

## Research Associate in Photonics AI

Job Ref: REQ240720

**As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.**

The Emergent Photonics Research Centre is a 500m<sup>2</sup> university research facility dedicated to complexity in Photonics within the domains of Ultrafast Photonics, Optical Frequency Combs in Microresonators, Artificial Intelligence for Photonics and Terahertz technology. The Centre hosts a multi-million portfolio of facilities and running research grants from several funders including the European ERC, EPSRC, DSTL, Innovate-UK, and The Leverhulme Trust. These include several early career Fellowships and PhD studentships.

The Physics Department at Loughborough University has a vibrant community of scholars who are committed in supporting each other to deliver outstanding research. It hosts a significant theoretical expertise in covering the foundation of complexity and nonlinear dynamics in several disciplines, with a high international profile and staff members collaborating with the world's top physicists. Loughborough University holds the Athena SWAN Bronze award, recognizing its commitment to improving the representation and career progression of women in STEM (science, technology, engineering and mathematics) subjects. The Department of Physics is committed to creating a diverse and inclusive culture in which staff and students can thrive, regardless of gender, religious and philosophical beliefs.

### Project Description

Applications are invited for a Postdoctoral Research Fellow in Photonics AI at the Emergent Photonics Centre in the Department of Physics at Loughborough University. The position is initially for 2 years, but based on research requirements, it may be extended to 3 years.

The position is part of the **EPSRC Quantum Technologies fellowship project "AI-powered micro-comb lasers: a new approach to transfer portable atomic clock accuracy in integrated photonics"**

(<https://gow.epsrc.ukri.org/NGBOViewGrant.aspx?GrantRef=EP/W028344/1>) (total value £1.2M). The project focuses on developing a new class of AI-powered ultrafast lasers capable of "learning" how to optimise their emission in real-time and in real-life experimental conditions. The research activity combines theoretical modelling and the design and implementation of machine-learning control techniques for experimental photonic setups.

The specific aim of this post is to design and implement experimental setups to implement different machine-learning control approaches to stabilize ultrafast lasers at high optical powers, including mode-locked fiber lasers and micro-combs. Our approach combines standard stabilization techniques (e.g., feedback control) with state-of-the-art machine learning approaches, such as reinforcement learning, physics-informed neural networks, and neuromorphic photonic low-latency predictors.

The successful applicant should have a PhD in a field related to our research areas (nonlinear photonics, ultrafast photonics, nonlinear wave propagation) and some background, preferably in ultrafast characterization and machine-learning applications in photonics, with a good publication record. Previous experience with photonic bench implementations would be desirable, along with basic knowledge of ultrafast laser operation and a history of international involvement and aggressive publications strategy. Evidence of potential leadership, independence and strong motivation are also essential. Some of the typical tasks for this position include the operation of ultrafast

lasers and optical frequency combs, the design of optical benches, the acquisition of data using fast electronics and their analysis.

The successful applicant will be based in the Department of Physics and in the Emergent Photonics Research Centre at Loughborough University. They will work with Dr Juan Sebastian Toterogongora, in direct collaboration with researchers involved in several ERC, EPSRC and Leverhulme Trust research projects in nonlinear photonics, metrology and integrated photonics.

They will be part of a larger group of Loughborough researchers based in Physics, Chemistry and Computer Science who are active in the fields of Photonics.

## Job Description

### Job Grade: Specialist and Supporting Academic Grade 6

#### Job Purpose

*To conduct research in the area of machine-learning applications in photonics, ultrafast lasers control, micro-combs and nonlinear photonics. To investigate theoretically and experimentally the interplay between different nonlinear effects in the stability of the laser emission with the target of identifying repeatable strategies to stabilise the system at high emission powers. To lead independently a small research team that may include PhDs, graduate and undergraduate students. To lead the dissemination of the specific research activity in leading peer-reviewed journals and dissemination outlets such as conferences and workshops.*

