

# MSc and PhD Projects in Electrical Engineering

Beginning: January and May 2019

## *Interdisciplinary Institute for Technological Innovation (3IT)*

Department of Electrical and Computer Engineering

Université de Sherbrooke, Québec, Canada

**Laboratory:** Quantum Semiconductors and Photon-based BioNanotechnology

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**Subject 1: Nanostructuring of III-V semiconductors with *in situ* passivated surfaces**

**Subject 2: Spectroscopy of self-assembled monolayers on digitally photocorroded surfaces of GaAs/AlGaAs nano-heterostructures**

**Subject 3: Development of a regenerative biosensor employing stacks of III-V quantum well microstructures**

### Projects summary

Members of the Quantum Semiconductors and Photon-based BioNanotechnology Laboratory of the **Interdisciplinary Institute for Technological Innovation (3IT)** have been involved in fundamental and applied research related to physics and chemistry of surfaces and interfaces of III-V quantum semiconductor microstructures. One of the axes of the related research concerns exploration of the so-called digital photocorrosion (DIP) effect. Some members of the group have recently patented the application of DIP for biosensing.<sup>1</sup> However, the ramification of this discovery goes much further due to the significant potential of the DIP process in applications addressing construction of unique organic-inorganic interfaces and fabrication of nano-scale devices unattainable with current manufacturing technologies.

**Subject 1** and **Subject 2** are **MSc level projects** designed to address some of the challenges of the surface passivation of III-V semiconductors that plays a critical role in the operation of nano-scale opto-electronic devices based on III-V semiconductors and, e.g., in delivering highly efficient quantum wire lasers. The fabrication of a “**defect-free**” **graphene-GaAs interface** is one of the exploratory subjects addressed in the frame of these activities. Both these projects are offered to physics or electrical engineering students with a background in solid-state physics.

The content of **Subject 3** is related to a biosensing project carried out in collaboration with Health Canada and supported by Defence Research and Development Canada. We are looking for a **PhD candidate** capable of undertaking research focused on advancing the concept of a **regenerative biosensor**. In addition to basic knowledge of solid-state physics, the skills required concern rigorous data collection, modeling (COMSOL), independent thinking and initiative, openness to the interdisciplinary character of the research and interest in working with biological samples. This candidate will take advantage of collaboration with an instrumentation engineer and a biotechnologist.

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Dubowski, J.J.; Nazemi, E.; Aithal, S.; Huang, X., Photo-electrochemical sensing method using photoluminescence-emitting semiconductors. *Patent 2018, US 10,001,480 B2*.