QUANTUM COMPUTING APPLICATION CLUSTER

THE UNIVERSITY of EDINBURGH

University of Strathclyde Glasgow

University of Glasgow

WHO ARE WE?

The Quantum Computing Application Cluster joins up academic capabilities to help expand and further develop the ecosystem for quantum computing and simulation across the Scottish Central Belt. Combining expertise in quantum hardware and software, as well as classical HPC, we work with industry to

- **develop next generations of hardware and software for quantum computing**
- **identify end-user computational challenges that can be addressed with quantum computing, developing software solutions and understanding the timescales for impact on each sector**
- **bring added value to the training of PhD students and researchers at all levels across the traditional academic boundaries of physics, engineering, computer science, and HPC**

CONNECTED CAPABILITY

We are strongly embedded within the National Quantum Technologies programme, especially collaborating with the National Quantum Computing Centre (NQCC) and as part of the Hub for Quantum Computing and Simulation and large Innovate UK and EPSRC projects. We are also part of projects in the EU Quantum Technologies Flagship, and US-funded projects.

Hardware

Neutral atoms: The University of Strathclyde is the leading UK department in quantum computing and simulation with neutral atoms, developing cold atoms in optical lattices, and tweezer arrays in collaboration with industry. Neutral atom quantum computing offers the potential to rapidly scale up the number of qubits and thereby tackle a larger range of "real world problems" earlier.

Superconducting Circuits: The University of Glasgow hosts a strong programme in developing cryogenic hardware for quantum computing, including superconducting detectors and circuits that form the basis of quantum computers being developed also by IBM and Google. We have unique access to the leading James Watt Nanofabrication Centre (JWNC) with an established commercial unit, Kelvin Nanotechnology to provide components for quantum computing.

Other developing platforms and technologies: We have ongoing work in spin qubits (Strathclyde), and hybrid superconducting-semiconductor qubits (Glasgow). More broadly, there is a lot of regional strength across all four areas of quantum technologies, with the Universities of Strathclyde and Glasgow the only two universities in all four quantum technologies hubs.

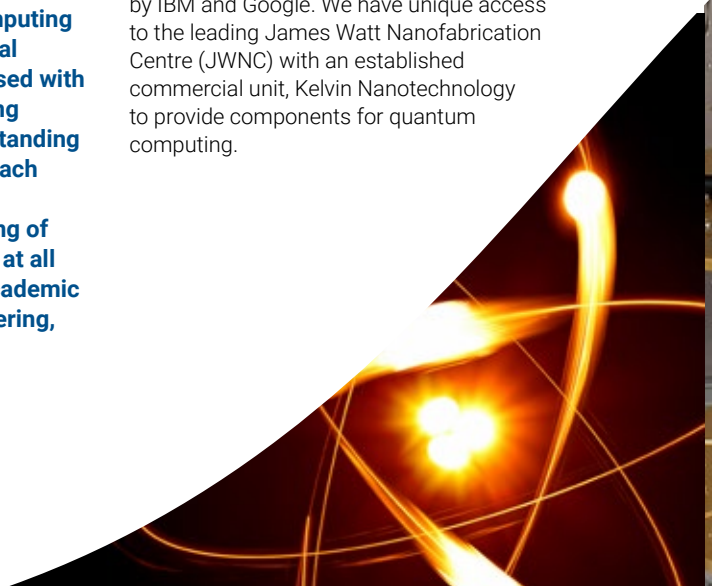
Software

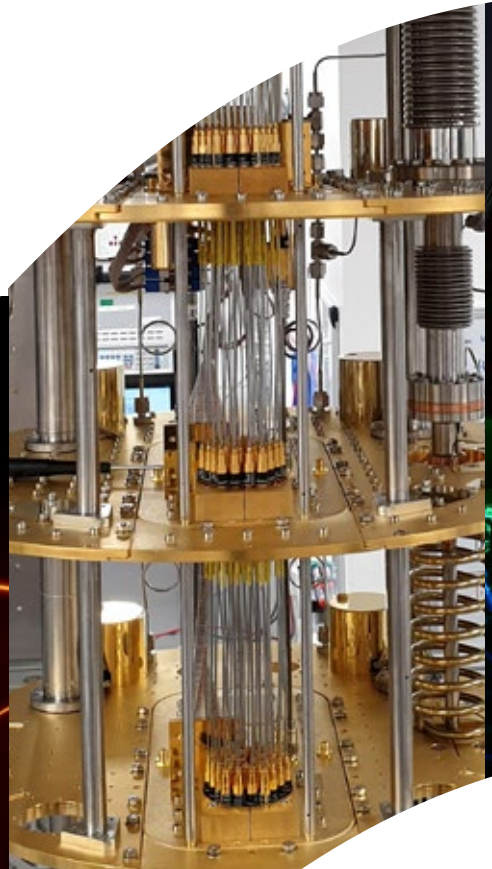
Our software capabilities spread between The University of Edinburgh Quantum Informatics Group, which is the largest of its kind in the UK, and the University of Strathclyde, which specialises in specific connections to near-term hardware and scientific computing. We work on applications including:

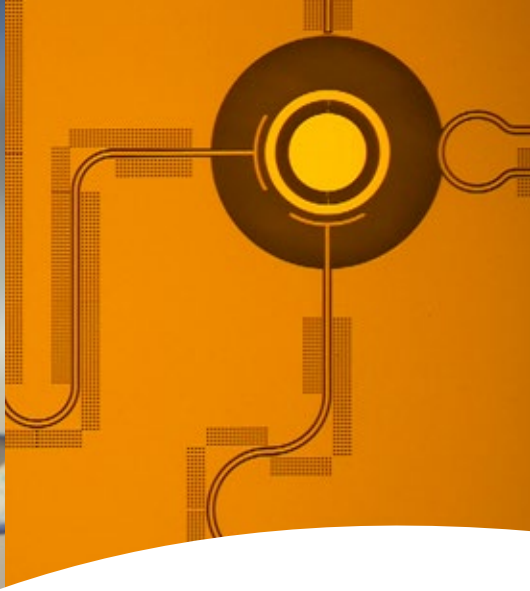
- Quantum simulation, with applications to materials science and quantum chemistry
- Variational quantum algorithms and optimisation tasks
- Quantum Machine Learning
- Quantum Cyber Security, including post-quantum security and quantum cryptanalysis

We develop the full underpinning software stack for quantum computing, including:

- Quantum Programming Languages and circuit compilation
- Benchmarking, testing and verification of quantum technologies
- Quantum Systems/Architectures and the quantum internet







High Performance computing and connections to end-user applications

A key distinguishing characteristic of our cluster is the involvement of the Edinburgh Performance Computing Centre (EPCC), an international centre for excellence in HPC, and host of world-class systems (including the national supercomputer, Archer2). They bring the opportunity for joined-up connections with HPC hardware, as well as connections to end users and an understanding of key computational challenges in industry.

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CONTACT

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