On-Demand Generation of Indistinguishable Photons in the Telecom C-Band

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Quantum networks based on in-fiber quantum channels require high-quality single photons at Telecom wavelengths [1]. We present progress towards the generation of such single photons using semiconductor Quantum Dots. This includes recent work demonstrating the coherent, on-demand generation of indistinguishable photons from single QD devices consisting of InAs/InP QD-mesa structures heterogeneously integrated with a metallic reflector on a silicon wafer [2]. The coherent excitation enabled two-photon-interference visibilities > 30% preparation fidelities > 80%, independently confirmed by different methods.

Furthermore, we aim for new experimental results which extend the employed two-photon-resonant excitation using chirped excitation laser pulses based on chirped fiber Bragg gratings. Moreover, by adding a stimulation laser pulse resonant with the biexciton to exciton transition we plan to further improve the indistinguishability of the exciton and allow deterministic setting of the polarization of the emitted photon as already demonstrated at lower wavelengths [3].

[1] Vajner, Daniel A., et al. "Quantum communication using semiconductor quantum dots." Advanced Quantum Technologies 5.7 (2022)
[2] Vajner, Daniel A., et al. "On-demand Generation of Indistinguishable Photons in the Telecom C-Band using Quantum Dot Devices." ACS photonics (2024)
[3] Karli, Yusuf., Vajner, Daniel A. et al. "Controlling the photon number coherence of solid-state quantum light sources for quantum cryptography". NPJ Quantum Information, 10(1), 17. (2024)