Triplet exciton dynamics in single-wall carbon nanotubes

Florian Späth[1], Dominik Stich[1], Daniel Schilling[1], Hannes Kraus[2], Andreas Sperlich[2], Vladimir Dyakonov[2,3] and Tobias Hertel[1]

[1]Institute of Physical and Theoretical Chemistry,
Julius-Maximilian University Würzburg
Am Hubland, 97074 Würzburg, Germany
[2]Institute of Physics,
Julius-Maximilian University Würzburg
Am Hubland, 97074 Würzburg, Germany
[3]Bavarian Center for Applied Energy Research e.V.
Am Hubland, 97074 Würzburg, Germany

We present pump-probe, time-correlated single photon counting and spin sensitive photoluminescence studies of semiconducting single-wall carbon nanotubes (SWNTs) in aqueous and organic solvent environments. The studies allow clear identification of signatures from triplet-triplet interactions and thereby provide access to studying triplet exciton dynamics in semiconducting SWNTs. The experiments allow for the first time the determination of triplet lifetimes which are here found to be (60±30) µs. The triplet diffusion constant on the other hand is determined to be on the order of 10 cm^2 s^{-1} which is similar to that found for singlet excitons. Moreover we present evidence for the contribution of free charge carrier dynamics to pump-probe transients.