Early Stage Researcher

Reference: 0894-23

Salary: £39,730 (without family allowance). £44,600 (with family allowance, if eligible)

Contract Type: Fixed Term (up to 36 months)

Basis: Full Time

Job description

Position 1 (NESTOR DC2): Low-complexity digital signal processing techniques for beyond 5G X-haul.

Position 2 (NESTOR DC5): Cross-layer data-driven techniques for next generation access / metro networks

Applications are invited by Aston Institute of Photonic Technologies (AIPT) for two prestigious three-year postgraduate positions (leading to a PhD) as Doctoral Candidates (DC) within the European Doctoral Network project 'Next generation high-speed optical networks for metro access (NESTOR)'. The project is funded by the Horizon Europe Marie Sklodowska- Curie Actions (MSCA), with the UK candidate being supported by the EPSRC. The successful candidate will receive a generous monthly salary, membership in a high-quality pension scheme, full social security benefits and a fee bursary to fully cover the PhD tuition fees. Successful candidates with family will be entitled to an enhanced salary. Notably, 9 months of the study and research period will be spent in the industrial sector with either British Telecom (UK) or Ericsson (Italy). The successful applicant will benefit from close interaction and joint training events with the project world-leading industrial partners: Infinera (Germany, Portugal), SM-Optics and Ericsson (Italy), and VPI Photonics (Germany). The project also involves dynamic interaction and collaboration with leading EU universities: Politecnico di Torino, Scuola Superiore Sant'Anna (both Italy), Universitat Politecnica de Catalunya (Spain), University Institute of Lisbon (Portugal), and Technische Universiteit Eindhoven (the Netherlands) and a bespoke training program in advanced technical and personal soft skills. The successful UK applicant will be fully integrated into the project's cohort of 12 PhD students.

Both candidates will be fully integrated into the prestigious Marie Skłodowska-Curie Actions (MSCA) Doctoral Network (DN) programme, an initiative by the European Commission to train creative, entrepreneurial, innovative researchers, who are able to face current and future societal challenges and will convert knowledge and ideas into products and services for the economic and social benefit of Europe.

Background to the Project:
Next generation high-speed optical networks for metro access (NESTOR)
The NESTOR project (https://cordis.europa.eu/project/id/101119983) is designed to address the paramount challenges arising from the deployment of upcoming innovation such as 5G/6G, Internet of Things, and virtual reality by reducing costs and power consumption. As we are approaching the Shannon capacity limit, the cost per bit cannot be further reduced only by improving the optical performance. Instead, higher flexibility is required so that the network operation is simplified, and the number of deployed devices is reduced. At the core of NESTOR, there will be a new generation of advanced coherent pluggable transceivers that can simultaneously transmit to one or more end-users. This provides the flexibility required in the metro access segment so that operators can optimize the number of network elements, power consumption, cost and spectrum based on actual needs and traffic patterns without overprovisioning in terms of capacity, number of devices, electrical power, etc. Combination of the advanced coherent pluggable transceivers with newly developed artificial intelligence / machine learning algorithms, will allow the network to be effectively optimised.

Training and Secondments
The MENTOR Training Programme will be implemented through the unique combination of the "hands-on" research training, non-academic placements and advanced inter/multidisciplinary/ inter-sectoral training together with an extensive transferable skills training and attendance in conferences, workshops and symposia. NESTOR's 12 Doctoral

Candidates will each spend significant time directly with its world leading industrial partners in the core telecom industry (Infinera, BT, Orange, SM-Optics, VPI and Ericsson) to acquire specific skills and knowledge highly required by the private sector. Upon completion of NESTOR's advanced research and bespoke training programme, it's PhD students will be able to breach the inter-sectorial divide and become the next generation of leaders in industry or academia.

