Toward Scalable, Fully Controllable Single-Photon Sources in the Telecom C-Band

Elizaveta Semenova [1,2]

[1] *NanoPhoton-Center for Nanophotonics, Technical University of Denmark, Kgs. Lyngby, Denmark*
[2] *DTU Electro, Technical University of Denmark, Kgs. Lyngby, Denmark*

Epitaxial quantum dots (QDs) are among the most promising platforms for realizing high-performance single-photon sources for a wide range of quantum information applications[1]. Achieving scalable and fully controllable devices operating in the telecom C-band, however, requires the co-integration of advanced material growth, deterministic fabrication, and active control schemes.

In this talk, we present our approach based on InAs QDs grown on InP, enabling direct emission in the telecom C-band with high single-photon purity. We discuss the epitaxial engineering of QDs, including the development of p–i–n and n-i-n diode structures that enable electrical control of the QD emission properties.

We will address methods of deterministic QD device fabrication, the integration of pre-selected QDs into photonic structures using optical localization, combined with aligned nanofabrication[2], as well as site-controlled growth techniques[3].

This approach enables scalable fabrication of both fiber-coupled emitters and on-chip integrated devices. These results highlight a pathway toward scalable quantum photonic devices combining deterministic positioning, electrical control, and telecom-wavelength operation.

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