Electronic/photonic integrated circuits for telecommunication applications
Promoter: Gunther Roelkens, Johan Bauwelinck

Silicon photonics has over the last decade emerged as a key integration platform for optical functionality, both in the context of optical communication and sensing. For optical communication devices such as high-speed transmitters and receivers, the dense integration with electronic integrated circuits is of paramount importance for reasons of ultimate bandwidth and power consumption. However, when you can densely integrate photonic ICs with electronic ICs you can also make the optical communication devices more powerful in a sense that new device functionality can be implemented, which on the photonic integrated circuit itself is very difficult to do. In this project we will design and demonstrate such new optical functionalities in the context of multi-mode coherent and microwave transceivers for telecommunication applications. Nowadays, long distance optical communication systems start making use of advanced modulation formats, using both amplitude and phase of the optical wave, to send as much as possible data over a single optical fiber. Modulation formats such as quadrature phase shift keying (QPSK) and 16-QAM put stringent requirements on the optical and electrical components in the receiver. New types of multi-mode or multi-core fibers promise a significant capacity upgrade using space division multiplexing. The most recent demonstrations of such systems rely on expensive optical setups, while a cost-effective fully integrated solution will be needed for large-scale deployments. For this both an advanced optical integrated circuit and a dedicated linear transimpedance amplifier array are required. The dense integration of electronic and photonic integrated circuits is key to achieve very high bandwidth, high aggregated bit rate, small footprint and low-power consumption. Besides multi-mode communication, the developed buildings can also be applied in emerging micro-wave or mm-wave photonic applications for e.g. radio-over-fiber applications in the 5G context.

This PhD project will be a joint PhD project between the Photonics Research Group (design and characterization of the PICs) and the INTEC Design group (prof. J. Bauwelinck, design and characterization of the EICs). This research will involve both electronics and photonics design. If you are interested, with a strong background in electronics chip design, please contact Prof. Gunther Roelkens (gunther.roelkens@intec.ugent.be) and Prof. Johan Bauwelinck (johan.bauwelinck@intec.ugent.be) with your CV and motivation.