# Optical characterization of InAs/InP quantum dots in the p-i-n junction emitting in the telecom C-band

**E. Zięba-Ostój[1], S. Fornetti[2], P. Holewa[1,2], C. P. Gunnarsson[2,3], M. Xiong[2,3], P. Mrowiński[1], K. Yvind[2,3], E. Semenova[2,3], M. Syperek[1]**

[1] *Department of Experimental Physics, Wrocław University of Science and Technology, Poland*
[2] *DTU Electro, Technical University of Denmark, Kongens Lyngby 2800, Denmark*
[3] *NanoPhoton-Center for Nanophotonics, Technical University of Denmark, Kongens Lyngby 2800, Denmark*

In quantum communication, generating single photons and entangled photon pairs in the telecom C-band is crucial for long-distance communication through fiber-based telecom infrastructure. For this purpose, self-assembled InAs/InP quantum dots (QDs) can be used as an essential element of the photon state generator. A major challenge for a single QD-based photon source is the control over its charge environment, as the charge fluctuations environment can deteriorate the source performance (e.g. coherence)[1,2]. This issue is particularly challenging in QD-containing microstructures with a small footprint.

In this contribution, we present prototype devices that contain a single QD in the *p-i-n* junction placed on an Al mirror to enhance QD emission visibility[3] (Fig. 1a). The presence of the junction should provide more efficient dissipation of excess charge carriers. We have employed high spatially resolved photoluminescence, time- and polarization-resolved photoluminescence to examine the optical properties of each device (Fig.1b). We have demonstrated autocorrelation and cross-correlation measurements for selected emission lines originating from different exciton complexes from a single quantum dot. The architecture of the presented device has the potential to modify its optical properties by manipulating the charge environment and the QD charge state through applying an external electric field.

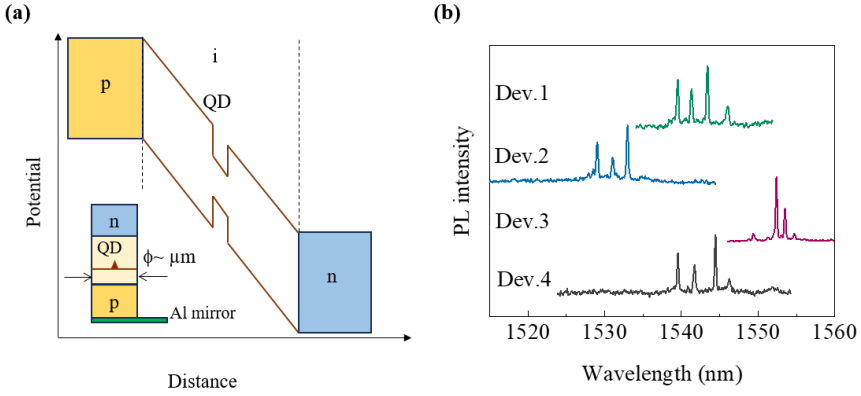


**Figure 1** (a) Scheme of the *p-i-n* device with a single QD, (b) emission from selected *p-i-n* devices

## References

[1] P. Holewa et al, *Scalable quantum photonic devices emitting indistinguishable photons in the telecom C-band*, arXiv:2304.02515 (2023).
[2] D.A. Vajnert et al. *On-demand Generation of Indistinguishable Photons in the Telecom C-Band using Quantum Dot Devices*, ACS Photonics, 11, 2 (2024).
[3] P. Holewa et al. *Bright Quantum Dot Single-Photon Emitters at Telecom Bands Heterogeneously Integrated on Si*, ACS Photonics 9, 7 (2022).