Two dimensional Fourier transform spectroscopy of resonance energy transfer

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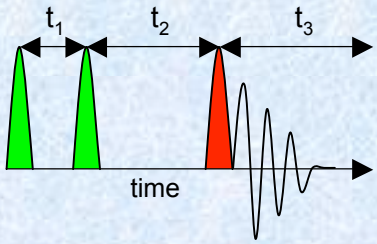
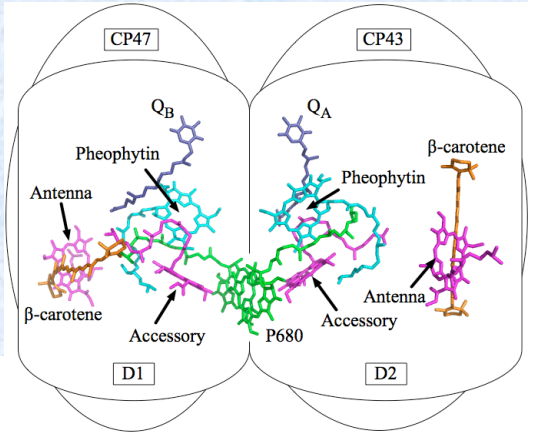
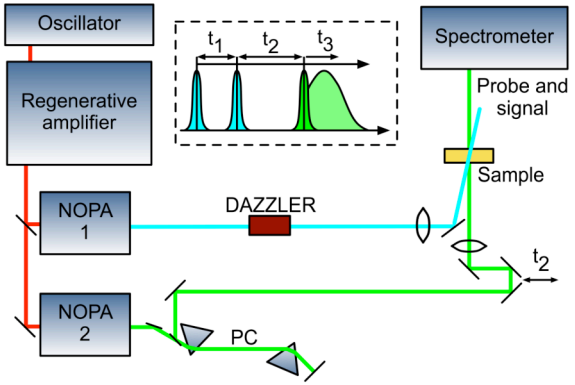
How biological molecules harness and control light energy is fundamental to life. In photosynthesis, elaborate antenna arrays gather solar energy and transfer it to photochemical reaction centers with 95% efficiency. We aim to use two dimensional Fourier transform spectroscopy to uncovering the design principles of light-harvesting complexes.



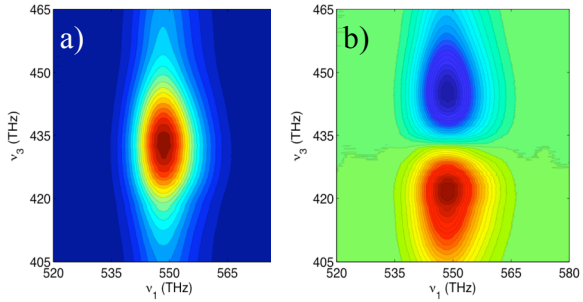
In analogy to NMR, a multiple pulse sequence excites the sample, allowing correlations to be made between excitation and detection frequencies. The resulting 2D spectrum reveals couplings and lineshapes that provide insight into electronic structure and energy transfer events.



PSII reaction center



A simplified 2D spectrometer design based on a pulse-shaper.



2D spectra recorded wth a pulse-shaper. a) Real (absorptive), b) Imaginary components of the 2D spectrum of LDS750 in acetonitrile at t_2 = 500 fs.

Future studies will apply 2DFTS to the DNA repair enzyme DNA Photoylase and the photosystem II reaction center from spinach to uncover the energy and charge transfer pathways.