Theory of feedback control of quantum light and phonon emission from semiconductor quantum dots

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This talk is focused on the control of the statistics of coupled electrons, phonons and photons of single semiconductor quantum dots in optical or acoustic cavities. Within a self-consistent, non-perturbative description we discuss:

- the phonon statistics in acoustic cavities, in particular the conditions of acoustic phonon lasing; single phonon emission or a poissonian phonon statistics can be induced by an externally controlled Raman process.

- the photon dynamics in optical cavities, in particular its control via optical feedback due to an external mirror to stabilize cavity Rabi oscillations in a bad cavity limit.

- the control of entanglement of the quantum dot biexciton emission via time delayed optical feedback due to an external mirror.

As a typical example the figure shows the optical excitation of a quantum dot in a acoustic cavity via a Raman process (left, c, v: electronic states, n: phonon number) and the resulting acoustic phonon statistics p(n) (right) as a function of time. Here, the temporal transition from thermal to poissonian statistics can be observed.