Sonderseminar

Donnerstag, 25. Oktober 2018
16:00 Uhr

WSI, Seminarraum S 101

“Investigating the propagation of excitons through inorganic nanocrystal assemblies and 2-D semiconductors”

The creation of electron hole pairs, called excitons if the electron and hole are coulombically coupled, in semiconductors is governed by the quantum mechanically determined electronic structure and for the most part well understood. However, their spatial propagation is still illusive and yet, it is a key property to optimize light harvesting or emission and opens ways to define entirely new opto electronic functionalities. Our goal is to visualize, understand and eventually control deliberately the transport of excitons through nano building block assemblies. In the first part of the talk we will show the Foerster Resonant Energy Transfer (FRET) mediated exciton propagation through CdSe quantum dot assemblies. We find 30nm of exciton diffusion, which can be enhanced to 50 nm by aligning the dipoles via an external electric field. For perovskite quantum dots we find intrinsic diffusion length of up to 250mn, which can be enhanced by either enhancing the excitation power enforcing directional diffusion or by coupling the exciton transport to plasmonic transport via an underlying Au film. In the second part we will discuss the excitonic behavior and its propagation through deep in gap states in 2-D semiconductors such as 2-D MoS2 and WS2. Excitons in 2-D semiconductors exhibit strong binding energies and their diffusion is determined by the band structure and limited to few 10s of nm. However, chalcogen vacancies induce deep in gap states, and a FRET like propagation from chalcogen vacancy to chalcogen vacancy is an alternative exciton propagation theme. Here we will present our first results on the exciton propagation efficiency and length as a function of defect density and therefore inter defect coupling.

Dr. Alexander Weber-Bargioni
Molecular Foundry
Lawrence Berkeley National Laboratory
Berkeley, California, USA