Energy Transport in Nanocrystal Solids

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Abstract

Colloidal quantum dots (QD), also known as semiconductor nanocrystals, are a promising material platform for solution-processable optoelectronic devices, such as solar cells, light-emitting diodes, thermoelectric modules, and flexible electronics. Central to the operation of many of these technologies is the formation and decay of bound electron-hole pairs, known as excitons. In this talk, I will detail my group's efforts to obtain a deeper understanding of excitonic energy transport in colloidal QD materials. These studies include spectrally-resolved transient photoluminescence spectroscopy, transient photoluminescence quenching, time-resolved optical imaging, and kinetic Monte Carlo simulation. We find that surface chemistry and energetic disorder play a central role in regulating exciton transport, and apply this understanding to control exciton movement in colloidal QD assemblies.