End-to-End Dynamic and Entanglement based Quantum Networking

Type of award	PhD Research Studentship
Department	Electrical and Electronic Engineering / High Performance Networks Group
Scholarship Details	Minimum £17,668 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	Available Now

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/2021/eng/phd-computer-science/ or https://www.bristol.ac.uk/study/postgraduate/2021/eng/phd-elec-electronic-eng 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 £17,668 tax-free stipend per year for living expenses
- tuition fees at UK student rate
- Research Training Support Grant – minimum £4,900 over 4 years

Application Details
- All candidates should submit a full CV and covering letter to quantum-data-centre-project@bristol.ac.uk (clearly marked with *End-to-End Dynamic and Entanglement based Quantum Networking*) by the deadline.
- Formal applications for PhD are not essential at this stage, but can be submitted via the University of Bristol homepage (clearly marked with *End-to-End Dynamic and Entanglement based Quantum Networking*): https://www.bristol.ac.uk/study/postgraduate/apply/
- A Selection Panel will be established to review all applications and to conduct interviews of short-listed candidates.
- Candidates will be invited to give a presentation prior to their formal interview, as part of the final selection process.
- Application deadline 22 December 2022 or sooner if an appropriate candidate is found. Early application is recommended.

For questions about **eligibility and the application** process please contact SCEEM Postgraduate Research Admissions sceem-pgr-admissions@bristol.ac.uk