

Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage

Date de la proposition : 22/09/17

Responsable du stage / internship supervisor:	
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Nom du Laboratoire / laboratory name: Centre de Nanosciences et de Nanotechnologies	
Code d'identification :UMR 9001	Organisme :CNRS / Université Paris Sud
Site Internet / web site: http://c2n.universite-paris-saclay.fr/	
Adresse / address: batiment 220, Université Paris Sud	
Lieu du stage / internship place: batiment 220, Université Paris Sud	

Titre du stage / internship title: Active photonic devices for mid IR photonic integrated circuits
<p>Mid-infrared (mid-IR) integrated photonics (i.e. with $2\mu\text{m} < \lambda < 20\mu\text{m}$) is actually a subject of increased emphasis, with a strong potential to revolutionize different application fields. As an example 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 this 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 would 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. Mid-IR photonic circuits on silicon chips can also have important applications for free space telecommunications or military applications.</p> <p>In this context, we develop a new route for the development of chip-scale integrated circuits on silicon for the mid-IR wavelength range, based on Ge-rich SiGe materials. We recently demonstrated the strong potential of this platform for broadband operation in the mid-IR. We also studied nonlinear properties of Ge-rich SiGe waveguides, showing that band-gap engineering can be used to tune the non-linear effects and to exploit diverse phenomena based on nonlinear effects.</p> <p>As a next step we would like to investigate the possibility to command electrically the properties of these integrated devices (by applying an electrical voltage). While electro-optical control of Si based devices in the near IR has been largely studied, very little work has been reported up to now in the mid-IR wavelength range. The main idea will be to use refractive index/absorption coefficient variations by free carrier concentration variations, in order to develop reconfigurable spectrometers. Besides this objective, the development of active devices in the mid-IR can also have a strong impact for other application such as free space communications.</p>

The goal of this internship will be to develop electrically-controlled optical devices such as ring resonators and Mach Zehnder interferometers based on Ge-rich SiGe waveguides, from 5 to 8 μm wavelength.

The research activity will include: <ul style="list-style-type: none">- theoretical study and electro/optical simulations (using commercial software) to evaluate the key metrics for tuning the optical properties of the waveguide modes- experimental characterizations of passive devices developed within the group, using a unique mid-IR optical bench existing in the group The work is done in the framework of the ERC INsPIRE project, in a strong collaboration with Giovanni Isella's group (L-Ness lab (Politecnico di Milano)). <p>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.</p>

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : Oui / YES
Si oui, financement de thèse envisagé/ financial support for the PhD: Projet européen / financement école doctorale

Lumière, Matière, Interactions	<input checked="" type="checkbox"/>	Lasers, Optique, Matière	<input checked="" type="checkbox"/>
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