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Energy Transfer Processes in Solar Energy Conversion
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This program involves the experimental and theoretical study of optically induced electron transfer and electronic excitation transport in systems with complex structures. The focus is to obtain an understanding of the intimate interplay among intermolecular interactions, structure, and dynamics. A combination of picosecond transient grating experiments, time resolved fluorescence depolarization experiments, conventional optical spectroscopy, and statistical mechanical theory is being employed to elucidated fundamental aspects of processes which are important in the conversion of solar energy to usable forms of energy.

We are continuing to address the very important problem of electron back transfer following optically induced donor to acceptor electron transfer. In a system in which there are donors (low concentration) and acceptors (high concentration) randomly distributed in solution, optical excitation of a donor can be followed by transfer of an electron to an acceptor. Once electron transfer has occurred, there exists a ground state radical cation (D^+) near a ground state radical anion (A^-). Since the thermodynamically stable state is neutral ground state D and A, back transfer will occur. The electron will back transfer from A^- to D^+ to regenerate the neutral species. In liquid solution, back transfer competes with separation by diffusion. Separated ions are extremely reactive and can go on to do useful chemistry.

The purpose of the experimental and theoretical work we are pursuing in this area is to understand the dynamics of the combined forward and back transfer processes. While the forward transfer process is relatively straight forward to study using time resolved fluorescence quenching, the back transfer process requires the application of a method which is sensitive to the ground state ion concentrations. We have previously shown that picosecond transient grating experiments can

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