Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 04/11/2013

Responsable du stage / *internship supervisor*:

Nom / *name*: **Belabas** Prénom/ *first name* : **Nadia**

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Nom du Laboratoire / *laboratory name*: **: Laboratoire de Photonique et de Nanostructures**

Code d'identification :UPR 20 Organisme :CNRS

Site Internet / *web site*: http://www.lpn.cnrs.fr/en/PEQ/PEQ.php

Adresse / *address:* **Route de Nozay, 91460 Marcoussis**

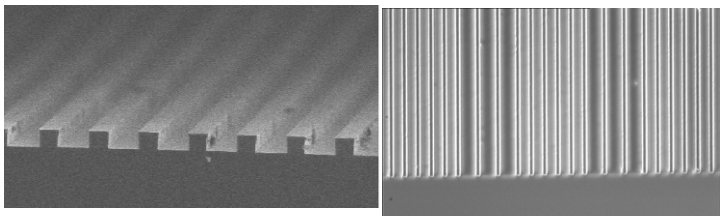
Lieu du stage / *internship place*: **Route de Nozay, 91460 Marcoussis**

Titre du stage / *internship title*:

Discrete integrated classical and quantum optics : exploiting the versatility of on-chip functionalized waveguide arrays

Résumé / *summary*

Light manipulation on-chip promises novel prospects in classical and quantum photonics, due the scalability, stability and flexibility of the photonic platform. One recent direction line in this field is based on bidimensionnal metamaterials



formed by coupled waveguide arrays. In such novel platform, the scalability and stability benefit from the integration of the optical functions on a single planar setting; the flexibility exploits the versatility of the various advanced functionalities achieved via a clever engineering of the waveguide geometry. Analogues of junctions, lenses, wells or waveguides, superlattices or Bragg stacks, etc. can be implemented, opening a new route for all optical signal processing on-chip. In the quantum regime, advanced patterning of the coupling strength between waveguides, enable high-dimensional quantum manipulation, implementing quantum walks, emulating quantum operators or even generating entanglement.

Examples of such 2D waveguide arrays with various coupling strength (right image), processed in LPN clean room.

LPN has launched a research activity in this direction line, by revisiting the field of waveguide arrays. It pioneered a novel design approach, benefiting from a conceptual parallel between optical waveguide arrays and gap-engineered semiconductor quantum wells and superlattices. This novel approach is supported by experimental work on InP-based waveguide arrays processed in the LPN nanofabrication facility. We developed a full corpus of achievable photonic functionalities on-chip (refraction, focalization, beam routing... up to a photonic transistor) taking advantage of the propagation of extended waves (guidonic beams) exhibiting unique propagation features while remaining in the guided regime. We have successfully experimentally demonstrated some linear functions (superguiding, routing). Following analogies with optics and electronics, the internship project will aim at demonstrating a photonic transistor by implementing and controlling via optical nonlinear effects a photonic resonant-tunneling double barrier. The internship will involve design, simulation and characterization with nonlinear optics. This internship may be pursued within a PhD work, aiming at implementing quantum light manipulation on chip. PhD work will involve again design, simulation, nanofabrication and advanced quantum optics experiment (photon correlations...).

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***: Allocation ED**

Lasers, Optique, Matière		Lumière, Matière : Mesures Extrêmes	
Plasmas : de l'espace au laboratoire			