

PHD POSITION ON MASSIVE LOCAL TUNING OF PHOTONIC ICs

Ghent University – IMEC, Photonics Research Group
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We are looking for a motivated PhD candidate to work on large-scale photonic integrated circuits (silicon photonics) where thousands of elements can be independently and locally tuned. Different circuit topologies can be used, such as waveguide meshes that interfere, networks of ring resonators, or waveguides that couple through a recently discovered phenomenon of ‘lateral leakage’.

One of the challenges of larger photonic circuits is to guarantee that all circuit elements are properly matched, i.e. their optical properties should be sufficiently similar. In silicon photonics, this is a difficult problem, because the optical properties depend on nanometer-scale variations of the geometry. The good news is that this can be compensated by locally tuning the individual elements of the photonic circuit, but this tuning (which is usually done with a heater) is difficult to implement on a large scale.

In this project, we will explore new ways to scale up the tuning the phase of large photonic circuits. This requires ways to independently address a large number of elements, with sufficient accuracy. For this, we are stepping away from the traditional method of implementing a heater element close to the optical waveguide. Instead, we consider methods with much larger parallelism, such as a liquid crystal overcladding, or optical illumination using a spatial light modulator. This way, the refractive index of the waveguide can be locally altered, inducing a phase shift.

These techniques will be applied different optical circuit architectures: waveguides interfering in Mach-Zehnder interferometers or networks of ring coupled resonators. An circuit geometry that is especially attractive for these forms of distributed tuning is ‘lateral leakage’, where waveguides can couple with each other over large distances.

We are looking with a PhD candidate with a background in photonics, applied physics or electrical engineering. You should have a strong interest in experimental work, a good knowledge of optics and electronics, and basic programming skills (Python is the standard language in our lab). An open mind and a multi-disciplinary attitude is a must. The research work will involve simulation (electromagnetic and circuits), chip design, chip assembly and building custom measurement setup. Chip fabrication will be based on existing processes executed in IMEC.

This PhD project is part of the **PhotonicSWARM** project, a 5-year consolidator grant funded by the European Research Council (ERC). We offer you the opportunity to work in a large, multi-disciplinary research group that covers a broad spectrum from fundamental to very applied research in the field of integrated photonics. There will be opportunities to collaborate with other groups in Ghent University and in an international context with various partnering research institutes.

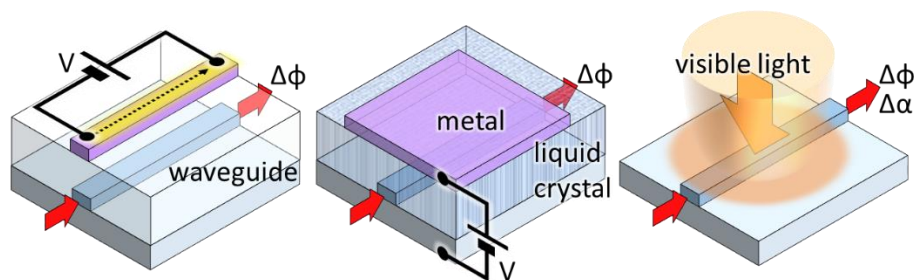


Figure 1: Different tuning mechanisms: Heaters, Liquid crystal overcladding, or local optical illumination

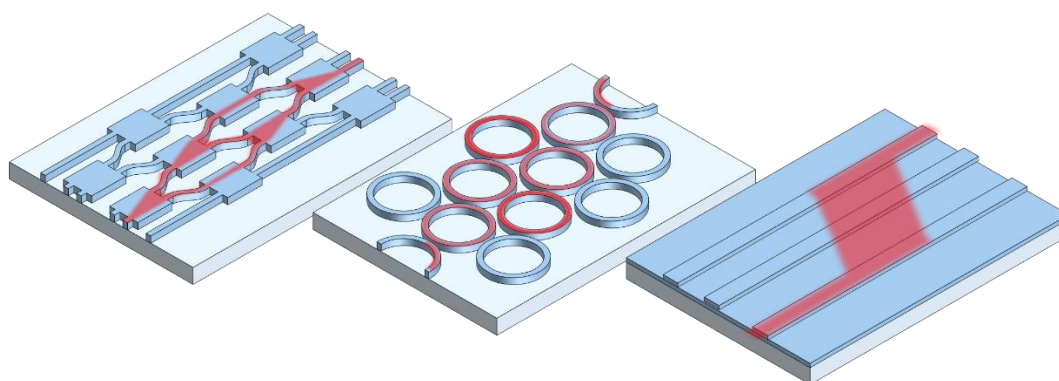


Figure 2: Different circuit topologies studied in the PhotonicSWARM project: Mach-Zehnder lattices, Ring meshes and lateral leakage.

Application

You can express your interest through this [application form](#).

More information:

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About the Photonics Research Group

The Photonics Research Group (about 85 people) is associated with IMEC, and is part of the Department of Information Technology of Ghent University. The group is headed by Prof. R. Baets and has been active in photonics device research for many years. The other professors in the group are P. Bienstman, W. Bogaerts, B. Kuyken, N. Le Thomas, G. Morthier, G. Roelkens and D. Van Thourhout. The main research directions are silicon nanophotonics, heterogeneous integration, optical communication, photonic (bio)sensors and photonic integrated circuits for biomedical applications in the near-infrared and mid-infrared wavelength range. More in particular, the silicon nanophotonics work focuses on the design and fabrication of SOI-based photonic devices using standard lithographic techniques compatible with CMOS-processing.

The Photonics Research Group has been coordinating the network of excellence ePIXnet and is involved in a number of EU-projects, including the FP7 projects ActPhast, PLAT4M, Cando, and Pocket and the H2020 projects TOPHIT, TeraBoard, PIX4Life, MIRPHAB and Phresco. Furthermore, the group is partner of the Center for Nano- and Biophotonics of Ghent University and the group has been awarded three ERC Independent Researcher Starting Grants, one ERC consolidator grant (this PhotonicSWARM project) and one ERC Advanced Investigator Grant.

About the PhotonicSWARM project

The PhotonicSWARM project is a 5-year (2017 – 2022) consolidator grant awarded by the European Research Council (ERC) to Wim Bogaerts. In PhotonicSWARM, Wim Bogaerts researches different architectures for scaling photonic integrated circuits by distributing light over many on-chip optical paths at the same time. This can make optical circuits more robust and create new functionalities that are not possible with simple one-path circuits. Distributed circuits will need some form of control (tuning) to realise the functionality, and as such the system becomes a combination of photonics, electronics and software. PhotonicSWARM looks at different circuit architectures, ways to implement large-scale tuning, and the control algorithms needed to create stable distributed circuits.