

Research Fellow / Research Associate (Quantum
Communication Simulation)
Nanyang Technological University

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Posted Nov. 5, 2025, set to expire May 6, 2026

Job Title	Research Fellow / Research Associate (Quantum Communication Simulation)
Department	Fraunhofer Singapore Research Centre
Institution	Nanyang Technological University Singapore, , Singapore
Date Posted	Nov. 5, 2025
Application Deadline	Open untill filled
Position Start Date	Available Immediately
Job Categories	Research Scientist/Associate
Academic Field(s)	Physics - General
Job Website	https://ntu.wd3.myworkdayjobs.com/Careers/job/NTU-Main-Campus-Singapore/Research-Fellow---Research-Associate--Quantum-Communication-Simulation- R00022462
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Job Description	

Research Associate / Research Fellow – Simulation and Digital Twins for Quantum Communication Security Testing and Evaluation (Fraunhofer@NTU)

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The Fraunhofer Singapore Research Centre FSR@NTU is an independent research centre established at Nanyang Technological University (NTU). It forms part of the Fraunhofer-Gesellschaft (www.fraunhofer.de), one of the world's leading applied research organizations with around 32,000 employees, predominantly scientists and engineers. In Singapore, Fraunhofer operates two closely linked but legally independent entities: Fraunhofer@NTU (FSR@NTU) and Fraunhofer Singapore Research Ltd, the first Fraunhofer affiliate in Asia. Both work in joint facilities to advance applied R&D bridging academia and industry in cutting-edge technological domains.

We invite applications for a Research Associate / Research Fellow (full-time) focusing on simulation and digital twins for quantum communication security testing and evaluation. You will work in an interdisciplinary and international team that combines theoretical and experimental perspectives to jointly develop new approaches and paths for QKD testing and evaluation. The team includes experts from QKD, quantum optics, quantum information, cryptographic engineering, and security testing and evaluation. Together, the team develops novel security evaluation frameworks that advance the testing, evaluation, and assurance of quantum communication systems.

A key part of this role is the design and development of simulation pipelines and digital twin architectures that couple virtual simulation environments with physical QKD security testbeds. This also includes using AI-based modelling, learning-enhanced co-simulation, and predictive analytics to improve the fidelity, automation, and scalability of quantum communication security evaluations.

Key Responsibilities:

- Conduct advanced R&D in the theoretical and practical evaluation of quantum key distribution technologies and quantum cryptography implementations.
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Develop co-simulation pipelines and digital twin frameworks for quantum communication and quantum attack characterization.

- Simulate quantum communication systems, quantum hacking attacks, and security evaluation scenarios, assessing countermeasure effectiveness.
- Collaborate with experimental teams to design experiments, collect component characterization data and demonstrate simulation-driven evaluation capabilities for physical testbeds.
- Collaborate with quantum information theorists to integrate secure key rate calculations with simulations.
- Investigate and apply AI and machine learning techniques to improve and support secure-by-design development, automated optimization, and adaptive co-simulation and testing workflows for QKD systems and protocols.
- Translate research insights into tools, methodologies, and frameworks for quantum security testing and certification.
- Contribute to publications in leading international conferences and journals in quantum communication, simulation, and cybersecurity.
- Prepare technical documentation, reports, and system design descriptions to support ongoing projects.

Job Requirements:

- PhD or MSc/MEng in Physics, Computer Science, or related disciplines with a focus on quantum

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physics or quantum information, or digital twins and simulation for physical systems.

- Strong foundation in mathematical modeling, simulation and quantum mechanics.
- High proficiency in scientific programming (Python, C++, MATLAB, or similar), with experience in simulation frameworks (e.g., NetSquid, QuTiP)
- Demonstrated expertise in modelling and simulation, particularly in co-simulation of complex systems (e.g., quantum optics, communication networks, or cyber-physical systems).
- Experience with digital twin development or simulation pipelines integrating both virtual and physical components.
- Working knowledge of quantum optics and classical information security principles (e.g., testing, evaluation, and certification processes).
- Proficiency in artificial intelligence for simulation and co-simulation tasks.
- Experience contributing to scientific software projects using modern software engineering practices (version control, CI/CD, reproducibility).
- Strong analytical, independent problem-solving, and project execution skills under time constraints.
- Excellent communication and collaboration skills, with the ability to bridge domains (quantum theory, hardware, security engineering) in a multidisciplinary, international team.

We regret that only shortlisted candidates will be notified.

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Contact Information

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Contact

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