Emission Behaviors of Single Colloidal Quantum Dots: Laser Pulse-Width Dependence

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We have demonstrated the enhancement of the multiphoton emission from a single quantum dot (QD) using plasmonic nanostructures.[1-4] It is important to consider the excitation laser pulse-width for clarifying the enhancement mechanism of the multiphoton emission. In this work, to investigate the relationship between the multiphoton emission and the laser pulse-width, we observed the multiphoton emission behaviors from single QDs using femtosecond (100 fs) and picosecond (100 ps) pulsed lasers. Fig. 1 shows emission behaviors depended on excitation laser power and laser pulse-width. In the case of the fs laser (a, b, c, d), the probability of the multiphoton emission slightly increased with increasing the excitation laser power (a, c) and short lifetime appeared (b, d). On the other hand, in the case of the ps laser (e, f, g, h), the probability of multiphoton emission (e, g) and the contribution of the short lifetime (f, h) significantly increased. The increase in the probability of multiphoton emission was caused by the increase in the number of exciton within one laser pulse. These results indicate that the multiphoton emission behavior is influenced by the laser pulse-width.

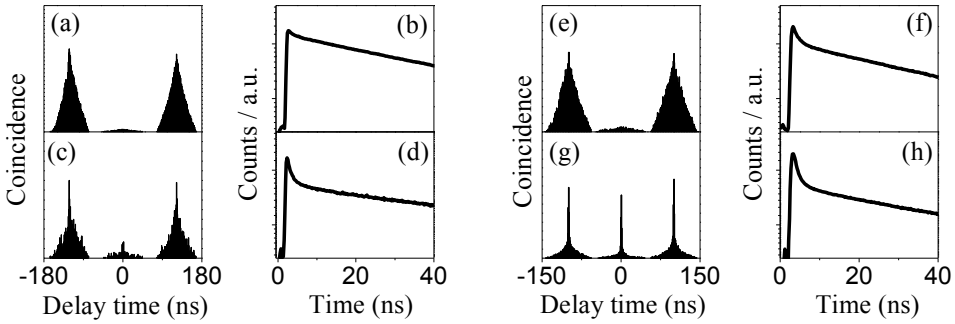

Figure 1. Photon correlation histograms (a,c,e,g) and emission decay curves (b,d,f,h) detected from single QDs using a fs laser (a-d) and a ps laser (e-h) with 0.3 kW/cm^2 (a,b,e,f) and 1.4 kW/cm^2 (c,d,g,h) of the excitation laser power.

References:

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