Spectroscopy and Photosynthesis

Photosynthesis provides the energy for almost all life on earth. The primary processes of photosynthesis involve light collection, excitation energy transfer and trapping either at reaction centers or at sites created to remove excess excitation when too much light is present. These processes span timescales from 100fs to tens of minutes. Devising spectroscopic methods and theoretical modeling approaches to enable insight into how nature achieves the exquisite efficiency (more than 98% at low light levels) of light harvesting combined with an ability to regulate this efficiency in response to changing external conditions such as transitions from light to shade or vice-versa is therefore challenging. In this talk I will describe several spectroscopic methods including the recently developed two-dimensional electronic-vibrational (2DEV) spectroscopy as well as theoretical and simulations covering individual pigment-protein complexes and large membrane patches. Together, these build up a picture of a highly sophisticated and dynamic system that is based on a rigorous microscopic description.