#### Job Duties

- *Investigate theoretical and numerical models related to ultrafast lasers and microcombs.*
- *Design and develop experimental demonstrators based on nonlinear photonics and related methodologies.*
- *Participate in the development of machine-learning control models and their implementation in experimental photonic systems.*
- *Collect, manage and evaluate research data obtained from simulations and experiments in the form of specialist reports suitable for publication in peer-reviewed scientific journals.*
- *Be responsible for conducting the day-to-day running of the project.*
- *Formulate detailed plans for the project based on broad guidance from the project team.*
- *Provide progress feedback and recommendations to the project team.*
- *Write up regular progress reports and present outcomes to all Investigators and Collaborators.*
- *Write research papers suitable for publication in high-quality academic journals.*
- *Attend and contribute to conferences.*
- *Travel to attend meetings and make presentations both academic researchers (e.g., at conferences) and to external stakeholders.*
- *Apply specialist knowledge in the planning and progression of the project, including direct contribution to the draft of additional grant bids.*
- *Assist the academic staff in the project team with the supervision of undergraduate MSc and PhD project work and day-to-day supervision and support of other researchers.*
- *Advise and co-supervise PhD students involved in the project.*
- *Organise and advise on funding applications relevant to securing partnerships and research funds.*
- *Where appropriate, to deliver teaching, tutorial and laboratory sessions to students.*
- *Engage in training programmes at the university (or elsewhere) that are consistent with the needs and aspirations of the project and those of the department.*
- *Undertake other duties as may be reasonably requested and that are commensurate with the nature and grade of the post.*

#### Points To Note

The purpose of this job description is to indicate the general level of duties and responsibility of the post. The detailed duties may vary from time to time without changing the general character or level of responsibility entailed.

### **Special Conditions**

All staff have a statutory responsibility to take reasonable care of themselves, others and the environment and to prevent harm by their acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Policy & Procedures.

All staff should hold a duty and commitment to observing the University's Equity & Diversity policy and procedures at all times. Duties must be carried out in accordance with relevant Equity & Diversity legislation and University policies/procedures.

Successful completion of probation will be dependent on attendance at the University's mandatory courses which include Respecting Diversity and, where appropriate, Recruitment and Selection.

### **Organisational Responsibility**

Reports to Dr Juan Sebastian Toterogongora.

## Person Specification

Your application will be reviewed against the essential and desirable criteria listed below. Applicants are strongly advised to explicitly state and evidence how they meet each of the essential (and desirable) criteria in their application. Stages of assessment are as follows:

- 1 – Application
- 2 – Test/Assessment Centre/Presentation
- 3 – Interview

### Essential Criteria

Area	Criteria	Stage	
Experience	Background in Ultrafast Photonics	1,2	
	Background in Nonlinear Optics	1,2	
	Project Specific Experience	1,3	
	Authoring Original Work for Academic Journal Papers, conference papers, and technical reports	1	
	Understanding of project specific physical challenges	3	
Skills and abilities	Project Specific skills	1	
	Good written and oral communication skills, including writing peer-reviewed research publications	1,2	
	Self-motivated and ability to meet deadlines	3	
	Good interpersonal and organisation skills	3	
	Working knowledge of MATLAB and/or Python	1,3	
	Ability to write project reports and deliver technical presentations to industrial and academic research groups	1,2	
	Knowledge of relevant Health and Safety issues and provisions	2,3	
Training	Provide evidence of having undertaken further training	3	
Qualifications	PhD (or near completion)	1	
Other	Commitment to observing the University's Equal opportunity policy at all times	3	
	Commitment to observing the University's Information Security and Export Control policies at all times	3	

### Desirable Criteria

Area	Criteria	Stage
Experience	Track record in Photonics	1,3
	Track record in Nonlinear Optics	1,3
	Track record in Machine Learning applications in photonics	1,3

	Development of proposals for funding from external agencies	1,3
	Experience of supervision of students in relevant areas	1,3
	Strong publication track record	1
Skills and abilities	Expertise in Machine Learning Control applications	1,3
	Experience in the implementation of automated controllers in photonics experiments	1,3
	Experience in the stabilisation of ultrafast lasers	1,3
Other	Able to travel independently	3
	Ability to manage independently working patterns following project needs	3

## Conditions of Service

The position is FULL TIME and FIXED TERM for 24 months with a possible extension to 3 years. Salary will be on Grade 6, £33,966-£44,263 per annum, at a starting salary to be confirmed on offer of appointment. The appointment will be subject to the University's Terms and Conditions of Employment for STAFF GRADES 6 AND ABOVE, details of which can be found [here](#).

The University is committed to enabling staff to maintain a healthy work-home balance and has a number of family-friendly policies which can be found [here](#).

The University offers a wide range of employee benefits which can be found [here](#).

We also offer an on-campus nursery with subsidised places, subsidised places at local holiday clubs and a childcare voucher scheme (further details are available at: <http://www.lboro.ac.uk/services/hr/a-z/childcare-information---page.html>)

In addition, the University is supportive, wherever possible, of flexible working arrangements. We also strive to create a culture that supports equality and celebrates diversity throughout the campus. The University holds a Bronze Athena SWAN award which recognises the importance of support for women at all stages of their academic career. For further information on Athena SWAN see <http://www.lboro.ac.uk/services/hr/athena-swan/>

## Applications

The **closing date** for receipt of applications is **29/09/2024**.