Advanced Quantum Science and Technologies

Devices whose operation is based on quantum rules are revolutionising information processing and sensing. Improving hardware and demonstrating quantum advantage in real-world applications of current quantum computers are two drivers of the quantum ready economy.

Quantum Ecosystem: Collaborations and Partnerships

- National Quantum Technologies Programme
- National Quantum Computing Centre
- National Physical Laboratory: Joint students, secondments, joint projects
- UKRI Oxford Quantum Computing and Simulation Hub
- Industrial Partnerships (Innovate UK partners, EMP)
- International partnerships (US/UK Strategic Intent, Nov 2021).

Our Infrastructure

- National UK Centre for Superconducting and Hybrid Quantum Systems (SuperFab)
- London Low Temperature Laboratory /European Microkelvin Platform (European Advanced Infrastructure).

Capacity Building across School of EPMS

Quantum software
- Hardware architecture
- Quantum algorithms
Tools: Industrial liaison, NPL liaison, NQCC and NQTP liaison. New posts; Secondments. PhD studentships.

Fundamental research diversification/expansion
- Spintronics
- Topological materials
- Cavity optomechanics

Infrastructure expansion
- National Infrastructure for Quantum Integration proposal.
- Developing nanofabrication at Royal Holloway for broad user community.

Quantum workforce
EPSRC QT Career Development Fellowships
PhD training

Funding Portfolio

Innovate UK
Reliable, high throughput production and characterisation of coherent superconducting quantum devices. Led by Oxford Quantum Circuits (£4.5m)
IN-QUEST: Innovative quantum-enabling sub-Kelvin technology. Led by Chase Research Cryogenics Ltd (£0.35m)
AQuaSec: Agile quantum safe communication. Led by Toshiba (£0.33m)

Quantum Technology for Fundamental Physics
Quantum Sensors for the Hidden Sector (£4.8m)
Quantum Simulators for fundamental physics (£4.3m)
QUEST-DMC: Quantum enhanced superfluid technologies for dark matter and cosmology (£3.4m)

Superconducting quantum devices
CQUID: Charge quantum interference device and applications (£0.63m)
QUANTUM E-LEAPS: Toward a new era of electrical measurements through phase slips (£0.34m)
SuperQuant: Microwave metrology for superconducting quantum circuits (£0.2m)
Josephson travelling wave parametric amplifier and its application for metrology (£0.25m)
Equipment for quantum science and metrology (£0.46m)

Quantum Information Science and Materials
EMP: European Microkelvin Platform (£10m)
Topological mesoscopic superfluidity of 3He (£1.4m)
Cavity optomechanics with superfluid 4He (£0.74m)
Topological spintronics (£0.46m)
Harnessing disorder to tune, tailor and design classical and quantum spin liquids (£0.28m)
Non-Ergodic Quantum Information Manipulation (£7.03m)
A new statistical and dynamical theory of disorder interacting quantum systems
Intertwined superfluid and density-wave orders in quantum many body systems (£0.19m)
Lattice based cryptography and post quantum cryptography (£1.26m)
Coherent near-field scanning microwave spectroscopy techniques (Google Research Award)

Skills and Training (Future strategy)
- Assess landscape of current provision; Target need
- Develop capability [+ outreach and immersive technology]; Partner with NPL and industry

For further information contact j.saunders@rhul.ac.uk