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Studies of Photosynthetic Energy and Charge Transfer by Two-dimensional Fourier transform electronic spectroscopy

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Two-dimensional (2D) Fourier transform electronic spectroscopy has recently emerged as a powerful tool for the study of energy transfer in complex condensed-phase systems. Its experimental implementation is challenging but can be greatly simplified by implementing a pump-probe geometry, where the two phase-stable collinear pump pulses are created with an acousto-optic pulse-shaper. This approach also allows the use of a continuum probe pulse, expanding the available frequency range of the detection axis and allowing studies of energy transfer and electronic coupling over a broad range of frequencies. We discuss several benefits of 2D electronic spectroscopy and present 2D data on the D1-D2 reaction center complex of Photosystem II from spinach. We discuss the ability of 2D spectroscopy to distinguish between current models of energy and charge transfer in this system.