

**Research field:** Solid state physics, surfaces and interfaces / Solid state physics, chemistry and nanosciences  
Theoretical Physics / Theoretical physics

**Title:** Modeling electronic transport in semiconductor nanowires

**Abstract:** The characteristic size of the transistors on a processor has steadily decreased over the years and now reaches ~ 22 nm. In 2016, the transistors will likely resemble, in a way or the other, to semiconductor "nanowires" with diameter < 10 nm, in which the potential and current are precisely controlled. At this scale, the physics of the devices becomes very complex, and shows signatures typical of quantum mechanics, such as confinement and tunneling.

In this context, theory and modeling are expected to play an increasing role in the exploration of innovative concepts for micro-electronics. The objective of this PhD thesis is to model and understand the transport properties of semiconductor nanowires, and to assess their potential for ultimate transistors. The most versatile approach for that purpose is the non equilibrium Green's functions method. It describes, in a quantum framework, the non-linear (high electric field) response of nanowires to all kinds of perturbations, such as surface roughness, impurities or electron-phonon coupling (lattice vibrations). The candidate will use a non equilibrium Green's functions code developed at the laboratory. This code is at the state of the art and allows the modeling of realistic systems with unprecedented accuracy. It has received a prize in 2012 for its achievements on national high performance calculators ([http://bull-world.com/v\\_8mrVJ\\_en](http://bull-world.com/v_8mrVJ_en)). The results will allow a better understanding of the physics of the the nanowire transistors fabricated and characterized at CEA/LETI, and to make original proposals for new devices. The candidate will also be given the opportunity to collaborate with the French and European partners of the CEA in this topic.

**Location:** Institut nanosciences et cryogénie  
Service de Physique des Matériaux et Microstructures  
Laboratoire de Simulation Atomistique  
Starting date: 01/10/2013  
Centre : Grenoble

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**More about:** [http://inac.cea.fr/L\\_Sim/Qui/YMNiquet/](http://inac.cea.fr/L_Sim/Qui/YMNiquet/)  
[http://inac.cea.fr/L\\_Sim/](http://inac.cea.fr/L_Sim/)  
<http://en.wikipedia.org/wiki/Nanowire>

**University/Graduate School:**

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Grenoble I (UJF)

Ecole Doctorale de Physique de Grenoble - Grenoble I -

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**Thesis supervisor:**

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