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 :

Responsable du stage */ internship supervisor*:

Nom / *name*: Prénom/ *first name* :

Tél : Fax :

Courriel */ mail*:

Nom du Laboratoire / *laboratory name*: Institut d'Electronique Fondamentale (IEF),

Code d'identification : UMR 8622 Organisme :

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

Adresse / *address:* Bat 220, Campus Scientifique, 91405 ORSAY CEDEX

Lieu du stage / *internship place*: B 111

Titre du stage / *internship title*: ***Modeling the optical properties in Ge/SiGe Multi Quantum Well***

Résumé / *summary*

The interest in silicon photonics is continuously growing as it is now considered to have potential applications in telecommunication and data communications. Among the main challenges for the development of silicon photonics, high speed, low loss and compact modulators are one of the key building blocks. In this context, Ge/SiGe multiple quantum well structures are a promising solution to get compact and low power electro-absorption modulator. The preliminary results allowed us to demonstrate experimentally Quantum Confined Stark Effect (QCSE) at room temperature for light incident perpendicular and parallel to the QW planes. In order to get further in the design of efficient optoelectronic structures, theoretical calculation are required in order to get direct gap-related optical and optoelectronic properties of these structures. The goal of this internship is to **develop the theoretical models,** and to **compare the results with the experimental results** obtained in the lab, in collaboration with Politecnico Milano Italia. This work is part of ANR project GOSPEL.

The main objective of the work is to assess the optical properties of such MQW as a function of the structure geometry including strain and electric field-induced confinement effect. A 6-band k.p technique will be used to estimate the direct bandgap transitions within Γ valley and next the indirect transitions to L valleys [2].

The secondary objective is to explore the carrier dynamics and transport properties in such structure to evaluate their high frequency performance. This part of the work will be achieved by using the particle Monte Carlo simulator developed in our group [3].

[1] P. Chaisakul, D. Marris-Morini et al, Polarization dependence of Quantum-confined Stark effect in Ge/SiGe quantum well waveguides, Optics letters, 36 (10), 1794-1796 (2011).

[2] Modélisation du transport sous contrainte mécanique dans les transistors sub-65 nm pour la microélectronique CMOS, K. Huet, Thèse de Doctorat en Sciences, Université Paris-Sud Orsay, 29 septembre 2008

[3] D. Querlioz, J. Saint-Martin, K. Huet, A. Bournel, V. Aubry-Fortuna, C. Chassat, S. Galdin-Retailleau, P. Dollfus, "On the ability of the particle Monte Carlo technique to include quantum effects in nano-MOSFET simulation", IEEE Trans. Electron Devices 54 (2007) 2232-2242

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***: ED, ANR**

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

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