Internship subject

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Electro-optic germanium devices for high-speed communications.

Silicon with its mature integration platform has brought electronic circuits to mass-market applications; silicon photonics is going to follow this evolution. Indeed, over the last years, silicon photonics has seen a tremendous increase in research outputs, leading to commercial exploitation potential. Most of these efforts have been devoted to the development of elementary building blocks and complete Photonic Integrated Circuits, which are needed to support the large potential markets. In this context, numerous efficient devices and system based on silicon have then been demonstrated.

However, there are still many challenges to be addressed in order to build photonic functions on an active CMOS circuit. One of the key challenges is the reduction of the power consumption of optical modulators down to few fJ/bit. Several strategies have been developed so far but none has reached the drastic requirements for the next generation of integrated circuits. A promising approach is to use germanium for optical modulation.

In this context, the objectives of the internship will be to design and characterize electro-absorption germanium modulators based on Franz-Keldysh effect in close collaboration with CEA/Leti. Different strategies will be developed in order to achieve high-speed optical modulation integrated in Si waveguide. The candidate will actively interact with CEA/Leti where the devices will be fabricated.

The research activities will include:

- **Theoretical study and electro/optical simulations** to evaluate the characteristics of Ge devices.
- **Experimental characterizations** of optoelectronic Ge structures

During the internship, the student will be actively involved in the current research activity of the group, collaborating with PhD students, postdocs and researchers of different research backgrounds and nationalities.

VALUED QUALITIES IN THE STUDENT

- Curiosity for novel research experiences and fields.
- Creativity and pro-activity in the search for innovative solutions and approaches.
- Attractness in experiments and simulations.
- Capability to communicate and share results in a multidisciplinary and multi-nationality environment.

Bibliographie

- L. Virot et al., Germanium avalanche receiver for low power interconnects, Nature Communications 5, Article number: 4957 doi:10.1038/ncomms5957
- L. Virot et al., Integrated waveguide PIN photodiodes exploiting lateral Si/Ge/Si heterojunction, Optics Express, Vol. 25(16), pp. 19487 – 19496, (2017).
- L. Virot et al. , High-performance waveguide-integrated germanium PIN photodiodes for optical communication applications, Photon. Res. 1, 140-147 (2013) - invited review paper
- L. Vivien et al., "Zero-bias 40Gbit/s germanium waveguide photodetector on silicon," Opt. Express 20, 1096-1101 (2012)"

This project can be continued and expanded within the frame of a PhD.