

Research Programme Description

“QuNEST– Quantum Enhanced Optical Communication Network Security Doctoral Training” is hiring 11 Doctorate Candidates” to be funded by the Marie Skłodowska-Curie Actions (MSCA) Doctoral Networks. QuNEST is a highly interdisciplinary and intersectoral Doctoral Network composed of leading academic and industrial partners. The consortium consists of six academic institutions, namely: Eindhoven University of Technology, Technical University of Denmark, Karlsruhe Institute of Technology, University of L'Aquila, University of Warsaw and University of Geneva as well as the companies: ADVA Network Security, Exatel, IDQuantique, Infinera Germany, KEEQuant (SME), NKT Photonics, Nokia Bell Labs France, Telecom Italia Mobile, Quantum Optical Technologies (SME), Quantum Telecommunications Italy and VPIphotonics and involves seven different European countries. The diverse consortium provides a unique and timely opportunity to train students in quantum physics and optical communications.

QuNEST will provide an advanced training to 11 highly achieving Doctoral Candidates, in a collaborative ecosystem. This Doctoral Network is strongly multidisciplinary, spanning areas of quantum physics, simulations, photonics, optical transmission, Quantum Key Distribution (QKD) protocols, implementation security, error correction algorithms, digital signal processing, networks and control. It requires cross-disciplinary and intersectoral training, creating experts in this emerging field. The QuNEST Doctoral Candidates will do research, in which they demonstrate the potential of combining quantum and classical optical data signals in a single fiber with the aim to develop ground-breaking and commercially attractive, short-to-medium term solutions targeting European industry leadership in this challenging and promising sector. QuNEST will train much-needed future scientists and engineers who will design, build, deploy and operate the next generation quantum secured optical communications infrastructure.

The Doctoral Network program is designed to **foster technical, scientific, and transferable skills**, enabling the next generation of young researchers/engineers with excellent skills in understanding and solving the challenges of quantum secure optical communications. All Doctoral Candidates will carry out secondments and placements with industrial partners at the earliest possible opportunity. Transferable skills and technical workshops from industrial partners will be central to the training of the Doctoral Candidates.

About the host institution

KEEQuant GmbH is a high-tech start-up in the field of **Quantum Key Distribution (QKD)**. We develop and commercialize the paradigm-shifting Continuous Variable Quantum Key Distribution (**CV-QKD**) technology to **secure European critical infrastructure**. Taking advantage of the latest scientific breakthroughs in telecommunication, high-frequency electronics, photonic integration, and digital post-processing, we aim to bring QKD to the mass-market.

KEEQuant leverages the huge potential of **Photonic Integrated Circuits (PICs) to achieve scalability of QKD**. Our vision is to transfer all the optics required for CV-QKD onto a single PIC. The relevant technical properties such as size, weight, power consumption, environmental requirements, but especially volume-manufacturing and cost of QKD systems will become similar to today's telecom devices. Our long-term vision is to make CV-QKD an integral part of tomorrow's standard telecom transceivers – a true commodity with almost no extra hardware cost.

Besides scalability, we are **pioneering certification for QKD**. Today, QKD relies on academic security proofs. While these provide a good basis, academic papers often lack the cybersecurity system perspective. We therefore believe that QKD will only find wide-spread adoption, if independent third parties certify its security or national bodies approve it. We are therefore pushing the cybersecurity boundaries to achieve the world's first certified or nationally approved QKD system.

To address all these challenges, we require **excellent thinkers and doers. Our team is 18 people strong and steadily growing**. With a careful selection process, we ensure new colleagues integrate well with the team, both in a social and technical manner. Since QKD is such an interdisciplinary technology, we form smaller groups of experts to solve difficult problems together. We strive to take rational decisions while having respectful discussions. If things don't work out, we take the time to reflect what went wrong and hopefully make it better the next time.



Job Description

- ▶ Project title: Photonic Integrated classical/quantum transceiver for classical quantum communications
- ▶ Host institution: KEEQuant
- ▶ PhD enrolment: Eindhoven University of Technology
- ▶ Supervisors: I. Khan (KEEQuant), C. Okonkwo (Eindhoven University of Technology). Mentor: T. Buchner (EXATEL)
- ▶ Research Objectives: Design, develop and characterise the opto-electronic and photonic subsystems of an integrated CV-QKD transceiver. DC9 will study the integrated transceivers suitability for enabling quantum/classical propagation applications, e.g., considering choice of wavelength, platform substrates (InP, Si, SiN), modulation format and Tx/Rx DSP. Simulations will be performed to narrow parameter spaces for subsequent design choices. The DC will be trained in the full chain of design, development, lab characterisation of photonic integrated circuits, enabled by multi-project wafer runs. The candidate will investigate the impact of the developed transceiver on the achievable secret key rate for quantum/classical propagation both in a lab as well as in a field-test environment.
- ▶ Expected Results:
 - 1) Perform simulation of CV-QKD module on engineering level,
 - 2) Design of a CV-QKD transceiver module
 - 3) Characterization and performance evaluation
 - 4) Test in a fiber and free-space optical transmission scenario
- ▶ Secondments: The doctoral candidate secondments periods are planned at Eindhoven University of Technology, Technical University of Denmark, University of L'Aquila

