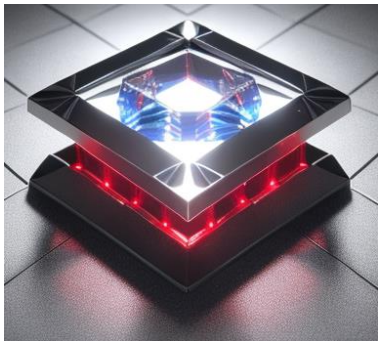
MSc Thesis Project

Waveguide design and fabrication for efficient delivery & collection of light from NV centers in diamond for quantum biosensing



Nitrogen-vacancy (NV) centers in diamond are very promising biosensors. Our goal is to bring the sensing component of such setups down to chip level and realize an on-chip, portable system to perform high-sensitivity and high-accuracy sensing of bio-samples, such as detection of magnetic footprint of cancerous cells.

To achieve this, we will fabricate a diamond substrate with an array of single NV centers and integrate it with a CMOS chip featuring an array of Single-Photon Avalanche Diodes. These photodetectors will enhance detection sensitivity, speed, and signal-to-noise ratio by efficiently capturing light emitted by individual NV centers in the diamond.

Project Goals:

In bio-sample measurements, however, laser excitation must be carefully controlled in order to prevent sample damage. Therefore, we aim to employ **photonic structures** to precisely direct excitation light to each NV center.

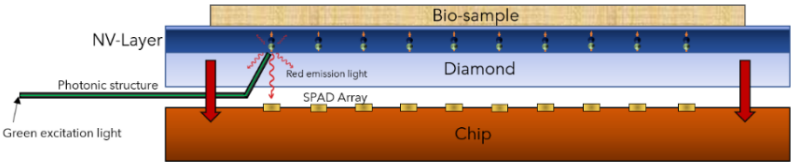


Fig.1 Concept of photonic structure driving the excitation light towards the NV-centers of a diamond integrated in a SPAD array chip.

- In this work, you will design, simulate, fabricate and optically test the performance of the fabricated waveguides.

Outcome:

The successful completion of this project will prove to be very valuable in enabling the desired diamond-on-chip quantum biosensor. By the end of this MSc thesis project, we anticipate achieving the following outcomes:

- **Design** and 3D electromagnetic **simulations** of different waveguide structures and selection of the one matching our system's criteria.
- **Fabrication** of these waveguides. This will be carried out in a **cleanroom** environment and equip you with substantial fabrication **experience**.
- **Characterization** of your fabricated waveguides, by making use of optical measurement setups in a lab environment.

For more info, contact:

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