Quantum dot-based scalable quantum photonic devices operating in the telecom C-band

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Epitaxial quantum dots (QDs) are among the leading contenders for the realization of highly efficient quantum light sources for a broad range of applications in quantum information processing. However, the wavelength of emitted photons ideally should be in the telecom band to facilitate integration with the existing fiber-based telecom infrastructure. This could be realized within well-known InAs/GaAs QD systems either via a metamorphic approach [1,2] or down-converting single photons using non-linear processes [3]. Alternatively, a different material system could be chosen. In this contribution, we present our findings on the epitaxial growth of InAs QDs in InP, yielding an emission wavelength in the telecom C-band [4] with high single photon purity [5].

Furthermore, we have realized the high-yield fabrication of two types of quantum photonic devices emitting single photons. The first generation of single photon emitters is designed for out-of-plane emission, facilitating efficient fiber coupling. The second generation of devices is heterogeneously integrated on a Si waveguide designed for on-chip integration. Utilizing the far-field photoluminescence imaging method [6], we localize the QDs with predefined spectral properties with respect to alignment marks. This allows us to fabricate photonic cavities centered around preselected QDs deterministically via electron beam lithography. In this talk, we will discuss the QD epitaxy, nanofabrication, and characteristics of fabricated quantum photonic devices.

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