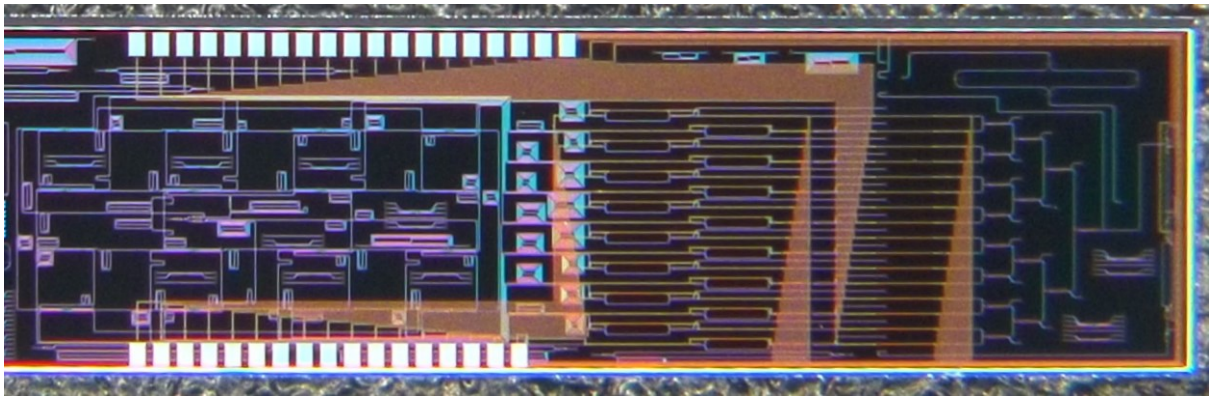
PhD or Postdoc Position in non-conventional photonic computing for telecom and combinatorial optimisation

Ghent University – IMEC, Photonics Research Group
Tech Lane Ghent Science Park – Campus A
Technologiepark – Zwijnaarde 126, B-9052 Gent, Belgium

We are looking for several highly motivated PhD and/or postdoc candidates with a background in photonics and an interest in machine learning or in combinatorial optimisation, for several research projects in the field of **non-conventional photonic computing**.



As a group, we have been active in this field for over 10 years, both at the simulation level and at the experimental level. E.g., we were the first to fabricate silicon photonics chips based on **reservoir computing** (a variant of recurrent neural networks) [Vandoorne et al., Nature Communications 5 3541, 2014]. The main application for this technology that we have been pursuing recently is **telecommunication**. Indeed, we used these neuromorphic chips to show the experimental realisation of nonlinear dispersion compensation in a telecom link [S. Sackesyn et al., Optics Express, 29, 20, 30991, 2021] and [E. Gooskens et al., Scientific Reports, 13, 21399, 2023]. Currently, we are closely collaborating with telecom companies to bring this closer to market. We are looking for highly motivated people to help us in that endeavour, so that we can offload costly processing by digital electronic DSP to analog photonic hardware.

A second strand of non-conventional photonic information processing is related to **coherent Ising machines**. These are based on the idea that the lowest energy state of a well-constructed dynamical system can encode the solution to a complex **combinatorial optimisation** problem. Such problems are very relevant for industry, e.g. for logistics, finance, biomedical research, … . However, finding a solution conventionally requires high-performance computer clusters that consume large amounts of energy and run for a long time. Using photonics, we want to speed up these computationally difficult tasks in a way unlike any current digital computer, i.e. by letting a hardware system with binary variables relax to the minimum energy state, at the same time finding the solution to the optimisation problem. However, more research is needed to achieve this, and we are currently e.g. investigating higher-order or multilevel Ising machines.

In summary, we are looking for **motivated and talented candidates** to strengthen our team and to bring these research lines forward. Based on your skills and interest, we can match you with a current or new research line in our group. We offer you the opportunity to perform cutting-edge, blue-sky research, in a challenging, motivating environment, working within a multidisciplinary team consisting of both photonics people and

computer scientists. A willingness to tackle challenges coming from these multidisciplinary collaborations is a must.

Application:

Please submit your expression of interest with resume and motivation letter via email to Peter.Bienstman@UGent.be

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. Dries Van Thourhout and has been active in photonics device research for many years. The other professors in the group are Roel Baets, Peter Bienstman, Wim Bogaerts, Stephane Clemmen, Bart Kuyken, Nicolas Le Thomas, Yanlu Li, Geert Morthier, Gunther Roelkens and Kasper Van Gasse. The main research directions are silicon nanophotonics, heterogeneous integration, optical communication, neuromorphic computing, photonic (bio)sensors and photonic integrated circuits for biomedical applications in the near-infrared and mid-infrared wavelength range.

The Photonics Research Group has been coordinating the network of excellence ePIXnet and is involved in a number of EU-projects, including the H2020 projects ActPhast4R, AQUARIUS, CALADAN, FUN-Comp, Hydroptics, InSiDe, INSPIRE, MedPhab Pilot Line, MIRPHAB Pilot Line, PIX4Life Pilot Line, MORPHIC, NEBULA, Neoteric, TopHit and PhotonHub. The group also host two EOS Research projects, INTERREG projects and several ITNs (MICROCOMB, OMT, WON, Phonsi). Furthermore, the group is partner of the Center for Nano- and Biophotonics of Ghent University and leads ePIXfab, the European Silicon Photonics Alliance.

The group has been awarded five ERC Independent Researcher Starting Grants, one ERC Consolidator Grant and two ERC Advanced Investigator Grants.