Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

Friday, November 11th 2016 - 11:00
CFEL Seminar room V (Bldg. 99)

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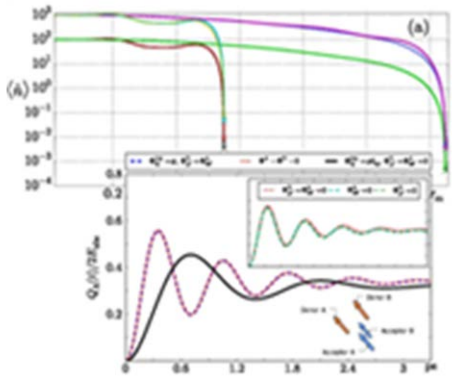
Energy and Entropy Transfer in Natural and Handmade Systems

The talk will cover the resonance energy transfer in light-harvesting systems and entropy transfer in nanomechancial resonators.

In the first part, I will present a classical formulation of the quantum multichromophoric theory of resonance energy transfer developed on the basis of classical electrodynamics. The theory allows for the identification of a variety of processes of different order in the interactions that contribute to the energy transfer in molecular aggregates with intracoupling in donors and acceptor chromophores. Enhanced rates in multichromophoric resonance energy transfer are shown to be well described by this theory. Specifically, in a coupling configuration between N_A acceptors and N_D donors, the theory correctly predicts an enhancement of the energy transfer rate dependent on the total number of donoracceptor pairs. As an example, the theory, applied to the transfer rate in light harvesting II, gives results in excellent agreement with experiment. Finally, it is explicitly shown that as long as linear response theory holds, the classical multichromophoric theory formally coincides with the quantum formulation.

In the second part, I will present a sideband cooling strategy that incorporates (i) the dynamics induced by structured (non-Markovian) environments in the target and auxiliary systems and (ii) the optimally time-modulated interaction between them. For the context of cavity optomechanics, when non-Markovian dynamics are considered in the target system, ground state cooling is reached at much faster rates and at much lower phonon occupation number than previously reported. In contrast to similar current strategies, ground state cooling is reached here for coupling-strength rates that are experimentally accessible for the state-of-the-art implementations. After the ultrafast optimal-ground-state-cooling protocol is accomplished, an additional optimal control strategy is considered to maintain the phonon number as closer as possible to the one obtained in the cooling procedure. Contrary to the conventional expectation, when non-Markovian dynamics are considered in the auxiliary system, the efficiency of the cooling protocol is undermined.



Host: Angel Rubio

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