PhD Project title associated with the position 1:
Low-complexity digital signal processing techniques for beyond 5G X-haul.
This project delves into innovative low-complexity digital signal processing (DSP) techniques for "beyond 5G" X-haul in RANs, a crucial step towards future-proofing network performance and reducing power consumption. We'll break new ground by combining fibre and wireless channel distortion mitigation at the RF signal generation stage, ideally close to the remote radio unit (RRU). Project objectives include:

- ▶ Identify requirements for combined signal processing in a full-duplex connection, including beam-steering, MIMO, fading channel equalization, and component/fibre channel distortion mitigation.
- ▶ Design reconfigurable DSP architectures for B5G X-haul that can dynamically adapt to changing functional split scenarios in C-RAN.
- ▶ Develop innovative DSP algorithms that are computationally efficient and optimized for real-time processing on resource-constrained platforms.

PhD Project title associated with the position 2:
Cross-layer data-driven techniques for next generation access / metro networks
This project harnesses the power of machine learning (ML) to revolutionize next-generation optical access and metro networks. We'll focus on developing tailored ML techniques for multiband amplifiers and reconfigurable transceivers, key components in high-capacity access networks. By considering physical channel limitations and dynamic traffic patterns, we'll design ML-based control strategies that optimize network performance and resource utilization. Project objectives include:

- ▶ Develop ML-driven control algorithms for multiband optical amplifiers, enabling seamless channel upgrades, robust add/drop functionalities, and alignment with routing and resource management strategies.
- ▶ Implement ML-based performance improvement solutions for metro networks, including real-time telemetry and intelligent algorithms for proactive network management.
- ▶ Investigate the integration of ML with network telemetry systems for enhanced network visibility and control.

Salary
The successful candidates will be employed on a full-time basis with a competitive salary in accordance with the MSCA regulations for Doctoral Candidates and the personal circumstances of the applicant. The successful candidate will receive a generous financial package consisting of the MSCA living allowance and a mobility allowance, eligible candidates with family will also receive an additional family allowance according to the rules of the MSCA. Social security, pension contributions and a PhD fee waiver are included in this package.

Person Specification
NESTOR is looking for candidates with exceptional skills and grades in engineering, or physics, and/or computer science, with the knowledge of machine learning and/or some expertise in the areas related to optical and wireless communications and photonics, or electrical engineering. Preferred skill requirements include experience in scientific

programming and computing, signal processing, communications and information theory, statistical analysis, optical communication systems. Knowledge of mathematical methods and numerical analysis are an asset. The candidate will have a strong drive to carry out the cutting- edge research for a doctoral degree.

Applicants holding a Master of Science degree (or expected to be awarded one soon) in Electrical Engineering, Physics, Applied Mathematics, Computes Science, or equivalent, are especially encouraged to apply.

For informal enquiries about this project and other opportunities within the AIPT, contact. Prof. Sergei Turitsyn by email: s.k.turitsyn@aston.ac.uk

The successful applicant is expected to register for a PhD at Aston University and therefore will have to comply with minimum PhD Entry Requirements to be found in the section "Entry Requirements" detailed here.

Requirements
- ▶ Outstanding BSc or MSc qualification in Computer Science, Communications, Electrical Engineering, Physics, Applied Mathematics, or equivalent.
- ▶ Experience in theoretical and/or experimental work, knowledge of scientific programming and computing, particularly in the context of application to machine learning (Python, Tensorflow, etc.) and photonics.
- ▶ English Language: Minimum requirements can be found in the section "English Language Entry Requirements" detailed here
- ▶ Comply with MSCA eligibility and mobility criteria as listed below.

