Institutskolloquium

Am Mittwoch, den **09. März 2011, 16:00 Uhr** spricht

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über

'Room Temperature Single Photon Sources: Design, Performance, and Applications'

Single photon sources are key devices for optical quantum information processing, miniaturized optical elements, as well as light standards. Several physical systems have been exploited to generate on-demand or heralded single photons. Examples are semiconductor quantum dots, defect centers in diamond, alkali atoms, and parametric down-conversion sources. In this talk I will review these sources and highlight their unique properties and peculiarities with respect to applications in quantum information processing.

A special focus lies on room temperature sources. A narrow-band heralded photon source based on intra-cavity parametric down-conversion will be introduced [1]. Photons from these sources are matched to atomic resonances and thus ideally suited to transfer quantum bits and entanglement [2].

Furthermore, I will discuss experiments where nitrogen-vacancy (NV) centers [3] in nanodiamonds are used. The are particularly suitable as fundamental light sources for integration in ore complex elements since they are large enough (10nm-100nm) and optically stable even under ambient conditions at room temperature. We show coupling of these emitters to different nanophotonic structures, such as toroidal microresonators [4], photonic crystal cavities [5], or optical photonic crystal fibers [6]. We discuss how the complexity of these model devices can be extended in the future to involve several emitters, resonant dielectric structures, as well as plasmonic nano circuits.

[1] "Statistics of Narrow-Band Single Photons for Quantum Memories Generated by Ultrabright Cavity-Enhanced Parametric Down-Conversion", M. Scholz, L. Koch, and O. Benson, Physical Review Letters **102**, 063603 (2009).
[2] "Direct measurement of heralded single-photon statistics from a parametric down conversion source", D. Höckel, L. Koch, and O. Benson, Phys. Rev. A **83**, 013802 (2011).
[3] "Single defect centres in diamond: A review", F. Jelezko, and J. Wrachtrup, Phys. Stat. Sol. A **203**, 3207 (2006).
[4] "On-demand positioning of a preselected quantum emitter on a fiber-coupled toroidal microresonator", M. Gregor, R. Henze, T. Schröder, T, and O. Benson, Appl. Phys. Lett. **95**, 153110 (2009).
[5] "Enhancement of the zero phonon line emission from a single nitrogen vacancy center in a nanodiamond via coupling to a photonic crystal cavity", J. Wolters, A. W. Schell, G. Kewes, N. Nüsse, M. Schoengen, H. Döscher, T. Hannappel, B. Löchel, M. Barth, and O. Benson, Appl. Phys. Lett. **97**, 141108 (2010).
[6] "Fiber-Integrated Diamond-Based Single Photon Source", T. Schröder, A. W. Schell, G. Kewes, T. Aichele, and O. Benson, Nano. Lett., DOI: 10.1021/nl103434r (2010).

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Interessenten und Gäste sind herzlich eingeladen.

Prof. Dr. T. Elsässer