Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Date de la proposition : 27/11/2018

Responsable du stage / *internship supervisor*:			
Nom / *name*:	Leo	Prénom/ *first name* :	Giuseppe
Tél :	01 57 27 62 27	Fax :	
Courriel */ mail*:	giuseppe.leo@univ-paris-diderot.fr		
Nom du Laboratoire / *laboratory name*:	MPQ (Matériaux et Phénomènes Quantiques)		
Code d'identification : UMR 7162	Organisme : CNRS & Université Paris Diderot		
Site Internet / *web site*: https://www.mpq.univ-paris-diderot.fr			
Adresse / *address:* 10, rue Alice Domon et Léonie Duquet - 75013 Paris			
Lieu du stage / *internship place*: Laboratoire MPQ			

Titre du stage / *internship title*: **Electrically injected optical parametric oscillator on-chip**

The Optical Parametric Oscillator (OPO) is a well-known optical instrument, which from a functional point of view is a coherent, wavelength-tunable source. Like the laser, it is based on an optical amplifier in a resonant cavity. Unlike the laser, it relies on a parametric amplification instead of population inversion. This PhD project aims to demonstrate the first electrically pumped OPO. This will be a major scientific breakthrough because, unlike the laser, whose heterostructure diode version has boosted the field of photonics with a high societal and economic impact, the search for a monolithic OPO with electric injection is still open half a century after the first OPO demonstration.

Today OPOs, pumped by conventional lasers, are available in different temporal, spectral and power formats. Much of the related technology is coming to maturity for several industrial, health and environmental applications, and new commercial products are being introduced to an ever-growing market. However, most of this market is still very research-related, mainly because of the limited portability of current OPOs. This limitation could be overcome by the source that is the subject of this M2/PhD internship, which will emit in the continuous-wave regime in the infrared between 1.5 and 2.5 μm. The source that we will develop is an OPO monolithically integrated to a quantum-well laser diode, the two structures being linked by a vertical coupling. This design, based on these two distinct cavities and two independent temperature controls, benefits from adequate manufacturing tolerances and sufficient degrees of freedom to fulfil the phase matching condition, and is a serious candidate to result the first electrically injected OPO.

In the very competitive field of photonics, the demonstration of such an OPO would be a major breakthrough in the spectral window between 2 and 3 μm, which is widely used for civilian applications such as gas detection, security and medical applications, as well as military applications. The availability of integrated components for this spectral range remains extremely limited, the devices operating in this region being limited to self-contained, narrow-band sources. The availability of such source would bring about a revolution in this field, due to its compactness, broad tunability, energy efficiency and low cost, with a potential impact on sensors for military, environmental or medical surveillance.

This internship will take place within a strong partnership with III-V Lab. The presence of Thales and Nokia's industrial intelligence behind the III-V Lab, with their excellent results in the development of new advanced optoelectronic products, considerably enhances the prospects for the development of this project.

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? :**
Yes

Si oui, financement de thèse envisagé/ *financial support for the PhD***:**
Yes (DGA, CIFRE, EDPIF)

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**