Transport properties of quantum-dot cavity systems

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Abstract: We present an open system approach to the photon-assisted transport in self-assembled quantum dots embedded in a single-mode cavity. Instead of starting our analysis from a Lindblad equation we derive a markovian Master equation for the reduced density matrix of the QD-cavity system in terms of 'dressed' states. The populations of various many-body configurations (e.g exciton, trions, biexcitons) and the mean photon number are calculated and discussed. In the strong coupling regime ($g_c \gg \kappa$) the steady-state current $J_S(\kappa)$ shows a non-monotonic behavior as a function of the cavity losses κ. We find that the tunneling processes from and to the contacts are renormalized by the quantum dot-cavity coupling g_c. As long as the biexciton binding energy hampers the exciton recombination the dynamics can be described in terms of the dressed states of a three-level Λ system. This is joint work with I. V. Dinu and P. Gartner.