Main Duties/Responsibilities:
- ▶ To simulate single-channel and WDM optical transmission systems
- ▶ Develop accurate simulation models for fibre and wireless MIMO channels in beyond 5G X-haul scenarios.
- ▶ Design test beds and conduct experiments to validate the channel models.
- ▶ Explore advanced signal processing techniques such as beamforming, MIMO precoding, and adaptive channel equalization.
- ▶ Analyze the trade-off between complexity, performance, and power consumption of different DSP solutions.
- ▶ Investigate the use of field-programmable gate arrays (FPGAs) or other hardware accelerators for efficient execution of the DSP algorithms.
- ▶ Develop and train ML models (e.g., deep neural networks, reinforcement learning) for controlling and configuring multiband amplifiers and reconfigurable transceivers in optical access and metro networks.
- ▶ Develop effective data preprocessing techniques to handle missing values, outliers, and other data quality issues.
- ▶ Develop ML-based techniques for dynamic resource allocation and power consumption optimization in access and metro networks.
- ▶ Design real-time telemetry systems to provide the ML models with accurate and timely network information for informed decision-making.
- ▶ Investigate the use of federated learning and distributed reinforcement learning for decentralized decision-making in large-scale networks.
- ▶ Compare the performance of the ML-based approach with traditional methods.
- ▶ To collect synthetic and experimental data
- ▶ To design, train, and test the equalizers based on deep neural networks for the optical line impairments mitigation
- ▶ To optimisation of the most promising neural network designs
- ▶ To development of the augmentation techniques for the efficient neural networks training
- ▶ To perform quantization and binarisation of neural networks for the complexity reduction

- To development of transfer learning methods for improving the generalizability of the neural network-based equalizers
- To carry out the research and raining activities specified by a personal career development plan (to be developed)
- Undertake mandatory training programs and secondments as required at the facilities of other consortium members
- Actively participate in training activities and submit reports in fulfilment of the project requirements
- Participate in outreach and dissemination activities promoting the NESTOR project and MSCA program
- Prepare regular progress reports on the performed research and training activities and present the research outcomes at meetings, project workshops, and to external audiences to disseminate and publicise research findings
- To contribute to publications of research outcomes in high impact journals and major international conferences.
- To contribute to the delivery of reports associated with assigned projects.
- To contribute to research initiatives with colleagues in and beyond the project as appropriate.
- To engage in training and professional development programmes in the University consistent with personal needs and aspirations and with the strategic goals of the Institute.
- To support the development of further research proposals.
- To undertake such other duties as reasonably requested by the supervisor(s).

Additional responsibilities
- Engage in continuous personal and professional development in line with the demands of the role, including undertaking relevant training and development activities to develop themselves and support the development of others.
- Ensure and promote the personal health, safety and wellbeing of staff and students.
- Carry out duties in a way which promotes fairness in all matters and which engenders trust.
- Promote equality of opportunity and support diversity and inclusion as well as working to support the University's environmental sustainability agenda and practices.

MSCA Eligibility and Mobility rules:
- Applicants must not have been awarded a doctoral degree. Researchers who have successfully defended their doctoral thesis but who have not yet formally been awarded the doctoral degree are not considered eligible.
- Researchers may not have resided or carried out their main activity (work, studies, etc.) in the UK for more than 12 months in the 3 years immediately before the first day of POST- DIGITAL employment. Short stays, such as holidays, are not taken into account.
- Compliance with these rules will need to be demonstrated at a later stage of the application process.
- Candidates can be of any nationality, but may require security clearance for their research.

Application
As part of your application form, you will need to attach the following documents:
- Degree Certificate(s). If your qualifications are from an overseas institution please provide transcripts of the marks you have already achieved with your application
- English Language Certificate, if appropriate
- A copy of your passport (All pages)

Person specification

	Essential	Method of assessment
Education and qualifications	BSc or MSc qualification in Electrical and Electronic Engineering, Physics, Applied/Numerical Mathematics, Computer Science, or equivalent. Applicants must be Early Stage Researchers	Application form
Experience	Exceptional skills in engineering, or physics, and/or computer science, with the knowledge of machine learning and/or some expertise in the areas related to nonlinear optics and photonics, or electrical engineering.	Application form and interview
Aptitude and skills	Creative problem solving skills Excellent English Language: Minimum requirements can be found in the section "English Language Entry Requirements" detailed here Ability to contribute and coordinate collaborative project reports and deliverables Ability to present data in both a clear and concise manner Ability to prepare written and oral communications to a high standard A willingness to undertake further training as appropriate and to adopt new procedures as and when required	Application form and interview

