Postdoctoral Position in medical physics (M/F)

"Spatio-temporal optimization for the development of innovative radiation therapy"

The hosting structure

Institut Curie

The Institut Curie (IC), founded by Marie Curie in 1909, is a comprehensive cancer centre accredited by OECI employing more than 3500 researchers, physicians, medical physicists and nurses all dedicated to the fight against cancer. IC has therefore a long-standing history of basic and translational radiation research and is a major player in the research and fight against cancer. One objective of the IC is also to develop basic research and to use the knowledge produced to improve the diagnosis, prognosis, and therapeutics of cancers as part of the continuum between basic research and innovation serving the patient. This position will be associated with a research project led by Institut Curie, whose goal is to develop new methods for radiation therapy treatments, and their application to spatially and temporally optimised radiotherapy. This is an exciting opportunity to join the radiation therapy research activities in Orsay, within both the hospital and the research center.

Context

Laboratory

The Laboratory of Translational Imaging in Oncology (LITO) is a research unit (U1288) supported by Inserm (= French NIH) and Institut Curie, the first cancer center in France (*https://www.lito-web.fr/*). LITO has approximately 30 researchers, including physicists, engineers, physicians, pharmacists, and technologists. The Orsay Proton therapy Center (CPO), founded in 1991, is part of the radiation oncology department at Institut Curie hospital group, which is one of the European-wide recognition as a Comprehensive Cancer Center of excellence.

Position

Radiotherapy is currently one of the main techniques used for the treatment of cancer. During the last thirty years, numerous technical advances have allowed to considerably improve the conformation of the irradiations to the specific characteristics of each tumour and to reduce their side effects. Nevertheless, the tolerance of healthy tissues remains the main limitation of this type of treatment, especially in the case of particularly radiosensitive patients, such as children, or radioresistant tumours for which the control of the side effects of radiotherapy remains a major therapeutic challenge. The development of innovative approaches that reduce the sensitivity of healthy tissues to irradiation while maintaining the efficacy of the treatment on the tumour is therefore of crucial importance for the progress of the efficacy of radiotherapy. Recently, pioneering work at the Institut Curie has demonstrated that ultra-high dose rate irradiation (so-called FLASH) has a major healthy tissue sparing effect - while preserving anti-tumour efficacy (Favaudon et al 2014).

Within the radiation oncology department and LITO team based at the Institut Curie- Hospital Orsay (91), the medical physics' team is recruiting a postdoctoral fellow, with a strong interest in translational research on cancer treatment. As part of the activities of this project, the applicant would be expected to conduct research in optimizing cancer therapy, especially in radiation oncology using innovative techniques (FLASH, protons, and electrons).

Indeed, in radiotherapy, many irradiation parameters can be adjusted to target the tumor as effectively as possible, while sparing healthy tissue through which the radiation passes. Inverse optimization in radiotherapy is then a technique used to determine the optimal radiation dose distribution to treat the tumor while minimizing damage to surrounding healthy tissue. A complex mathematical model is used and solved to adjust treatment parameters (such as radiation beam intensity or weights, energy, dose rate, or direction) to meet these objectives. However, all the criteria cannot be optimized at the same time. Obtaining the trade-offs is then an active area of research as automation of this process is essential for multi-criteria problems, where a Pareto optimal solution is needed. With the advent of new scanned-beam techniques with intensity modulation, and the multiplication of possible parameters for treatment plan optimization (time dependent such as the dose rate), studies on inverse treatment plan optimization algorithms are needed to find the best possible configuration of radiation parameters that will satisfy the predefined medical criteria for the patients. The goal of this project is to develop new sets of optimization algorithms that can be used in FLASH radiotherapy treatment planning studies and take into account possible biologically effective dose models.

Candidate Profile

The candidate must hold a PhD in (computational) physics, (applied) mathematics, operational research, or a related discipline • Preferred expertise and experience in one or more of the following areas: programming skills (MATLAB, Python, C++, TensorFlow, PyTorch) – Numerical– Measurements – Treatment planning – Optimization – AI methods. You will also be expected to have experience in working as part of a multidisciplinary team.

All our opportunities are open to people with disabilities

Contract information

Type of contract: *Fixed-term contract.*
Starting date: *as soon as possible*
Duration: *24 months*
Working time: *full time- number of days*
Remuneration: according to the current grids
Benefits*:* Collective catering, reimbursement of transportation fees up to 70%, supplementary health insurance
Location of the position: *Orsay*
Reference: *not to be completed*

Contact

Please apply by e-mail (CV + application letter + references/support letter) to ludovic.demarzi@curie.fr

Deadline for application: 30th Dec 2024

Institut Curie is an inclusive, equal opportunity employer
and is dedicated to the highest standards of research integrity.

References

Favaudon V, Caplier L, Monceau V, et al. Ultrahigh dose-rate FLASH irradiation increases the differential response between normal and tumor tissue in mice. Sci Transl Med. 2014;6(245):245ra93. doi:10.1126/scitranslmed.3008973

Ronga MG, Cavallone M, Patriarca A, et al. Back to the Future: Very High-Energy Electrons (VHEEs) and Their Potential Application in Radiation Therapy. Cancers. 2021;13(19):4942. doi:10.3390/cancers13194942