Mid-IR integrated Nonlinear Optics

INL, CNRS/Ecole Centrale de Lyon

Name of the hosting institution in France: CNRS Centre National de la Recherche Scientifique
Name of the host laboratory / research team: Institut des Nanotechnologies de Lyon
Address: INL – UMR 5270 Ecole Centrale de Lyon – 36 av Guy de Collongue 69134 Ecully Cedex, France
Website: https://inl.cnrs.fr/
Name of the supervisor: Christian Grillet
Function: Head of Mid-IR group
Email: Christian.grillet@ec-lyon.fr
Phone number: +33 4 72186253

Internship offer

Topic of the internship (title): Mid-IR integrated Nonlinear Optics
Proposed dates of the internship: Start 01/10/2023 End 31/03/2024

Scientific and academic objectives of the internship:

The Mid-infrared (Mid-IR) wavelength range - from 2.5 to 13 µm - is currently experiencing a huge surge of interest for an enormous range of applications that affect almost every aspect of our society, from compact and highly sensitive biological and chemical sensors, to imaging, defence and astronomy.

Despite their recognized potential, Mid-IR technologies are still limited in their range of applications, largely because of the bulky size of the Mid-IR devices and the prohibitive costs of the instruments used. Compact Mid-IR optical devices are indeed currently lacking and despite recent breakthroughs related to integrated mid-IR supercontinuum sources, compact and broadband sources in particular are critically missing.

Our strategy is therefore based on the development of an integrated hybrid Mid-IR platform, involving the miniaturization of optical components and their integration on a planar substrate made of materials with remarkable optical properties (particularly in terms of transparency and non-linearities) at MIR wavelengths like SiGe alloys, LiNbO3 or emerging III-V semi-conductors like GaP.

The student’s project will focus on one of the fundamental issues of integrated Mid-IR, namely efficient and broadband MIR sources and their integration into an optical circuit. In this thesis, we will exploit nonlinear phenomena over an unprecedented wavelength range (from visible to Mid-IR). The aim will be to develop an on-chip supercontinuum (and potentially combs) that can cover a broad wavelength span, from the visible to the mid-IR.


Industrial partner

Does the project involve a French industry partner? Yes
Name [Insert here]
Role of the industrial partner in the internship project
Main contact [Insert here]
Email [Insert here]
Main contact industrial partner’s branch in Australia
Email [Insert here]

Australian partner

Is the internship project proposed in the framework of an existing collaboration with an Australian partner university? Yes
Name of the Australian partner institution: University of Adelaide
Lab/department/team involved in the collaboration: Institute for Photonics and Advanced Sensing (IPAS)
Main contact in the Australian partner institution: Andy Boes
Outside of this ongoing collaboration, will students from other Australian universities be considered by the hosting institution in France? Yes

### Expected profile of applicant

<table>
<thead>
<tr>
<th><strong>Level of study</strong></th>
<th>Master</th>
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<tr>
<td><strong>Discipline</strong></td>
<td>Photonics</td>
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<tr>
<td><strong>Prerequisite knowledge, qualities and skills</strong></td>
<td>The required skills for the intern will be a good knowledge and a solid background in the field of optics, nonlinear optics, solid-state physics, and semiconductor devices. S/he should work towards his/her Masters/honours or Engineering degree in a field appropriate to one of these areas. An experience in photonics, clean-room fabrication, material deposition or optical modeling and characterization will be strongly appreciated.</td>
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<tr>
<td><strong>Other specific eligibility criteria</strong></td>
<td>[Insert citizenship requirements, language requirements or other preferences here]</td>
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