# Development of AlGaN nanostructures for electron-pumped UV light emitting devices

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**Stage pouvant se poursuivre en thèse :** Oui

**Résumé :**
The student will participate in a project to develop a new concept of UV lamp based on electron pumping of AlGaN nanostructres. Within this project, the master student will be in charge of the fabrication of AlGaN-based nanowires emitting in the UV-B and UV-C ranges, their structural and optical characterization, comparison of the results with theoretical calculations using a commercial software, and finally comparison of the performance of such nanowire structures with quantum wells and quantum dots available in our laboratory.

**Sujet détaillé :**
Our project is a contribution to the development of high-brightness, mercury-free, 100% recyclable and high-gloss UV lamps. UV disinfection is usually carried out using discharge lamps containing large quantities of mercury, a highly toxic substance strictly regulated by EU directives. The currently explored alternative consists of UV (LED UV) light emitting diodes based on AlGaN semiconductors. However, after more than 15 years of R&D, the UV LED technology is progressing very slowly, and comparative studies show that it is still far from rivaling the mercury lamp. The performance of UV LEDs remains limited by two major problems: the high activation energy of the dopants in the AlGaN and the diffusion length of the holes in these materials, extremely smaller than that of the electrons.

To circumvent the problems associated to the UV LED technology, we propose to pump an active region based on AlGaN nanostructures with an electron beam. In such a configuration, electrons and holes are generated throughout the active medium with the same spatial distribution, without the need for doping or electrical contacts.

Within this project, the master student will be in charge of (i) fabrication of AlGaN-based nanowires emitting in the UV-B and UV-C ranges, (ii) structural and optical charterization, (iii) comparison of the results with theoretical calculations using a commercial software, and (iv) comparison of the performance of such nanowire structures with quantum wells and quantum dots (available in our laboratory).

The strudent will be trained in the use of molecular-beam epitaxy, scanning electron microscopy, photoluminescence, cathodoluminescence and modeling of the electronic structure using the Nextnano commercial software.

**Compétences requises :**
Knowledge of semiconductor physics and taste for experimental work.