Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

QUESTING
Connecting to the future

Post Title:	PhD Studentship - Influence of topology in designing & operation of distributed quantum networks
Post Status:	Full-time
Research Group / Department / School:	Wireless Engineering and Complexity Science Lab (WhyCOM) & Not A Space Race Lab (NASR), School of Engineering, Trinity College Dublin, the University of Dublin
Location:	Department of Electronic and Electrical Engineering, Aras An Phiarsaigh, Trinity College Dublin, Dublin 2, Ireland
Reports to:	Prof Nicola Marchetti & Prof Harun Siljak
Terms & Conditions:	The appointment will be on a temporary basis for a maximum period of 36 months (PhD student, regular full-time employment contract), with an attractive salary plus allowances package according to the Marie Skłodowska-Curie / Innovative Training Networks rules, namely Annual Living Allowance: €51,843.80; Annual Mobility Allowance: €7,658.43; Annual Family Allowance, if applicable: €7,119.10; these figures are subject to taxes and social charges. Furthermore, the PhD academic fees will be paid by Trinity. The doctoral candidate must not have lived or worked in the Republic of Ireland for over 12 months in the 36 months before recruitment.
Hours of Work:	Full time ~ 38 hours/week
Closing Date:	Open until suitable candidate is identified

Post Summary

The **Wireless Engineering and Complexity Science Lab (WhyCOM)** and **Not A Space Race Lab (NASR)** at Trinity College Dublin is seeking a PhD student to explore the influence of topology in designing & operation of distributed quantum networks.

The candidate will be part of the Marie Skłodowska-Curie Action project 'QUESTING', a groundbreaking Doctoral Network initiative aimed at revolutionizing the field of Quantum Technology by addressing critical gaps in interdisciplinary education and training. This program will cultivate a new generation of "Q-System Innovators," equipping doctoral candidates with expertise in quantum networks, hybrid classical-quantum systems, and interoperable cultural co-design. By integrating mathematics, physics, computing, and communications engineering with sociocultural and ethical perspectives, QUESTING pioneers an innovative approach to building scalable, robust, and adaptive quantum systems.

The program's holistic methodology spans from theoretical advancements to real-world applications, including secure quantum communication, distributed resource management, and sustainable network topologies. Through its unique blend of participatory research, co-design processes, and industry-academic collaboration, QUESTING ensures alignment with global challenges such as cybersecurity, digital transformation, and equitable access to emerging technologies. This initiative is instrumental in advancing the European Union's Quantum Technologies Flagship and the UN Sustainable Development Goals, fostering innovation-driven growth while preparing Europe to lead responsibly in the quantum revolution.

For this QUESTING PhD position at Trinity College Dublin we are seeking a researcher to investigate the **influence of topology in designing & operation of distributed quantum networks**.

The specific objectives are:

a) **Modelling quantum network functions through dependency graphs, Petri-nets and Bayesian networks**, to evaluate performance indicators such as energy efficiency, scalability, and delay. The trade-offs across these metrics will be explored.

b) **Adopting network science-based models**, including Erdős–Rényi like graphs and small-world networks, to optimize network topologies balancing clustering and connectivity.

c) **Developing a quantum game-theoretical framework**, where entanglement distribution will be optimized by modeling strategic decision problems in terms of entanglement rate and fidelity.

This will involve designing topology and quantum operations using game-theoretical approaches.

d) **Enhancing technical rigor and redefine the interplay between classical and quantum methodologies**, by using the above-mentioned mathematical tools.

The PhD student will spend 3 months at the University of Naples Federico II, Italy, hosted by Prof Marcello Caleffi, to design quantum-aware routing algorithms via network science.

The student will also spend 3 months at Stichting SURF, Netherlands, hosted by Dr Rob Smets, to explore the standardisation aspects of quantum-aware routing algorithms.

The researcher will work closely with other members of a large multidisciplinary project team. This project is supported by the European Commission through the QUESTING MSCA doctoral training network.

Standard Duties and Responsibilities of the Posts

Applicants should ideally hold a primary degree in Electronic / Electrical Engineering, Computer Science, Physics, Mathematics or a related discipline. Preference will be given to candidates who have experience in classical or quantum networking algorithms and protocols, ideally encompassing both theoretical and experimental aspects. Specific skills that would enhance a candidate's application for the position might include experience in some of the following areas: classical communication systems and networks, quantum communication and networks. Excellent written and oral communication skills are essential.

