Spécialité de Master « Optique, Matière, Plasmas »

Stage de recherche (4 mois minimum, à partir de début mars 2012)

Proposition de stage pour l'année 2011-2012

Date de la proposition : 06/10/2011

Responsable du stage / *internship supervisor*:

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

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

Site Internet / *web site*: http://www.ief.u-psud.fr/

Adresse / *address:* Bâtiment 220 de l'Université Paris-Sud, 91400 Orsay

Lieu du stage / *internship place*: à l'IEF, département Photonique

Titre du stage / *internship title*:

"Artificial optical materials made of generalized 2D graded photonic crystals "

Résumé / *summary*

Photonic crystals (PhCs) are artificial materials made of a near-wavelength period corrugation in a dielectric medium. Due to the interference pattern between forward and backward optical waves, unusual physical properties are obtained, just like the photonic bandgap or the particular dispersive properties in allowed wavelength ranges leading to negative refraction, supercollimation, superlensing, and superprism phenomena. Planar PhCs are usually fabricated using semiconductor wafers that are insulated using lithographic techniques, and then etched to define a lattice of air holes in the photonic wafer for in-plane light propagation (and these techniques are available in our lab.).

Already interesting when they are strictly periodic, their properties become completely amazing when a structural gradient is introduced in their structure ('slow' chirp of the lattice parameter or the air-hole filling factor, or any other parameter).
In our group, we have recently begun to address the problem of light propagation in such particular media using the formalism of Hamiltoninan optics [1]. Yet, our study has been restricted to one particular case. To the present date, no theoretical general frame is available in the literature to describe the properties of this class of artificial optical materials. The aim of the work is to initiate this task, relying on the previous steps performed in the group.

The overall idea is being able to adjust a PhC dimensions "on-the-fly" in order to achieve given device functionality just like light polarization splitting or conversion, re-use of space by optical beams, etc. The next goal will be to define a library of effective parameters (index and dispersion as a function of photonic crystal design) for different configurations (slab waveguide, lattice hole shape, etc), making design of new optical functionalities in integrated nanophotonic circuits more straightforward in the future.
The main difference with other works already performed or proposed elsewhere is that PhC considered here cannot be homogenized as the lattice period over wavelength ratio is large (>>0.1).

[1] E. Cassan, K.V. Do, C. Caer, D. Marris-Morini, L. Vivien, "Short-Wavelength Light Propagation in Graded Photonic Crystals", Journal of Lightwave Technology, vol. 29, n°13, pp. 1937-1943, 2011.

We will be happy to provide you the pdf version of this paper 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 : Ecole Doctorale / Graduate School

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