

PhD position within the MOPERE team

## Characterisation of dosimeters based on optical materials for extreme radiation environments

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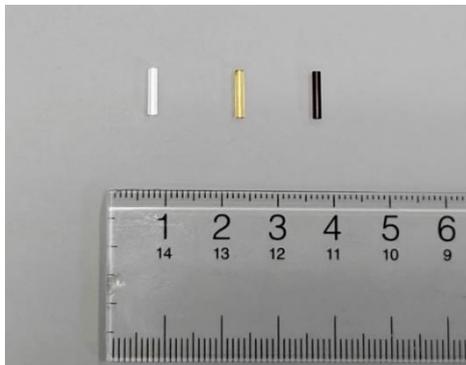
**Duration:** 36 months

**Location:** Saint-Etienne, France

**Expected start date:** Oct 2<sup>nd</sup> 2023

### Description

Reliable dosimetry represents a key technology for a wide range of applications operating in high-radiation environments, such as those generated by particle accelerators, high-power targets, fission and fusion technologies, medical physics and relative to space missions and to the radioactive waste management. Together with the development of such technologies, the doses to be measured in these conditions are becoming increasingly challenging, and in most cases delivered by complex mixed radiation fields.



Dosimeters based on optical materials such as optical fiber-based ones and Radio-photoluminescent glasses often lack adequate and complete characterization for use at high-doses, specifically in the MGy range. In particular, detailed information on the response dependence on several irradiation and environmental parameters such as dose rate, radiation type or temperature is needed. Within this context, characterization studies on existing and new dosimetry technologies are currently necessary for a wide range of applications already existing and under development.

Darkening of Radio-Photoluminescence dosimeters irradiated at different dose levels at CERN. Courtesy: Y.Aguiar (CERN)

The MOPERE (Materials for Optics and Photonics in Extreme Radiation Environments) team of the *Hubert Curien Laboratory* (University Jean Monnet UJM in Saint-Etienne, France) focuses on the study of optical materials. The PhD will be developed within the MOPERE team, which is currently expanding its research activities on this topic.

**This PhD topic is focused on:** the characterization of the radiation response of Radio-Photoluminescence dosimeters, Optical Fiber-based dosimeters and other dosimeters of interest in different irradiation conditions, for both passive and on-line use and with special focus on high-radiation applications.

## Topics and activities that are covered by this PhD

- Experimental characterization of dosimeter response under irradiation (on-line) and post-irradiation, using the in-house X-ray sources available at MOPERE;
- Use of the laboratory equipment required for various measurements, such as spectrometers, optical fibers, lasers, various types of light sources, LEDs;
- Organization and realization of irradiation campaigns in different radiation environments, such as gamma sources, high-energy neutrons, proton and electron beams, and in collaboration with external facilities and through scientific collaborations;
- Experimental study of the dosimeter response (during and after irradiation) as a function of different parameters: dose rate, temperature, atmosphere...
- Analysis of collected results to deepen the knowledge of radiation-induced effects in the selected dosimeters.

The investigated phenomena will be tackled with a multi-scale approach, ranging from the understanding of radiation to matter interaction to the development of complete and integrated devices operating in radiation environments.

This project will be partly executed in collaboration with the European Laboratory for Nuclear Research (CERN, Switzerland). One of the goals of this PhD is to contribute to the use of such dosimeters in real application conditions, e.g. accelerators and experimental areas of CERN, and for the development of integrated dosimetry solutions.

## Requirements

We are looking for candidates having the following requisites:

- An MSc or equivalent in applied/experimental physics, engineering or materials science.
- Analytic and experimental skills proven by MSc-work or work experience.
- Affinity with practical work to run experiments.
- Flexible attitude and adaptability towards the operation of experimental settings.
- Positive attitude towards a multidisciplinary environment with multiple stakeholders.
- Good knowledge of the English language (oral and writing) or of French language.
- Good communications skills (soft-skills).

The following additions would be a great asset:

- Background in radiation physics/optics/photonics.
- Experience with dosimetry.
- Experience with Monte Carlo simulation tools such as PHITS, FLUKA, Geant4, MCNP.
- Experience with programming such as Matlab, C++.

## The Hubert Curien Laboratory and the MOPERE team

The *Hubert Curien Laboratory* is a Joint Research Unit (UMR 5516) of the National Center for Scientific Research CNRS and the UJM, located at 18 Rue Professor Benoît Luras in Saint-Etienne, and administratively attached to the Faculty of Science and Technology of the UJM.

Additional information on the Hubert Curien Laboratory and its MOPERE team can be found at the following link:

<https://laboratoirehubertcurien.univ-st-etienne.fr/en/teams/materials-for-optics-and-photonics-in-extreme-radiation-environments.html>

## Deadline

The application deadline is May 31<sup>st</sup> 2023.

## Contact

For more information on this position, please contact:

Prof. Matteo Ferrari (PhD Thesis Supervisor)

[matteo.ferrari@univ-st-etienne.fr](mailto:matteo.ferrari@univ-st-etienne.fr)

## How to apply

Applicants should send the following documents directly to Prof. Matteo Ferrari:

- A complete CV;
- A cover letter;
- A copy of a valid ID document (ID card, passport...)

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**Note:** All employment at the Hubert Curien Laboratory is decided on the sole basis of qualifications, competence, integrity and organizational need. All are encouraged to apply to job openings regardless of their origin, identity, health, beliefs and orientations.