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Electrically driven and tunable plug&play single photon sources

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Single photon and entangled photon pair sources are an essential component of QKD cryptographic systems. For unattended long-life operation in potentially harsh environments, these devices shall contain the minimum number of optomechanical elements and moving parts, thus eliminating the risk of misalignment due to vibrations and/or temperature changes. Thus, for the development of plug&play single photon sources, which are both alignment-free and vibration resistant, a good start would be to integrate the pumping source and the single photon source in a monolithic design.

In this work, we will present our design for such a plug&play device [1]. It is based on a vertical multijunction heterostructure comprising quantum dots and two separated electrical injection and electrical tuning regions in a bi-polar transistor configuration. The connection between them is purely optical and thus, it naturally avoids sheet resistance problems when applied to nanophotonic devices. We will show finite element simulations of different electrical and photonic designs together with results obtained in the first fabricated devices.

[1] B. Alén et al. “Device for emitting single photons or entangled photon pairs”. European Patent EP 3 361 516 B1 (filed 08/02/2017 & granted 18/12/2019)