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Distinctive character of electronic and vibrational coherences in disordered molecular aggregates and photosynthetic pigment-protein complexes

Leonas Valkunas
Vilnius University, Lithuania

Coherent dynamics of coupled molecules are effectively characterized by the two-dimensional (2D) electronic coherent spectroscopy. Depending on the coupling between electronic and vibrational states, oscillating signals of purely electronic, purely vibrational or mixed origin can be observed. Even in the "mixed" molecular systems, two types of coherent beats having either electronic or vibrational character can be distinguished by analyzing oscillation Fourier maps, constructed from evolution of the 2D spectrum. The amplitude of the beatings with the electronic-character beatings is heavily affected by the inhomogeneous disorder and consequently electronic coherences are quickly dephased. Beatings with the vibrational-character depend weakly on the electronic disorder, assuring their long-time survival. We show that modeling of 2D spectroscopy signals of vibronically-coupled system provides direct information on the origin of the coherent beatings. 2D spectra of PSII reaction center, bacterial reaction center, FMO, and fucoxanthyn chlorophyll proteins are analyzed by using this type of model considerations.

Biography

Leonas Valkunas has completed his Ph.D. at the age of 27 years from Vilnius University. He is the head of the Department of Theoretical Physics of Vilnius University and the deputy director of the Center for Physical Sciences and Technology in Vilnius. He has published more than 250 papers in reputed journals.

leonas.valkunas@ff.vu.lt