In this thesis, possible active key components for quantum information technology like microdisk (MD) laser, waveguide and photodiode based on II-VI semiconductor systems including impurities and quantum dots (QDs) were developed and studied.

Excitons bound to fluorine donors in ZnSe appear to meet most requirements for quantum memories. Lasing in ZnSe donor-bound excitons may be particularly useful as a component in quantum processing devices for qubit initialization, control, and readout. In this work, a fabrication process of MD laser based on a strained fluorine-doped ZnSe quantum well was developed. The structural properties of these MDs, such as strain distribution and the density of extended defects were studied. Also, the optical characteristics of the disks were investigated and low-threshold lasing was observed.

While MD cavities are applicable as low-threshold lasers, membranes constitute waveguides structures for interconnecting MDs in integrated photonic circuits. In this context ZnSe/ZnMgSe membrane structures were fabricated. Investigations of strain distribution, extended defect density and optical properties were carried out.

Another approach to realise semiconductor qubits for quantum technology makes use of a two-level system which is formed by the exciton ground state in a single QD. For this reason, self assembled CdSe QDs were embedded in ZnSe and enclosed in a Schottky photodiode with electrical and optical access. We found a redshift of the photoluminescence due to the quantum confined Stark effect at increasing negative bias voltage. At resonant excitation of the QD excitons, the first demonstration of an electric readout of the wide-gap CdSe QDs was achieved.