Funding Information

This position is financially supported through the QUESTING doctoral training network of the European Commission granted to Professor Marchetti who is with the School of Engineering, Trinity College Dublin.

Person Specification

Qualifications

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). We are looking for someone that is motivated, intrigued by scientific discovery, diligent and pays attention – taking pride in their work; and overall a good team player. This is the primary criteria.

Knowledge, Experience and Skills (Essential & Desirable)

Essential

- Highly proficient English language skills
- Strong mathematical and analytical skills
- Strong programming skills (e.g. MATLAB / Python)
- Excellent background in communication networks and/or quantum physics
- Demonstrable research interests within communication engineering and quantum networks
- Excellent organisational skills, attention to details and the ability to meet deadlines
- Ability to think logically, create solutions and make informed decisions
- Ability to work independently and as part of a team
- Excellent written and verbal communication, including presentation skills

Desirable

- A strong commitment to their own continuous professional development
- Experience working as a research assistant in a top lab
- Experience working with qualitative and/or quantitative data

While candidates may not possess all the skills above, we still welcome applications from individuals in complimentary skills. For many of the techniques above, candidates will be expertly trained by existing members in our labs and through collaborators. It really is key that an individual is open to such training and can grasp concepts quickly.

Application Procedure

Applicants should submit a full Curriculum Vitae to include the names and contact details of 2 referees (including email addresses) to Professor Nicola Marchetti (nicola.marchetti@tcd.ie) and Prof Harun Siljak (harun.siljak@tcd.ie). Only shortlisted applicants will be responded to, the next stage being a telco with Prof Nicola Marchetti, Prof Harun Siljak, and their teams. Please include a cover letter, CV, relevant academic transcripts and other information in ONE submitted .pdf file.

Further Information for Applicants

URL Link to College	www.tcd.ie
URL Link to the Wireless Engineering and Complexity Science Lab (WhyCOM)	https://nicolamarchetti.wordpress.com/wireless-engineering-and-complexity-science-lab/
URL to Not A Space Race Lab (NASR)	https://notarace.space/

Trinity College Dublin, the University of Dublin

Trinity is Ireland's leading university and is ranked 75th in the world (QS World University Rankings 2026). Founded in 1592, the University is steeped in history with a reputation for excellence in education, research and innovation.

Located on an iconic campus in the heart of Dublin's city centre, Trinity has 20,000 undergraduate and postgraduate students across our three faculties – Arts, Humanities, and Social Sciences; Engineering, Mathematics and Science; and Health Sciences.

Trinity is ranked as the 31st most international university in the world (Times Higher Education Rankings 2024) and has students and staff from over 120 countries.

The pursuit of excellence through research and scholarship is at the heart of a Trinity education, and our researchers have an outstanding publication record and strong record of grant success. Trinity has developed 19 broad-based multidisciplinary research themes that cut across disciplines and facilitate world-leading research and collaboration within the University and with colleagues around the world. Trinity is also home to 5 leading flagship research institutes:

- Trinity Biomedical Sciences Institute (TBSI)
- Trinity College Institute of Neuroscience (TCIN)
- Trinity Translational Medical Institute (TTMI)
- Trinity Long Room Hub Arts and Humanities Research Institute (TLRH)
- Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN)

Trinity is the top-ranked European university for producing entrepreneurs for the past five successive years and Europe's only representative in the world's top-50 universities
(Pitchbook Universities Report).

Trinity is home to the famous Old Library and to the historic Book of Kells as well as other internationally significant holdings in manuscripts, maps and early printed material. The Trinity Library is a legal deposit library, granting the University the right to claim a copy of every book published in Ireland and the UK. At present, the Library's holdings span approximately 6.5 million printed items, 400,000 e-books and 150,000 e-journals.

With over 120,000 alumni, Trinity's tradition of independent intellectual inquiry has produced some of the world's finest, most original minds including the writers Oscar Wilde and Samuel Beckett (Nobel laureates), the mathematician William Rowan Hamilton and the physicist Ernest Walton (Nobel laureate), the political thinker Edmund Burke, and the former President of Ireland Mary Robinson. This tradition finds expression today in a campus culture of scholarship, innovation, creativity, entrepreneurship and dedication to societal reform.

Rankings

Trinity is the top ranked university in Ireland and ranked 75th in the world (QS World University Rankings 2026). Trinity ranks in the top 100 in 18 subjects (QS World University Rankings by Subject 2025). Full details are available at: https://www.tcd.ie/research/about/rankings/.