

## Quantum Network for Distributed Quantum Computing

*Type of award* PhD Research Studentship

*Department* [Electrical and Electronic Engineering](#) / [Smart Internet Lab](#) / [High Performance Networks Group](#)

*Scholarship Details* *Minimum £17,668 p.a. (subject to eligibility and confirmation of award)*

*Duration* 3.5 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 September 2022

### PhD Topic Background/Description

This studentship will be related to the UK Quantum Technologies Hub for Quantum Communications Technologies whose key technical objective is the development of quantum communications technologies at all distance scales, pursuing integration between these technologies and with conventional communications infrastructure. The Communications Hub is part of a larger UK National Quantum Technology Programme (UKQNTF) and Bristol is a key academic partner.

With demonstrations from the likes of IBM Q, Google's Bristlecone, Rigetti's Aspen and PsiQuantum, quantum computing is witnessing its first generation of quantum processors composed of tens of qubits. While this is a great achievement towards practical quantum computing, when it comes to scalability, we face two major limitations: (i) how to increase the number of qubits in such mono-lithic machines; (ii) how to share quantum computing resources efficiently and flexibly.

One solution is to use several few qubit quantum processors in a networked fashion. This distributed quantum processing resembles the structure of classical Data Centres (DCs). Current quantum computers are noisy. However, as their performance improves, and they are manufactured in number, how best to connect them together and ultimately create a quantum data centre becomes highly relevant.

This PhD aims to develop a quantum network for a scalable quantum computing interconnect in form of a Quantum Data Centre (QDC) able to provide service to multiple applications at the same time.

Outcome of this PhD will be a dynamic quantum network that will enable delivery of the processing power of a many-qubit quantum computer in form of network of few-qubit processors. To achieve this vision, PhD aim to develop new quantum networking concept and technology utilising a combination of techniques developed for quantum computing and communication as well as classical networking, distributed and disaggregated computing.

There are certain aspects of a QDC that can make it an attractive proposition to explore. In QDCs, we are working in a controlled environment within a DC warehouse. This allows us to achieve the high level of precision required, e.g., in phase and temperature stability, for proper operation. While an efficient and reliable transfer of quantum states over long distances is still extremely challenging the QDC can benefit from short-distance inter-processor communication.

The outcome of this PhD will be the first step towards the creation of a mega scale quantum processing capability that can serve a large number of users and applications simultaneously in the same way that today's Google and Amazon mega datacentres serve their users.

This PhD is expected to be a combination of theoretical, simulation and experimental proof of concept research activities utilising extensive experimental quantum networking facility at Bristol University.

URL for further information: [Quantum Communications Hub \(quantumcommshub.net\)](http://quantumcommshub.net)

## 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: Computer Science, Engineering

### Scholarship Details

This is a fully funded 3.5-year studentship covering:

- A tax-free stipend per year for living expenses
- Tuition fees at UK student rate
- Annual allowance of £1,500 for travel and consumables for the first 3 years

### Application Details

- All candidates should submit a full CV and covering letter to [quantum-data-centre-project@bristol.ac.uk](mailto:quantum-data-centre-project@bristol.ac.uk) (clearly marked with *Quantum Network for Distributed Quantum Computing*) 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 *Quantum Network for Distributed Quantum Computing*): <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](mailto:sceem-pgr-admissions@bristol.ac.uk)