Harnessing light-matter interaction for photonic quantum technologies

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Photonic quantum technologies have a unique potential for applications such as large-scale quantum networks and quantum-enhanced sensing. Furthermore, photons provide new paradigms for quantum simulations and a testbed for benchmarking the advantage of quantum simulators over classical ones. These applications demand novel resources such as efficient single-photon sources, large clusters of entangled photons, and non-linear optical gates. At the current stage, solid-state quantum optics can impact photonic quantum information processing strongly. Solid-state quantum emitters can generate the necessary single photons and more sophisticated cluster states deterministically, currently posing a significant bottleneck for photonic quantum information processing.

In this talk, he will present our work on realizing some of these elements using quantum dots in optical microcavities. In the first part, he will present an efficient source of indistinguishable single photons. He will show that they achieve an end-to-end efficiency of 57 %, 2.3 times higher than the state-of-the-art, and discuss the significance of this improvement for photonic quantum technologies. In the second part, he will present an optical equivalent of a diode. He will show that a single quantum dot can block the transmission of the photons in one direction while allowing the transport in the opposite direction. He will also show that the transmission of photons in our diode is nonlinear and that the onset of the nonlinearity is at the single-photon limit. At the end of his talk, he will discuss the potential of this platform for generating more sophisticated graph states and cluster states.

Einführung: Prof. Dr. A. Wieck

Die Fakultät lädt alle Interessierten herzlich ein.