

Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Date de la proposition : 12 décembre 2016

Responsable du stage / internship supervisor:			
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Code d'identification :	UMR 6602	Organisme :	CNRS / UBP /SIGMA
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Adresse / address:	Les Cézeaux, 4 Avenue Blaise Pascal, TSA 60026, CS 60026, 63178 Aubières Cedex		
Lieu du stage / internship place:	Institut Pascal (axe Photon)		

Titre du stage / internship title: Spectroscopy of GaN and ZnO waveguides for the achievement of a polariton laser electrically injected emitting in the UV range

Résumé / summary

One of the aims of the "Optical Spectroscopy of Solids" team is the realization of a UV polariton laser electrically injected at room temperature. This research is carried out within a collaboration between four French laboratories (ANR "Plug-and-Bose" project, November 2016 - March 2020). This component is compact and exhibits a very low threshold; the potential applications are optical switches and transistors, diodes, interferometers and optical routers; it can also be used for intra-chip communications.

Within this project, a solution can be the use of a monomode waveguide to obtain a strong coupling between light and matter and consequently the polaritonic laser emission stimulated by the final state.

This internship is devoted to the evidence of the light-matter coupling in GaN and ZnO waveguides which thickness is about 100 nm; it will be carried out through the following stages:

- From a theoretical point of view, the mode propagation in a planar guide structure will be analyzed by taking into account the cladding and substrate layers. The spatial repartition of modes will be determined and the introduction of a complex dielectric function simulating an excitonic resonance will allow to study the strong light-matter coupling.
- Spectroscopic experiments will be then achieved in order to analyze the optical properties of the guide. The strain of the layer in which the propagation occurs together with the residual impurities will be assessed. The planar guided modes will be identified through polarization measurements of the light emitted from the lateral faces. The comparison between experimental data and calculations will allow to determine the physical parameters of the guiding structure.
- At the end, the study of the coupling between the exciton and the optical mode will be investigated in a sample on which two gratings will be printed for injection and collect of the light. Polariton laser effect in this guide will be also examined through an optical excitation using a pulsed laser.

Perspective: This research activity will continue with the proposal of a thesis on the "**Realisation of a polariton laser electrically injected at room temperature**" within the ANR project "Plug-and-Bose". The funds for this thesis will be obtained through an application deposited by the candidate in May 2017 to the Doctoral School of fundamental Sciences at Blaise Pascal University of Clermont-Ferrand (*contact us for more details*).

Supervisors: François Réveret, Pierre Disseix, Joël Leymarie

Reference: O. Jamadi *et al.*, Phys. Rev.B **93**, 115205(2016).

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

Si oui, financement de thèse envisagé/ financial support for the PhD: Bourse de l'Université Blaise Pascal de Clermont-Ferrand (Université Clermont Auvergne à partir de 2017)

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