

PhD in Near-UV Photonic Integrated Circuits (PIC)

Starting date: From September 2022

Supervisors: Loïc Bodiou, Stéphane Trebaol, Joël Charrier

Research team: Photonic Systems at Foton Institute - Lannion - France

Context

NUV (near ultraviolet) photonic devices, like coherent sources and optical functions, may open up applications in sensing for biomedical, environment, and security applications. Coherent sources in the NUV would enable the development of quantum technology based sensors by probing the rich variety of molecular and atomic spectral features in this uncovered wavelength range.

Photonic integrated circuits (PIC) have allowed size and cost reduction of optical functions at telecom wavelengths. The development of PIC operating at NUV wavelengths would therefore address new paradigm in optical frequency metrology, quantum optics and sensing.

Our research group aims at laying the foundation towards chip-scale integration of photonic circuitry in the near ultraviolet range.

Objectives

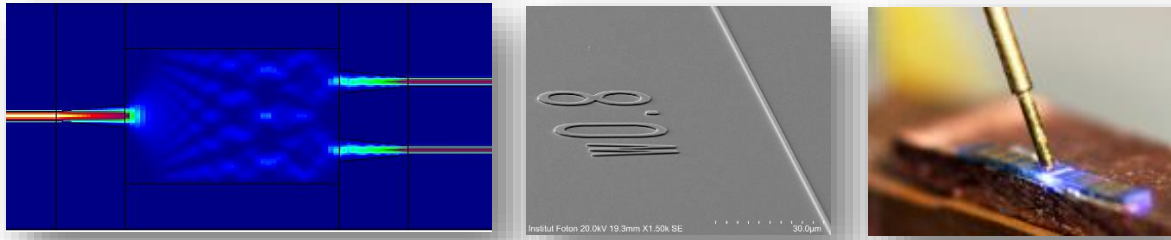
This PhD project concerns the design, fabrication and characterization of building blocks like GaN laser diode (LD) and associated integrated optical functions using UV-transparent materials platforms. It takes part at the early stage of a new trend in photonics to transpose integrated functions and components, first demonstrated at telecom wavelengths, to the blue and ultraviolet domains.

Following the hybrid approach developed at 1.55 μm consisting in the heterogeneous integration of III-V optical active functions on Si waveguides, III-Nitride lasers might be reported on Si-like platforms by molecular bonding offering a playground to design innovative devices. This work, combining integrated optical functions simulation, fabrication and experimental optical characterizations will be performed at Foton Institute in Lannion (France).

Research program

The PhD project will be decomposed in work packages:

- Building a library of various passive optical functions (waveguide, (de)multiplexer, ring, etc.) and chip based single mode GaN laser diodes
- Processing of optical functions in clean room environment on various material platforms
- Characterizing optically the fabricated structures in the blue/near-UV wavelength range



a) Multimode interferometer (MMI) designed at 405 nm (Foton Institute). b) SiON waveguide processed at Foton Institute. c) GaN laser diode fabricated at EPFL (Switzerland) and characterized at Foton Institute.

Qualifications

Candidates should have good knowledge in the areas of optics, material processing and physics. A previous experience in integrated optics or laser physics would be greatly appreciated. The ideal profile would combine interest for experimental work and for modelling and simulation works. Good interpersonal and communication skills in French or English are required. The applicant must hold an internationally recognized Master degree.

About the Institut FOTON (CNRS, UMR6082)

The Institut FOTON is a research unit of the French National Centre for Scientific Research (CNRS) associated to University of Rennes 1 and the National Institute for Applied Sciences (INSA) of Rennes. FOTON is composed of three research teams: the "Optoelectronics, Heteroepitaxy and Materials" team, the "laser Dynamics, microwave photonics, Polarimetry, terahertz, imaging" team located in Rennes, and the "Photonic Systems" team located in Lannion. The two cities are located approximately 170 km apart, in the province of Brittany, Western France. Photonic Systems team (~50 people) is involved in research on laser physics, and in particular on the experimental demonstration of new functionalities that could potentially contribute to overcoming the challenges related to sensors sensitivity, telecom capacity and guided optics (fibers and integrated photonics) in particular for sensing and nonlinear applications. The group has an established reputation in the area of laser physics and mid-IR integrated photonics. All the simulation and experimental (processing and optical characterizations) tools required for the project completion are available within the Photonic Systems Team in Lannion.

The successful candidate will carry out research in Lannion (France).

More information about FOTON can be found at: <http://foton.cnrs.fr>.

Application procedure

Please submit your application at your earliest convenience by e-mail to:

stephane.trebaol@univ-rennes1.fr ; loic.bodiou@univ-rennes1.fr ;

joel.charrier@univ-rennes1.fr

Your application should include:

- Cover letter
- Detailed CV
- Name and contact details of two potential referees with recommendation letters
- Grade transcripts
- List of publications, if applicable