Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage

Date de la proposition : ***21/11/2012***

Responsable du stage / *internship supervisor*:

Nom / *name*: **CASSAN** Prénom/ *first name* : **Eric**

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Nom du Laboratoire / *laboratory name*: **Institut d'Electronique Fondamentale**

Code d'identification : **UMR 8622** Organisme : **Université Paris-Sud / CNRS**

Site Internet / *web site*: **http://silicon-photonics.ief.u-psud.fr/?page_id=1127**

Adresse / *address:* **Bâtiment 220 de l'UFR Sciences d'Orsay, 91400 Orsay**

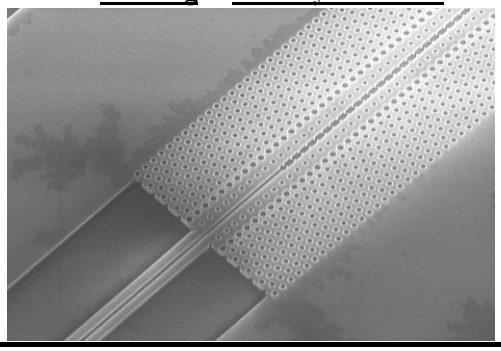
Lieu du stage / *internship place*: **IEF, Bâtiment 220 de l'UFR Sciences d'Orsay, 91400 Orsay**

Titre du stage / *internship title*: **Investigation and design of a slow light Erbium-doped waveguide amplifier in silicon photonics**

Résumé / *summary:*

Some years ago, silicon was seen as poor material for optoelectronics. Since then, impressive progress has been done in the silicon on insulator (SOI) photonics technology. Silicon waveguiding structures just like filters, wavelength demultiplexers, beam splitters, and active devices including fast optical modulators and integrated detectors have been demonstrated. Such progress is envisioned to revolutionize the field of communications and data processing with the convergence of optics and electronics on the same chips, taking part of the advantages of the two technologies. One of the main **remaining problems is yet related to optical losses** in silicon photonic circuits due to device insertion and waveguide propagation losses. **To counterbalance this, amplifying optical signals is vital.** The aims for this are to ensure correct bit error rates in present-technology optical links, and make viable next-technologies like all-optical signal processing. Optical amplification yet faces a strong difficulty related to the indirect bandgap of silicon. At the present time, explored solutions to amplify signals within the silicon technology mainly rely on either the bonding of III/V semiconductor laser diodes on silicon using hybrid technologies, or the use of non-linear phenomena in silicon, but they all face problems of integration or efficiency.

In this context, we have recently submitted and obtained a joint research project between France and China. This project is funded by the ANR (France) and NSFC (China) agencies, respectively, and is based on another approach: the integration of Erbium-doped materials for light amplification in the telecommunication wavelength window. This approach inherits from the strongly established Erbium-Doped Fiber Amplifier (EDFA) technology used in long-haul optical fiber networks. At the chip level, related devices are known as **Erbium-Doped Waveguide Amplifiers (EDWAs)**. The student will participate to the investigation of the possible enhancement of the amplification mechanism by the spatial compression of optical pulses in both slot and slow light photonic crystal waveguides like the one shown just hereafter. **We strongly wish that he/she continues the related studies in a 3 year PhD. We stress here that the funding is already obtained through the ANR project.**



[1] C. Caer, X. Le Roux, V. Khanh Do, D. Marris-Morini, N. Izard, L. Vivien, D. Gao, E. Cassan, "*Dispersion engineering of Wide Slot Photonic Crystal Waveguides by Bragg-like Corrugation of the Slot*", Photonics Technology Letters, vol. 23, n°18, pp. 1298-1300, 2011.

[2] C. Caer, X. Le Roux, E. Cassan, "*Enhanced localization of light in slow wave slot photonic crystal waveguides*", Optics Letters, vol. 37, n°17, pp. 3660-3662, 2012.

(We will be happy to provide you the pdf versions of these papers and discuss with you if you are interested in)

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*:
Already obtained funding by the ANR agency

Lasers et matière	**OUI**	Lumière, Matière : Mesures Extrêmes	
Optique de la science à la technologie	**OUI**	Plasmas : de l'espace au laboratoire	