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Triplet-triplet exciton interactions and delayed fluorescence in single-wall carbon nanotubes TOBIAS HERTEL, FLORIAN SPATH, Julius-Maximilans University of Wurzburg, DOMINIK STICH, Suddeutsches Kunststoffzentrum Wurzburg, HANNES KRAUS, ANDREAS SPERLICH, VLADIMIR DYAKONOV, Julius-Maximilans University of Wurzburg — We present pump-probe-, time-correlated single photon counting and spin-sensitive photoluminescence studies of semiconducting single-wall carbon nanotubes (SWNTs) which unambiguously identify triplet-triplet annihilation as the mechanism underlying a long-lived delayed fluorescence (DF) signal. DF decays with a $t^{-0.9}$ power-law, characteristic of diffusion-limited annihilation reactions in 1-dimensional systems. The experiments allow to determine triplet diffusion constants in SWNTs to be on the order of $1\,\mathrm{cm}^2\mathrm{s}^{-1}$ and the triplet lifetime which is found to be $60 \pm 30\,\mu\mathrm{s}$. The experiments indicate that the rate of diffusion-limited photo-reactions, here exemplified by triplet-triplet annihilation, can be reduced by one-dimensional confinement. A comparison of optical transients in aqueous and organic solvent environments also indicates how polaron pair dynamics can be influenced by the environment.

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