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Statistical Physics

Ultrafast Spectroscopy of Perylene Derivative Nanoparticles

Organic dye nanoparticles and nanostructures are of increasing interest in optoelectronic applications due to their potentially large exciton mobilities. While as inorganic nanoparticles are already applied in many scenarios, the properties of organic nanostructures are yet to be explored. Among a breadth of organic systems available, Perylene derivatives especially attract much interest as they provide a high oscillator strength, photostability, and a tuneability of the transition energy and supramolecular structure by changing the bay-substitutes.

We use flash precipitation to prepare nanoparticles of the Perylene Red (PR) and Perylene Orange (PO) dyes and correlate their optical spectra, quantum yields, emission lifetimes and their size. Ultrafast pump-probe spectroscopy is then performed on samples of different size classes to characterize their excited state dynamics. In PR nanoparticles, a new electronic state, formed after photoexcitation, was observed. Remarkably, no such intermediate state was observed in the PR monomer. In PO nanoparticles, we observe an ultrafast excimer formation. In both systems and for different size classes, we characterize the exciton diffusion in the nanoparticles by analyzing signatures in the transient dynamics resulting from exciton-exciton annihilation.

Talk: German/English

Slides: English

Location: Institute of Physics, Albert-Einstein-Str. 23, SR Didaktik

