

The RWTH Aachen PHYSICS COLLOQUIUM at the Physikzentrum Melaten

November 24, 2014

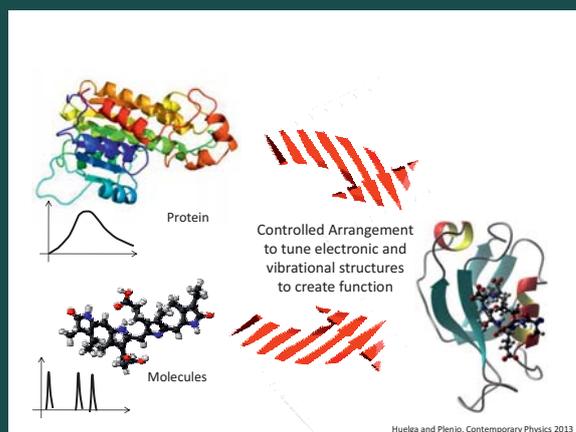
16:30h in 28D001

Susana Huelga (Ulm University)

Vibrations, Quanta and Biology

Quantum biology is an emerging field of research that concerns itself with the experimental and theoretical exploration of non-trivial quantum phenomena in biological systems.

At the heart of these investigations are the recent observations of beating signals in the excitation energy transfer dynamics of photosynthetic complexes, which have been interpreted as evidence for sustained coherent behaviour. The microscopic origin of these long-lived oscillations, however, remains to be fully uncovered. We will show that the coupling of excitonic and vibrational motion in molecular aggregates can provide efficient mechanisms leading to persistent excitonic coherence [1-3]. The non-trivial spectral structures of the environmental fluctuations and particularly discrete vibrational modes can lead to the generation and sustenance of both oscillatory energy transport and electronic coherence on timescales that are comparable to excitation energy transfer [4]. We discuss the spectral properties of the model in order to test the relation of the proposed mechanism to actual experimental observations of oscillatory behaviour using 2D photon echo techniques [5]. Recent experimental results using J-aggregates also fit nicely within this framework and corroborate the fundamental importance of the interplay of electronic and vibrational degrees of freedom in the dynamics of light harvesting aggregates.



- [1] M. del Rey, A. W. Chin, S. F. Huelga, M. B. Plenio, J. Phys. Chem. Lett. 4, 903 (2013)
- [2] F. Caycedo-Soler, A. W. Chin, J. Almeida, S. F. Huelga, M. B. Plenio, J. Chem. Phys. 136, 155102 (2012)
- [3] A. W. Chin, J. Prior, R. Rosenbach, F. Caycedo-Soler, S. F. Huelga, M. B. Plenio, Nature Physics 9, 113 (2013)
- [4] J. Prior, A. W. Chin, S. F. Huelga, M. B. Plenio, Phys. Rev. Lett. 105, 050404 (2010)
- [5] M. B. Plenio, J. Almeida, S. F. Huelga, J. Chem. Phys. 139, 235102 (2013)

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