AUDITORIUM –Institut d'Optique
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université PARIS-SACLAY | Institute for the Sciences of Light

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Colloquium ISL

Silicon photonics in the mid-infrared spectral range for sensing application

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Mid-infrared (mid-IR) spectroscopy is a nearly universal way to identify chemical and biological substances, as most of the molecules have their vibrational and rotational resonances in the mid-IR wavelength range. Commercially available mid-IR systems are based on bulky and expensive equipment, while lots of efforts are now devoted to the reduction of their size down to chip-scale dimensions. The demonstration of mid-IR photonic circuits on silicon chips will benefit from reliable and high-volume fabrication to offer high performance, low cost, compact, low weight and power consumption photonic circuits, which is particularly interesting for mid-IR spectroscopic sensing systems that need to be portable and low cost. Among the different materials available in silicon photonics, Germanium (Ge) and Silicon-Germanium (SiGe) alloys with a high Ge concentration are particularly interesting because of the wide transparency window of Ge up to 15 µm.

In this context, recent works on the development of graded-SiGe photonic integrated circuits will be presented. First passive devices will be reviewed. It will be shown that graded-SiGe waveguides can be used in an unprecedent spectral range, up to 11 µm wavelength. Mach Zehnder interferometers, resonators and integrated Fourier transform spectrometers will be reviewed. Then, the demonstration of large bandwidth optical source on chip based on non-linear optical effects of SiGe waveguides, and the realization of optoelectronic devices (modulator and photodetector) will be presented.