	Desirable	Method of assessment
Education and qualifications	MSc qualification in Physics, Electrical Engineering, Applied Mathematics, Computer Science, or equivalent.	Application form

	Desirable	Method of assessment
Experience	Experience in optical communications, machine learning, deep neural networks, knowledge of scientific programming and computing, physical optics, information theory, statistical analysis, communications	Application form, and interview
	Experience of initiating and conducting research up to doctoral level	
	Experience of writing up/contributing to the write up of research of high quality publications	
	Experience of producing papers, posters, reports presenting at seminars, conferences etc.	
	Experience of positive collaboration within and outside the immediate research team	

How to apply

You can apply for this role online via our website https://www2.aston.ac.uk/staff-public/hr/jobs.

Applications should be submitted by 23.59 on the advertised closing date.
All applicants must complete an application form, along with your CV.

Any CV sent direct to the Recruitment Team and Recruiting Manager will not be accepted.

If you require a manual application form then please contact the Recruitment Team via recruitment@aston.ac.uk
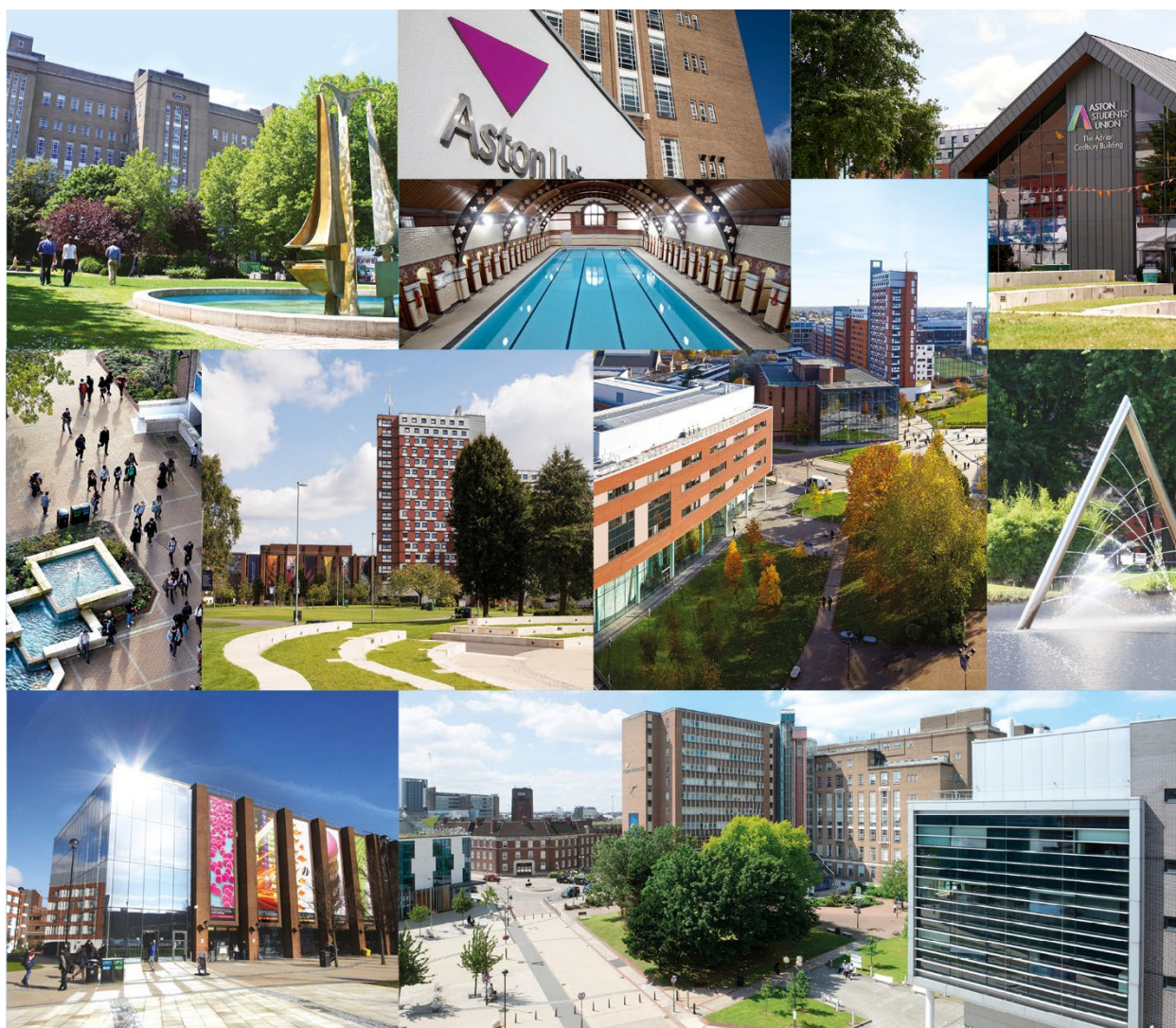
Contact information

