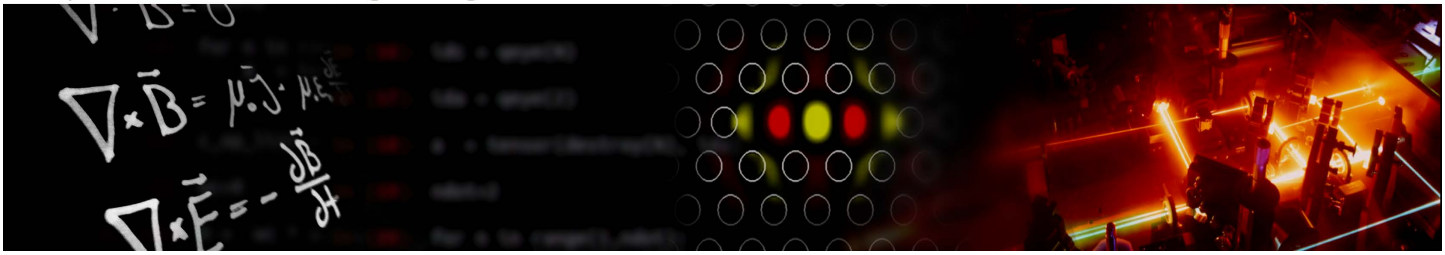

B.Sc. (including Fagprojekter) **or M.Sc. project**

the level of the project can be adapted to the study program

Nano-fabrication of quantum photonic devices

This project aims at processing crystal phase quantum dots in nanowires to propose new device designs for quantum photonic applications. This will be done using our state of the art clean room facility.

Precise control of optical properties of quantum devices would represent a major milestone, yet to be demonstrated, for communication and computation technologies exploiting quantum mechanical phenomena, such as quantum cryptography or quantum network. To realize this technologic stride, our approach is to employ a novel concept which is control of crystal phase switching in nanowires.

This polytypism – presence of different crystal phases – was discovered 25 years ago when random segments of zinc blende and wurtzite crystal structures were found in nanowires. The great potential for applications of nanowires is hampered by the modification of their properties related to these "defects". Despite the widespread research effort, this polytypism is still not yet well controlled.

Furthermore, enabling precise crystal phase control allows the realization of tailored crystal phase quantum dot (QD) -- consisting of small segments of ZB in WZ structure or vice versa in a nanowire – with atomically sharp interfaces. This unique advantage compared to other QDs -- made by changing or inserting an alloy in another host material -- would allow the production of device with controlled optical properties and uniformity. This makes crystal phase QDs one of the most promising candidate as quantum bit building block.

In our team we aim to develop these homostructures towards development of novel quantum devices using a Metalorganic vapour phase epitaxy (MOVPE) reactor. We are actually growing InP NWs by self catalization on Si and InP wafers. To improve crystal purity and achieve phase switching, we are employing different strategies along with feedbacks from electronic microscopy and optical characterization.

Goals of the project (which may be modified according to the interests of the student):

- Develop an understanding of the requirements for new quantum information devices
- Realization of quantum photonic devises through crystal phase quantum dots

Skills/knowledge acquired through the project:

Cleanroom growth (nanowires), nano-fabrication (e-beam/nano-imprint/PECVD/ICP) characterization (SEM, TEM), applications in Quantum Information.

More skills/knowledge will depend on the specifics of the project.

Background requirements:

Knowledge in quantum mechanics or/and cleanroom processing would be an advantage.

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