Laboratoire Hubert Curien
UMR ▪ CNRS ▪ 5516 ▪ Saint-Étienne

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INGÉNIERIE SANTÉ
UNIVERSITÉ DE LYON

ÉCOLE DOCTORALE
488

**PhD position - MOPERE team**

# "Radiation effects on opto-electronic technologies"

**Location**: Laboratoire Hubert Curien UMR CNRS 5516
( https://laboratoirehubertcurien.univ-stetienne.fr ), Université Jean Monnet Saint-Etienne
( https://www.univ-st-etienne.fr )

**Start date**: October 1st, 2024

**Application deadline**: March 15th, 2024

**Supervisors**:
Maxime Darnon ( maxime.darnon@univ-st-etienne.fr ),
Sylvain Girard ( sylvain.girard@univ-st-etienne.fr ).

**Keywords**: Optoelectronics, radiative environment

## Context

Whether in the space environment, that of particle accelerators, or nuclear reactors, optoelectronic components are exposed to radiative environments which modify their properties, change their behavior, and can induce failures with potentially dramatic consequences. [1]. Nevertheless, optoelectronic components remain essential and are taking a growing place due to their ability to convert light into electrical energy and vice versa. This property is used to power satellites (solar cells) or transmit energy by light ("Power over fiber") [2].
In this context, it is important to understand how different types of radiation (gamma, X-rays, electrons or protons) modify the properties of optoelectronic components, and what are the consequences of these modifications on the functioning of the systems that use them.
Among French university laboratories, the Laboratoire Hubert Curien, more specifically the Materials for Optics and Photonics in Extreme Radiative Environments (MOPERE) team, is one of the major players in the study of modifications of photonic technologies in radiative environments.[3] By relying on cutting-edge irradiators and characterization tools, and in collaboration with industrial and institutional players in the field, the MOPERE team combines an experimental and modeling approach to improve the understanding of radiative effects on optical and photonics components. With this doctoral thesis, the research team will extend its field of study to optoelectronic devices and systems.

## Ph.D. thesis objective

The objective of this doctoral thesis is to identify the mechanisms at play in the modification of optoelectronic components exposed to radiation.
This experimental doctorate will aim to set up and apply an irradiation/characterization protocol for optoelectronic components. The components will be characterized during irradiation by different types of particles (high-energy photons, protons, electrons) to highlight the degradation induced by radiation during their missions.
This experimental approach will be applied to several optoelectronic components, notably multijunction solar cells used in space, but also components of optical power transmission systems (laser diodes, optical fibers, photo transducers). The complete and assembled systems will also be studied to identify, under real conditions of use, the interactions between the components most impacted by the modifications induced by radiation.
All of these studies will clarify the degradation mechanisms of optoelectronic components and systems operating in radiative environments, and will open up research perspectives for more complex systems.

## Required profile

The candidate will hold a Master's degree in Physics, Materials Science, or an equivalent, with preferably a specialization in optics or optoelectronics. The applicant must demonstrate an excellent academic level compatible with pursuing doctoral studies.
The candidate must have a pronounced taste for experimental research, demonstrate initiative, autonomy, scientific curiosity and strong motivation to pursue a 3-year doctorate. Able to express orally and in written English, communication and cooperation skills will be an asset to the applicant.
The candidate will be enrolled in the doctoral school of the Université Jean Monnet "Sciences, Ingénierie, Santé" EDSIS488 ( http://edsis.universite-lyon.fr ).

## How to apply

Applications should be sent to supervisors by email (maxime.darnon@univ-st-etienne.fr and sylvain.girard@univ-st-etienne.fr) by March 15th, 2024, and must contain a cover letter, a curriculum vitae and a copy of master's transcripts available on the date of application. Applications will be processed upon receipt, and applicants are encouraged to apply without delay.
The recruitment procedure includes an audition in mid-May 2024 by the doctoral school of the selected candidates. The thesis start date is October 1st, 2024.

## References


1. Johnston, A. H. (2013). Radiation effects in optoelectronic devices. *IEEE Transactions on Nuclear Science*, *60*(3), 2054-2073.
2. Matsuura, M. (2021, August). Recent advancement in power-over-fiber technologies. In *Photonics* (Vol. 8, No. 8, p. 335). MDPI.
3. Girard, S., Kuhnhenn, J., Gusarov, A., Brichard, B., Van Uffelen, M., Ouerdane, Y., ... & Marcandella, C. (2013). Radiation effects on silica-based optical fibers: Recent advances and future challenges. *IEEE Transactions on nuclear science*, *60*(3), 2015-2036.