Conditions of employment

- ▶ The successful candidates will receive a gross salary of 3.258,02 € per Month in accordance with the Marie Skłodowska-Curie Actions (MSCA) regulations for Doctoral Candidate researchers (the mobility allowance is included in the previous value). According to the MSCA regulation, if the recruited doctoral candidate has or acquires family obligations during the action duration, a family allowance will be added to the previous value, in case of eligibility.
- ▶ The period of employment is 36 months. In addition to their individual scientific projects, all fellows will benefit from further continuing education, which includes secondments, a variety of training modules as well as transferable skills courses and attractive participation in conferences.
- ▶ The Doctoral Candidates are expected to travel to network partners under three secondments for a typical duration of 2-6 months. Additionally, the Doctoral Candidates are expected to participate in outreach activities including, but not limited to, YouTube videos, social media updates, participation in public events and campaigns, as well as dissemination to popular press.

Eligibility and mobility criteria (mandatory requirements EU rules)

- ▶ The recruited researchers must be doctoral candidates, i.e. not already in possession of a doctoral degree at the date of the recruitment.
- ▶ The recruited researchers must be employed full-time, unless the granting authority has approved a part-time employment for personal or family reasons
- ▶ The recruited researchers must be working exclusively for the project
- ▶ Recruited researchers can be of any nationality and must comply with the following mobility rule: they must not have resided or carried out their main activity (work, studies, etc.) in the country of the recruiting beneficiary for more than 12 months in the 36 months immediately before the recruitment date - unless as part of a compulsory national service or a procedure for obtaining refugee status under the Geneva Convention (1951 Refugee Convention and the 1967 Protocol).



Application Procedure

Documents requested:

- ▶ Complete CV (Europass format obligatory): <https://europass.cedefop.europa.eu/documents/curriculum-vitae>. The candidates are allowed to pursue a maximum of three positions in the QuNEST programme. If more than one position is pursued, please clearly indicate all the positions that are pursued with priorities on the first page of the CV.
- ▶ Motivation letter (maximum 1 page per position applied) should state why the applicant wishes to pursue the specific research and why the applicant thinks to be an ideal candidate for the position.
- ▶ Scan of certificates showing BSc, MSc and other courses followed, with grades and if it is possible a ranking.
- ▶ Up to three recommendation letters and/or contact e-mail addresses with a brief professional description (title, position, relationship with applicant) of the referring person.
- ▶ Up to two written scientific reports in English (e.g. MSc thesis, traineeship report or scientific paper)
- ▶ Eligibility Statement: for verifying the MSCA requirements, the candidates clearly indicate the country or countries of the main activity (work, studies, etc) and country or countries of residence in the last 5 years with the exact dates.

Selection Process

The selection process of invited candidates contains two phases:

In the first phase, a wide range of selection practices will be used (including expert assessment, face-to-face interviews, etc.) to evaluate the potential candidates. The selection committee for each doctoral candidate will be composed of three members: the main supervisor from the hosting institution, a QuNEST representative from another beneficiary and the future secondment manager of the doctoral candidate.

In the second phase, the selected candidate will be evaluated by QuNEST's Recruitment, Equality, Diversity & Inclusion Committee. The committee addresses gender balance and diversity issues within the entire Doctoral Network and needs to approve the selected candidate.

QuNEST deals with a recruitment process based on the European principles of openness, fairness and transparency that guarantee a selection of candidates in respect of merit and gender balance. All institutions have clear equal opportunities policies ensuring equal and fair recruitment and employment of men and women.

Please note that all submitted applications will be checked against the defined eligibility and mobility criteria. Applications that do not follow these criteria will not be considered.

- o **Deadline for online application: 17.11.2023**
- o Targeted Starting date: 01/02/2024

For more information about the project and any informal enquiries, please contact Imran Khan,

E-Mail: QuNEST@keequant.com

How to apply:

Please send us the above mentioned documents to the following E-Mail address: QuNEST@keequant.com.

