End-to-End Dynamic and Entanglement based Quantum Networking

Type of award: PhD Research Studentship

Department: Electrical and Electronic Engineering, High Performance Networks Research Group

Scholarship Details: Minimum £15,609 p.a. plus an additional top-up from the industrial sponsor (subject to confirmation)

Duration: 4 years

Eligibility: Home (UK) and EU citizens who have confirmation of UK settlement or pre-settlement status under the EU Settlement Scheme.

Start Date: From November 2021

PhD Topic Background/Description

Quantum communication technologies have substantially progressed over the last decade to allow point-to-point (p2p) quantum secure communication. However, there remains still major technological challenges towards enabling telecom network infrastructure to support dynamic quantum secure networking with quantum channel switching and routing capabilities. Furthermore, entanglement distribution has proved a very useful resource in quantum communication. It has potential to enable applications beyond QKD. It enables simultaneous multipoint quantum nodes interconnection enabling applications beyond QKD such as oblivious transfer, blind quantum computing, distributed quantum computing, clock synchronization and realization of device independent security. However, current entanglement-based quantum networking solutions are limited in scale (small number of nodes), facilitated by a single entangled photon source and delivered through a static or semi-static network that do not allow their dynamic re-configurations. Both dynamic QKD networking and also entanglement-based quantum networking are in their infancy state and require in depth research.

This PhD aims to address these research gaps and specifically looking into design of an end-to-end and dynamic and entanglement quantum secured network over access, metro and national scale. This PhD will focus on one or multiple of the following topics with Proof of Concepts where applicable within context of an end-to-end and dynamic quantum secure network:

- Dynamic QKD networking for access network (e.g. including IoT), metro and core networks support dynamic switching and routing of quantum channels
- End-to-end quantum security utilising cascade and/or overlay of multiple quantum security protocols and technologies
- Dynamic Entanglement distribution and networking for moving the quantum security information across the network
• Integration and co-existence scenarios and solutions for quantum and post-quantum security protocols
• Consistence of quantum secure communication channels with classical communication channels in a WDM/Flexi-WDM system.
• Novel quantum-based authentication technologies such as Physically Unclonable Functions

All above topics have significant amount of low TRL research specifically in the area of: dynamic QKD networking and switching, dynamic entanglement distribution quantum network, Consistence of quantum secure communication channels with classical communication.

Further Particulars

Candidate Requirements
Applicants must meet the entry requirements for the PhD Research programme they wish to apply to. Requirements can be found at http://www.bristol.ac.uk/study/postgraduate/2020/eng/phd-computer-science/ including English Language.

Basic skills and knowledge required:
• Essential: Excellent analytical skills and experimental acumen
• Desirable: A background understanding in one or more of the following: Telecommunication networks; Quantum physics and quantum mechanics; Security and cryptography.

Scholarship Details
This is a fully funded 4-year studentships covering:
• Minimum £15,609 tax-free stipend per year for living expenses
• tuition fees at UK student rate
• equipment and travel allowance to support research related activities.

For EPSRC funding, students must meet the EPSRC residency requirements.

Informal enquires
Please email Prof Reza Nejabati For questions about eligibility and the application process please contact SCEEM Postgraduate Research Admissions.

Application Details
Prior to any application, please contact Prof Reza Nejabati to discuss your research proposal to see if it aligns with his current research. No indication of an offer can be made until a completed application has been received.

To apply for this studentship, submit a PhD application using our online application system

Submit supporting documents https://www.bristol.ac.uk/study/postgraduate/apply/supporting-documents/

Please ensure that in the Funding section you tick “I would like to be considered for a funding award from the Electrical and Electronic Engineering Department” and specify the title of the scholarship in the “other” box below along with the name of the supervisor. Interested candidates should apply as soon as possible.