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Lateral energy transfer in thin film quantum dot induced via plasmonic effects

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Colloidal quantum dots (QDs) offer appealing features, such as narrow emission spectra, tunabilitiy, and high quantum yields. These features have made such nanocrystals prime candidates for various applications including fluorescence probes for imaging, biomolecular applications, light emitting diodes, solar cells, sensors, etc. Significant research is underway to improve fluorescence efficiency of such QDs using metallic nanoparticles (MNPs). Our recent findings in regard to the impact of plasmons on the emission of close packed colloidal CdSe/ZnS QDs have shown that MNPs can enhance interdot Forster energy transfer in monodisperse QD thin films, driving lateral flow of energy across the films. This forms regions in the thin films with high exciton concentrations, corresponding to the locations of QDs with large core sizes. The plasmonically driven lateral energy flow can also create regions with depleted exciton populations, as excitons are efficiently removed from QDs with small core sizes. In this contribution we discuss how such enhanced lateral energy transfer happens via the balance generated between the plasmonically renormalized radiative and non-radiative decay rates of excitons in QDs once they are in the vicinity of MNPs. As a result, although in monodisperse QDs the transition energies caused by their size variations are distributed over a narrow range; plasmonic effects can induce efficient interdot Forster energy transfer through them.

Biography

Seyed Sadeghi received his PhD in Physics from the University of British Columbia in Canada. He held NSERC postdoctoral fellowship before joining industry. In 2007 he joined University of Alabama in Huntsville. His fields of research include nanomaterials, quantum sensors based on hybrid nanoparticle systems, coherent optics of nanoparticles, and photophysics and photochemistry of colloidal quantum dots. Currently he is serving as an editorial board member of Journal of Nanomedicine and Nanotechnology and Dataset Papers in Optics.

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