+a_2\tau_2+a_3\tau_3)$, ± and $^{\P}$ $<\tau_{amp}> = (a_1\tau_1+a_2\tau_2+a_3\tau_3)/ (a_1+a_2+a_3)$

$^{\dagger\P}$ $<\tau> = \pm 5\%$

Table S2. Bleach recovery kinetic parameters of the QDs for the three nanocomposites.

| Quencher | Decay components | | |
|---|---|---|---|
| | $\tau_1(a_1)$ fs | $\tau_2$ ($a_2$) ps | $\tau_3$ ($a_3$) ps |
| $Au_{25}$(BSA) | 206±31 (8%) | 2.05±0.06 (74%) | 24.5±1.5 (18%) |
| $Au_{10}$(His) | 1300±500 (30%) | 5.75±1.3 (30%) | 50±4.1 (40%) |
| $Au_{25}$(GSH) | --- | 3.34±0.09 (60%) | 53.7±2.2 (40%) |

Bleach recovery in QD-$Au_{25}$(GSH) could not be fitted to a tri-exponential decay function like in the case of other two nanocomposites. Therefore, as the bleach recovery kinetics of this nanocomposite is very similar at shorter time-scale with the QD-$Au_{10}$(His) nanocomposite, indicating very similar electron transfer time in both cases.