



## Fully Funded PhD Position in “Quantum Network Tomography” Trinity College Dublin, Ireland

CONNECT - the Science Foundation Ireland Research Centre for Future Networks and Communications at Trinity College Dublin is pleased to announce a PhD studentship with a start date between 01 November 2022 – 01 March 2023 in the area of **Quantum Network Tomography**. This PhD position is part of a *large-scale ambitious programme named CoQREATE (Convergent Quantum REsearch Alliance in Telecommunications), involving top universities in the Republic of Ireland, Northern Ireland, and the US.*

<b>Open positions</b>	PhD Studentship in Quantum Network Tomography
<b>Location</b>	CONNECT research centre, Trinity College Dublin
<b>Duration</b>	4 Years
<b>Funding / Stipend</b>	The PhD position is funded for 4 years, including a monthly stipend and a travel budget to present at international conferences, workshops and seminars. The studentship will cover 4 years of tuition fees and a stipend of € 18,500 per annum.
<b>Contacts</b>	Prof Nicola Marchetti ( <a href="mailto:nicola.marchetti@tcd.ie">nicola.marchetti@tcd.ie</a> ) & Prof Indrakshi Dey ( <a href="mailto:indrakshi.dey@mu.ie">indrakshi.dey@mu.ie</a> / <a href="mailto:deyi@tcd.ie">deyi@tcd.ie</a> )
<b>Closing Date</b>	31 October 2022

### General Research Theme of the PhD Project

With the recent development of quantum computers, quantum networks are rapidly evolving to a reality. While the number of nodes communicating within a quantum network is increasing, the question arises how one can validate that information can be exchanged with high fidelity between the nodes. Moreover, the management of such networks requires characterization of the performance metrics of different network components, like quantum links, repeaters and end-nodes. In addition, these characterizations can be useful for diagnosing and localizing faults and identifying the presence of adversaries.

In this project, we will investigate an approach for modelling the overall network by combining the physical states and positions of the nodes, topological abstraction of the network, the network functions and the resources to be used by the nodes. We will study methods to monitor and capture the characteristics and behaviour of the nodes and links and then describe them using **Agent-Based Models (ABM)**. Such models will also capture how these nodes and links will respond to the change in communication scenario, environment, and the network configuration, thereby enabling the possibility of characterizing faithfully how information flows within any quantum communication network and how best to control and manage such networks.

## PhD Studentship

The PhD position is funded for 4 years, including a monthly stipend and a travel budget to present the research outputs at international conferences, workshops and seminars. The studentship will cover 4 years of tuition fees and a stipend of € 18,500 per annum. The successful candidate will be enrolled on the **PhD programme in Electronic and Electrical Engineering at Trinity College Dublin**. The candidate is expected to conduct theoretical analysis and perform experimental work at the newly set-up **Quantum Test-bench at Department of Electronic Engineering at Maynooth University**. The successful candidate will write their theses on topics related to **Quantum Network Tomography**, supervised by Prof Nicola Marchetti and Prof Indrakshi Dey for the entire duration of the PhD programme.

The successful candidate will be an integral part of the overall research programme that Prof Nicola Marchetti and Prof Indrakshi Dey are leading around the topic of future self-organising quantum communication networks. The successful candidate will be prepared to work with a network of highly reputed international collaborators who are among the leading scholars working on state-of-the-art technologies in quantum communications, including the CONNECT research centre director, Prof Dan Kilper from Trinity College Dublin, and Prof Don Towsley from the University of Massachusetts.

**In addition to PhD supervision, the successful candidate, where relevant, will benefit from a wide range of training activities, namely:**

- i. Summer/winter schools covering both technical topics within the scope of the PhD project (e.g., related to communication networks, quantum networks, network analysis tools including graph theory and ABM), and a range of transferable skills such as research integrity, research management, entrepreneurship, patents, etc.;
- ii. Training in both theoretical and experimental aspects of relevance to the up-and-coming quantum internet revolution;
- iii. *Research visits to our Irish partners (Dublin City University, Tyndall National Institute, University College Dublin, Waterford Institute of Technology, Queen's University Belfast) and US partners (University of Arizona, Massachusetts Institute of Technology, University of Chicago, University of Massachusetts) in the CoQREATE project;*
- iv. Short-term industry internship in a top company in the field of quantum internet.

The successful candidate will be supported to present the research findings at major international conferences, workshops and seminars within the scope of the PhD project.

## Duties and Responsibilities

1. Undertake postgraduate research in the area of agreed research project.
2. Work closely with the academic supervisor to ensure that the progress of the individual project is in line with the objectives of Prof Nicola Marchetti & Prof Indrakshi Dey's research programme.
3. Attend and participate in all training events and supervisory meetings.
4. Prepare PhD progress reports.
5. Present and publish research outputs to both academic and non-academic audiences.
6. Attend and participate in academic and non-academic conferences, events and seminars.

As the description of the duties and responsibilities cannot be exhaustive, it is worth mentioning that the PhD student may be required to undertake other duties that are broadly in line with the objectives of their research projects.

## Qualifications, Expected Skills and Competencies

1. PhD applicants must hold at least a Bachelor or Master degree in Electronic / Electrical Engineering, Computer Science, Physics, Mathematics or a related discipline with excellent academic performance (equivalent to first or upper second-class honours in Ireland)
2. Highly proficient English language skills.

3. Strong mathematical, analytical and programming skills.
4. Excellent background in communication networks and/or quantum physics.
5. Excellent written and verbal communication, including presentation skills.
6. Excellent organisational skills, attention to details and the ability to meet deadlines.
7. Ability to think logically, create solutions and make informed decisions.
8. Willingness to work collaboratively in a research environment.
9. A strong commitment to their own continuous professional development.

### **Application Process / Additional Information**

Applications must be sent by e-mail to Prof Nicola Marchetti ([nicola.marchetti@tcd.ie](mailto:nicola.marchetti@tcd.ie)) & Prof Indrakshi Dey ([indrakshi.dey@mu.ie](mailto:indrakshi.dey@mu.ie)) in a single PDF file with the title “PhD\_Application\_{Applicant’s surname}”. **Early applications are strongly encouraged.**

#### **Applications should include:**

1. A cover letter explaining the applicant’s motivation and interest to undertake a PhD in the project topic. Any relevant background and/or experience needs to be mentioned.
2. A CV that includes the applicant’s educational qualifications and any scientific publications and achievements.
3. Academic transcripts.
4. Two academic references.

Informal enquiries concerning the advertised positions, accompanied with the CV, can be made to Prof Nicola Marchetti ([nicola.marchetti@tcd.ie](mailto:nicola.marchetti@tcd.ie)) & Prof Indrakshi Dey ([indrakshi.dey@mu.ie](mailto:indrakshi.dey@mu.ie)).

Applications will close on **Monday 31<sup>st</sup> of October 2022**. The received applications will be analysed after the application deadline, and the shortlisted candidates will be invited to an online interview.