Invited Talk

Quantum dot - nanocavity QED for quantum information processing — Jelena Vuckovic — Ginzton Laboratory, Stanford University, Stanford, CA 94305-4088

Single quantum dots (QDs) in photonic crystal nanocavities are interesting both as a testbed for fundamental cavity quantum electrodynamics (QED) experiments, as well as a platform for quantum and classical information processing. In addition to providing a scalable, on-chip, platform, these systems also enable large dipole-field interaction strengths, as a result of the localization of the field to very small optical volumes. Such a platform could be employed to demonstrate a number of devices, including nonclassical light sources, electro-optic modulators and switches operating at the single photon level, and quantum gates. QD-cavity QED systems also exhibit interesting phonon-assisted off-resonant interaction between the QD and the cavity which can be employed for spectral filtering, as well as for coherent optical spectroscopy and quantum dot state readout, thereby overcoming issues coming from quantum dot inhomogeneous broadening. In order to make the platform compatible with fiber-optic telecommunication wavelengths, the intrinsic optical nonlinearity of the semiconductor employed to make a nanocavity can be employed for frequency conversion.

Topical Talk

The Single-Quantum-Dot Laser — Christopher Gies1, Matthias Florian1, Paul Gartner1,2, and Frank Jahnke1 — Institut für Theoretische Physik, Universität Bremen — National Institute of Materials Physics, Bucharest-Magurele, Romania

A single quantum-dot emitter coupled to a single microcavity mode represents a model system for fundamental quantum optical effects and various applications. We study the emission properties of this system for different excitation regimes from a single-photon source to lasing on the basis of a semiconductor model. As a function of the excitation conditions we investigate the onset of stimulated emission, the possibility to realize stimulated emission in the strong-coupling regime, as well as the excitation-dependent changes of the photon statistics and the emission spectrum. The role of possible excited charged and multi-exciton states and the different sources of dephasing for various quantum-dot transitions are discussed.

Topical Talk

Coherence and photon statistics of the Mollow triplet sideband emission of a quantum dot — Sven M. Ulrich, Ata Ulhaq, Stefanie Weiler, and Peter Michler — Institut für Halbleiteroptik und Funktionelle Grenzflächen (IHFG), Universität Stuttgart