



## Laboratory for Nanotechnology and Optical Instrumentation (LNIO)

### & Laboratory of Research in Nanosciences (LRN)

#### PhD project: Nanowire-based high gain photodetectors

This PhD project is part of a research program called 'NanoGain' aiming at the fabrication and characterisation of high gain photoconductors based on semiconductor nanowires. Recently, such nanostructures have come across as being very good photodetectors, with a very high internal gain (current/light conversion), and could be as efficient as state of the art photodetectors. However, the true measurement of the photoconductive gain of such nanowires is still challenging and the purpose of the 'NanoGain' project is threefold: 1) to grow, functionalise and characterise high gain nanowires 2) to develop a single photon source 3) to integrate both onto a plasmonic waveguide platform to efficiently channel the light from the single photon source to the nano-detector.

The PhD candidate will be mainly in charge of the nanowire photodetector fabrication and characterisation (the nanowires will be grown by other project members). A microphotoluminescence experiment at room and low temperature will be used to characterise various semiconductor nanowires (II-VI and III-V based), with different doping concentrations and dimensions. Surface functionalisation will be required to improve and control the nanowire gain. This will require the fabrication of metallic contacts and structures for the plasmonic platform. Structural, as well as optical and electrical characterisations will be performed using various techniques available in the labs, namely photo- and electro-luminescence, AFM and TEM and Kelvin probe microscopy. The results and perspectives for this project are a better knowledge of light-matter interaction at nanometer scales as well as a better understanding of the physical phenomena responsible for the high internal photoconductive gain in semiconductor nanowires. This project is mostly experimental although some simulation may be required to better understanding the nanowire response.

The student will be under a co-supervision: Christophe Couteau from the French Technological University in Troyes (UTT/LNIO) and Louis Giraudet from the University of Reims-Champagne (URCA/LRN). Collaborations with GEMaC at the University of Versailles-St Quentin, CINTRA, French-Singaporean laboratory in NTU in Singapore as well as with Prof Robert Taylor from the University of Oxford will be expected during the project.

**Dates:** Starting date is flexible from September 2013 onwards.

**Funding:** 3 years secured funding from the Champagne-Ardennes region council. Project "NanoGain" within the framework of the region call 'Emergence'. The selection of the candidate will be very severe.

**Preferred skills:** semiconductor optics, material sciences, optoelectronics, quantum optics

**Contact :** Please send a CV, Master's results, 2 recommendation letters and a motivation letter to the project leader Christophe Couteau, [couteau@utt.fr](mailto:couteau@utt.fr)

**QuantumNanoDevices (qnD):** [www.quantumnanodevices.com](http://www.quantumnanodevices.com)

