UCLA Department of Chemistry & Biochemistry

Physical Chemistry Seminar

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Singlet Fission: How Spin State Dynamics Allow Us to Make Two Excited States from One Photon

The 1→2 conversion of a high energy exciton into a pair of lower energy excitons could boost the efficiency of a solar cell by up to 30%. In organic materials, Frenkel excitons are the dominant optical excitations and the 1→2 conversion can occur via singlet fission, a spin-allowed process where an initially created singlet state spontaneously splits into a pair of triplet excitons. We use time-resolved spectroscopy on molecular semiconductors like tetracene and rubrene to determine the effects of quantum coherence, sample morphology, temperature, and magnetic field on this process. Our results are consistent with the "direct" mechanism for exciton fission, whereby the triplet pair is created in a concerted two-electron transition that creates a long-lived spin-coherent triplet pair. Triplet exciton dynamics and triplet-singlet interconversion are described using kinetic equations based on the time-dependent Liouville equation. The investigation of new materials for singlet fission, as well as efforts to harvest the triplets using hybrid organic-inorganic photovoltaic materials will be described.

Monday, November 25, 2013
4:00 P.M.
2033 Young Hall

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