Seminarankündigung

Dienstag, 18. November 2018
17:15 Uhr

WSI, Seminarraum S 101

"Nanophotonic spin systems for quantum information processing"

A central aim of quantum communication is the long-distance transfer of photonic qubits to realize secure quantum key distribution and to establish distributed quantum networks. The long-distance quantum state transfer requires quantum repeaters which could be implemented with quantum memories via entanglement swapping and distillation or, alternatively, with photonic cluster states in one-way communication schemes. Both schemes require efficient spin–photon interfaces and scalable photonic systems.

In this talk, I will discuss progress in the development and application of cavity- and waveguide-based spin-photon interfaces. In the first part of the talk I will focus on diamond photonics with colour centres [1] and introduce our work on nanophotonic–spin systems. I will discuss how diamond nanophotonic devices can be fabricated in a scalable way [2,3] and integrated into photonic architectures [4,5]. I will furthermore show how such devices can be used to control the emission properties of spin defects to overcome intrinsic optical inefficiencies, in particular of the nitrogen vacancy centre [6,7], which is an important step towards improved entanglement rates between distant qubits. Finally, I show how silicon vacancy centres in diamond can be deterministically coupled to optical nanocavities and exploited for the generation of coherent optical photons [8]. In the second part of the talk, I will focus on our recent experimental efforts with charged InGaAs quantum dots embedded in photonic nanostructures. Towards building quantum gates and creating spin-photon entanglement in photonic integrated circuits, I will introduce an efficient, optically controllable interface between an electron qubit and photons guided in a nanophotonic system allowing for the realisation of a proof-of-concept single-spin controlled photon switch [9]. Finally, I will discuss coherent optical control schemes in nanobeam waveguides to prepare arbitrary superposition states of embedded electron qubits and demonstrate bulk-like T2* coherence times [10].

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