CONACYT program 2015

PhD project proposal form

Discipline
Engineering Sciences, Electronics

Doctoral School
422 - Sciences and Technologies for Information, Telecommunications and Systems

TITLE: Simulation of InAs Ultra Thin Film- Metal Oxide Semiconductor FET

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RESEARCH INSTITUTE: Department nano-electronics, Institut d'Electronique Fondamentale (IEF), UMR8622, ORSAY, France.
RESEARCH GROUP: COMputationnal electronICS group (http://computational-electronics.ief.u-psud.fr)

Summary
The continuous miniaturization of CMOS Silicon devices, known as the Moore's law, has faced an intense power consumption crisis for a few years. Within this context, achieving low voltage FETs that can work at much lower voltage than Si MOSFETs while providing high frequency performance are highly sought. The ANR project MOSINAS propose to associate **InAs and GaSb materials** which present the largest electron and hole mobility respectively, to build **new complementary transistor technology**. It involves strong collaboration with experimental and theoretical groups belonging to academic laboratories and also STMicroelectronics. Involved in the **simulation aspect of the project**, the PhD student will have in charge the development a device simulator based on a **particle Monte Carlo** approach which allows studying the out of equilibrium transport and quantum confinement effects in both static and RF regime. The algorithm will be calibrated to fit experimental data available in the project.

Scientific Context
The continuous miniaturization of CMOS Silicon devices, known as the Moore's low, tends to reach its limit and CMOS technology has faced an intense power consumption crisis for a few years. Within this context, achieving low voltage FETs that can work at much lower voltage than Si MOSFETs while providing high frequency performance are highly sought. InAs material exhibits the highest electron mobility among III-Vs and can be co-integrated with GaSb-based compounds that present the largest hole mobility among III-Vs. These two materials could thus be associated to build new complementary transistors..

Objectives
The proposed thesis is directly related to the project MOSINAS which aims to study UltraThin Body MOSFETs with buried InAs channel on 300 mm silicon wafer. It will be performed under the support of the French National research agency (ANR) and involves strong collaboration with experimental and theoretical groups belonging to academic laboratories (IEMN, IMEP et CEA LETI) and one semiconductor industry (STMICROELECTRONICS).
The candidate will have in charge the development a device simulator based on a particle Monte Carlo approach (MC) which allows studying the out of equilibrium transport and quantum confinement effects.

It has been widely and successfully used to catch out-of equilibrium effects in both static and RF regime. The algorithm will be calibrated to fit experimental data provided by the experimental groups involved in the project.

Skills learned during the thesis

Student will acquire a broad range of skills: in solid state physics (band structure, phonon spectrum, electron transport, electron-phonon interaction and phonon-phonon interaction), technology devices, and scientific programming (Fortran and / or C / C + +, Matlab).

Candidate's Profile

Successful candidates must have a MSc in Physics, Electronics, Materials Science or related disciplines. We are seeking creative and highly motivated individuals well trained and skilled in scientific research, and available to collaborate in an interdisciplinary team. Computational programming experience is also desirable, but not mandatory.

How to apply

Please join a CV, a list of courses that you have followed and results of exams in the framework of your master program, and any other information that you judge useful.