

*Special Seminar in Energy Research*  
at the  
University of Pennsylvania

*From Dynamic Equilibrium to Photoinitiated  
Processes: Tracking Condensed Phase  
Dynamics*

*Abstract*

Many important processes in chemistry and biology occur in the solution phase, including protein conformation changes, energy transfer processes, and proton and electron transfer reactions. Understanding condensed phase dynamics is essential for describing and predicting these processes, which is why it is a prevailing topic throughout the scientific community. In this talk I will discuss two different research topics that explore different processes in condensed phase systems. The first focuses on understanding ultrafast photoinitiated processes of photosystem I, a light harvesting complex that catalyzes oxygenic photosynthesis. Here two-dimensional electronic spectroscopy (2DES) gives remarkable insight into the very first steps of light harvesting in photosynthesis. The second explores dynamic equilibrium in a fluxional metal-carbonyl complex. Here two-dimensional infrared (2DIR) spectroscopy is used to track an isomerization reaction on a ground electronic state. This well characterized reaction is then used to probe the dynamic influence of the solvent on a barrier crossing process. This work demonstrates the power of 2DIR spectroscopy to understand the dynamic role of the solvent in condensed phase processes. In conclusion, I will discuss the future directions of this research, including understanding the role of the protein matrix in light harvesting complexes and new experimental developments in two-dimensional electronic spectroscopy.

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