

Institute of Microelectronics of Barcelona IMB-CNM CSIC

The **IMB-CNM** is the largest institute in Spain dedicated to the research and development of Micro and Nano Technologies and Microsystems and with unique capabilities in silicon technology. It belongs to CSIC since its foundation in 1985 and is distinguished as a María de Maeztu Unit of Excellence.

IMB-CNM aims to contribute to the advancement of knowledge and to the economic and social development of society, as well as to the training of researchers and engineers and to the advice to public and private entities.

The research activities of IMB-CNM are dedicated to Micro/Nano Integrated Systems: miniaturized electronic systems which include sensing and/or actuating capabilities in addition to electronic information processing, power management and external interfaces.

The IMB-CNM is located on the Autonomous University of Barcelona (UAB) Campus and contains the largest clean room facilities in Spain with full capability to process its own CMOS technologies and laboratories.

Project Type: TFG

Project Title: Characterisation of a Photonic Integrated Circuit for quantum and bio-sensing Applications

Research Group: Radiation Detectors Group (RDG)

Project Description:

- ❖ This project proposes the characterisation of a photonic integrated circuit recently fabricated at the IMB-CNM.
- ❖ This circuit has been developed to efficiently transmit light from an optical source along a silicon nitride waveguide to a photodetector.
- ❖ This design couples photodetectors developed within the RDG group at the IMB-CNM, based on the Low Gain Avalanche Detector technology, with a wedge cladding which allows efficient coupling from the waveguide to the detector.
- ❖ The project's aim is to characterise both the waveguides and the photodetectors in terms of responsivity and compare with previous simulation models.
- ❖ The work will be performed in collaboration with international partners at the INAOE, Puebla, Mexico, who have developed the simulation models.

Work Plan:

The project will focus on the experimental characterisation of a photonic integrated circuit fabricated at the IMB-CNM. The circuit integrates silicon nitride waveguides with photodetectors based on Low Gain Avalanche Detector (LGAD) technology, using a wedge cladding for efficient optical coupling.

The methodology will involve:

- **Waveguide Characterisation:** Optical transmission measurements will be carried out to evaluate losses and coupling efficiency. A tunable laser source and appropriate

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coupling optics will be used to inject light into the waveguides, and the transmitted signal will be recorded using the TCT system available in the RDG laboratory.

- Photodetector Characterisation: The responsivity of the integrated photodetectors will be measured by varying the input optical power and recording the photocurrent generated. Electrical characterization (I-V measurements) will also be performed to assess detector performance.
- Photodetector-Waveguide Characterisation: The responsivity of the system will be measured by varying the input optical power and recording the photocurrent generated.
- Data Analysis and Comparison: Experimental results will be compared with simulation models developed by collaborators at INAOE. Discrepancies between measured and simulated values will be analysed to identify possible design or fabrication limitations.

Work Plan:

- Weeks 1–2: Literature review on photonic integrated circuits, LGAD technology and Familiarisation with measurement setups at IMB-CNM.
- Weeks 3–6: Experimental setup calibration and waveguide transmission measurements. Collection of optical loss and coupling efficiency data.
- Weeks 7–10: Photodetector responsivity measurements, including electrical characterisation.
- Weeks 11–12: Data analysis, comparison with simulation models provided by INAOE, and discussion of results.
- Weeks 13–14: Drafting of thesis chapters on methodology, results, and discussion.
- Weeks 15–16: Final writing, revision, and preparation for submission.

Candidate desired studies:

- ✓ BSc Physics

Application Process:

Before applying, please **check with your TFG/TFM program supervisor**, as he/she may already be coordinating with us to assign the project.

If there is no such coordination, **complete this [form](#) and send your CV and a motivation letter to Talent@imb-cnm.csic.es, with the subject: “TFG/TFM at IMB-CNM”**

Your CV will be forwarded to the Researcher leading the project who will contact you directly if interested.

Check our website for more information about the IMB-CNM and our research activities

<https://www.imb-cnm.csic.es/en>

Take the next step in your research career with us!

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*By applying, you accept our [data protection policy](#).

**IMB-CNM (CSIC) adheres to the [European Charter and Code of Conduct for Researchers](#), ensuring full alignment with their principles and requirements, including equal opportunity, transparency, merit and ability, caring for an open, fair, and excellence-based hiring processes.

IMB-CNM holds the [HR Excellence in Research award](#), which acknowledges CSIC's commitment to continuous improvement in HR strategies for researchers.