Enquiries about the vacancy:

Name: Professor Sergei Turitsyn
Job Title: Professor
Email: s.k.turitsyn@aston.ac.uk

Enquiries about the application process, shortlisting or interviews:
Recruitment Team via recruitment@aston.ac.uk

Additional information

Visit our website https://www2.aston.ac.uk/staff-public/hr for full details of our salary scales and benefits Aston University staff enjoy

Salary scales: https://www2.aston.ac.uk/staff-public/hr/payroll-and-pensions/salary-scales/index

Benefits: https://www2.aston.ac.uk/staff-public/hr/Benefits-and-Rewards/index

Working in Birmingham: https://www2.aston.ac.uk/birmingham

Employment of Ex-Offenders: Under the Rehabilitation of Offenders Act 1974, a person with a criminal record is not required to disclose any spent convictions unless the positions they applying for is listed an exception under the act.

Eligibility to work in the UK:

Non-British/Irish citizens moving to the UK to work will need to apply for a visa in advance. You can find more information about visas for work on the gov.uk website here.
Before applying for this role, you should ensure that you meet the requirements, including meeting the English Language requirements. If you do not meet the eligibility criteria, any application for a work visa would be unsuccessful.

The most common types of visa to work in the UK are:

Skilled Worker Visa
https://www.gov.uk/skilled-worker-visa

Global Talent Visa
If you are a leader or potential leader in one of the following fields, you may be eligible to apply for a Global Talent Visa:
- Academia or Research
- Arts and Culture
- Digital Technology

You can find information about the Global Talent Visa on the gov.uk website here, and on the Royal Society website here.

You can also find further information about work visa options on our website here.

Equal Opportunities: Aston University promotes equality and diversity in all aspects of its work. We aim to ensure, through our admissions policies for students, and our staff recruitment and selection processes that we encourage applications from all groups represented in the wider community at a local, national and international level.

The University will endeavour not to discriminate unfairly or illegally, directly or indirectly, against student or potential students, staff or potential staff. This commitment applies to all functions of the University and to any stage of an individual's career.

An Equal Opportunities Monitoring Form is included within the application form. Data you provide on the Equal Opportunities Monitoring Form will be included in a general database, for statistical monitoring purposes, enabling the University to monitor the effectiveness of its Policy, Codes of Practice and Guidelines on Equal Opportunities in Employment. Individuals will not be identified by name.

Data Protection: Your personal data will be processed in compliance with the Data Protection Act 2018 and the General Data Protection Regulation ((EU) 2016/679) ("GDPR"). The University's Data Protection Policy and Privacy Notices, including the Job Applicant Privacy Notice can be found at https://www2.aston.ac.uk/data-protection. Your application will only be used to inform the selection process, unless you are successful, in which case it will form the basis of your personal record with the University which will be stored in manual and/or electronic files. Information in statistical form on present and former employees is given to appropriate outside bodies.

Full details of our terms and conditions of service and associated policies and procedures are available online at https://www2.aston.ac.uk/staff-public/hr/policies

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