Progress on Semiconductor Quantum Dot Single-Photon Sources for Telecom Quantum Photonic Applications

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As high-performant sources of single photons, epitaxial quantum dots can be considered as a semiconductor launchpad for quantum photonic technologies.[1] Luckily enough, for curious scientists, there is still a variety of challenges to tackle on the road to an ideal single-photon source. Here, I present an overview of recent developments in the engineering of practical single-photon sources for quantum photonic applications made from III-V semiconductor quantum dots grown by molecular beam epitaxy:

Photonic wire-bonding of a quantum dot distributed Bragg grating waveguide was used to demonstrate a true plug-and-play fiber-coupled single-photon source, which allows for resonant-frequency pumping without the need of any additional cross-polarization filtering.[2]

By integrating InAs/InP quantum dots into circular Bragg grating resonators, Purcell-enhanced single-photon emission with $F_P \approx 7$ in the telecom C-band was achieved. [3]

The displacement with regard to the cavity center strongly determines the polarization characteristics from quantum dots in circular Bragg grating resonators, as the symmetry of the coupled QD-cavity device is broken, and the quantum dot will couple differently strong to the degenerate fundamental resonator modes. [4]

We demonstrated that GaSb quantum dots are a scientifically rich alternative material system for the generation of single-photons in the telecom S-band. [5]

References:

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