

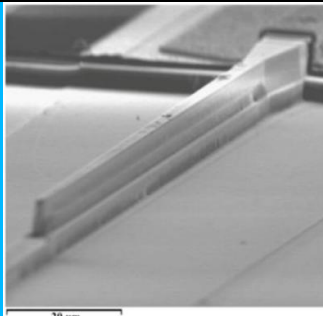
Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : October 8th, 2018

Responsable du stage / internship supervisor:			
Nom / name:	Delga	Prénom/ first name :	Alexandre
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Nom du Laboratoire / laboratory name: III-VLab			
Code d'identification :	Organisme : Thales Research and Technology		
Site Internet / web site:	www.3-5lab.fr		
Adresse / address:	1 av Augustin Fresnel 91116 Palaiseau Cedex		
Lieu du stage / internship place:	Palaiseau		

Titre du stage / internship title: High-speed modulators and detectors for mid-Infrared photonics	
Context <p>Following the rise of Quantum Cascade Lasers (QCLs) [1], mid-Infrared (3-12μm) photonics is now a field of science opening up to many exciting applications: Free Space Optical (FSO) communications, analytical sensing and spectroscopy, LIDAR... However, no practical solution for high-speed modulation and detection of optical signals is available today in this spectral range. Far reaching demonstrations such as frequency comb generation through active mode-locking of QCLs, or tens of GHz range FSO link between ground and space are not possible because of the absence of this crucial building-block</p> <p>The thesis, of which this internship is the first step, will aim at demonstrating external modulation of QCLs, using the Photonic Integrated Circuit (PIC) concepts that have revolutionized the telecom (1.55μm) range in the last decade. The goal is to design, fabricate, and measure record-breaking modulators in terms of speed, RF power consumption & modulation depth, and integrate them with QCL structures in Master Oscillator Power Amplifier (MOPA) architectures.</p> <p>The topic is at a meeting point between profound physical problems (semiconductor physics, optical and radio-frequency electromagnetism...), and cutting-edge technological challenges (nanofabrication...). The thesis will be advised in collaboration between Carlo Sirtori's QUAD group at Ecole Normale Supérieure, specialist on high-speed modulation of QCLs, and the industrial laboratory III-V Lab in Palaiseau, expert in advanced III-V material technologies and devices.</p>	
Missions et objective of the internship <p>Even if the thesis will be dedicated to modulators, the internship will focus on the characterization of high-speed Quantum Cascade Detectors (QCDs) fabricated in waveguide geometry [2].</p> <p>The core of the mission will be high-speed characterization of the devices. However; the intern will also carry out the design of the next QCD generation. Nanofabrication will also be possible for fast students..</p> <p>[1] : Vitiello, M. S. et al (2015). <i>Quantum cascade lasers: 20 years of challenges</i>. Optics express, 23(4), 5167-5182.</p> <p>[2] : Schwarz, B. et al. (2017). "The limit of quantum cascade detectors: A single period device." Applied Physics Letters 111.6 (2017): 061107.</p> <p>[3] : Gilles, C., PhD thesis (2016)</p>	
	
Vertical coupler between two waveguides, one passive (bottom) and one active (top). From [3].	

Your profile <p>Required skills: Pioneering spirit ,Electromagnetism (theory & experiment), Semi-conductor physics.</p> <p>Desired skills: Telecom (theory and experiment), Infrared Physics, Nanofabrication, Waveguides</p> <p>Language : English, (French)</p>

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : Yes, favored option
Si oui, financement de thèse envisagé/ financial support for the PhD: CIFRE

Lumière, Matière, Interactions		Lasers, Optique, Matière	
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Fiche à transmettre (fichier pdf **obligatoirement**) sur le site <http://stages.master-omp.fr>