



UNIVERSITY
OF SUSSEX



1 Advertisement

Post Title: Research Fellow in Trapped Ion Quantum Computing

School/department: School of Mathematical and Physical Sciences

Hours: Full time

Requests for flexible working options will be considered (subject to business need).

Contract: Fixed term initially 12 months, with the possibility of extension

Reference: 10525

Salary: starting at £35,333 to £42,155 per annum according to track record and experience

Placed on: 16 December 2022

Closing date: 31 January 2023. Applications must be received by midnight of the closing date.

Expected Interview date: 15 February 2023

Expected start date: 01 March 2023 or by negotiation

Applications are invited for the position of a Research Fellow in Trapped Ion Quantum Computing in the [Ion Quantum Technology Group](#) in the [Sussex Centre for Quantum Technologies](#) at the University of Sussex. The position is part of the UK National Quantum Technologies programme and is concerned with the development of utility scale quantum computers capable of solving disruptive societal and industry challenges.

Trapped ions are one of the most mature implementations to deliver practical quantum technologies. We have developed a unique approach for trapped-ion quantum computing that enables scaling to a large number of qubits. The approach couples scalable global microwave based quantum gate technology with fully integrated quantum computing microchip modules that can be linked together using fast electric field links.

This position is part of a larger effort to develop and operate quantum computing solutions which scale to significantly larger system sizes. We currently operate 5 quantum computer prototypes in our lab and the position will focus on one or multiple of these experimental setups directed towards the implementation of quantum error correction, ion transport and quantum gate execution, raising gate fidelities, operation of multi-module quantum computing prototypes and the development of quantum computing microchips.

Some of the typical tasks for this position include operation of ion trap experiments, high power microwave setups, laser systems, optical setups and ultra-high vacuum setups as well as carrying out quantum information science experiments, quantum error correction, perform simulations of quantum systems, quantum control and other relevant theory and

supervise undergraduate and postgraduate students.

The successful applicant should have an experimental PhD in a field related to our research area such as atomic physics, optical physics or quantum physics along with a good publication record. The salary offered will be appropriate to the qualifications, standing and experience of the successful candidate.

You can find out more about the group at:

<http://www.sussex.ac.uk/physics/iqt/>

Please include with your completed application form a CV, cover letter, the contact details of three referees and a list of relevant publications.

Please contact Prof Winfried Hensinger (w.k.hensinger@sussex.ac.uk) for informal enquiries.

The University is committed to equality and valuing diversity, and applications are particularly welcomed from women and black and minority ethnic candidates, who are under-represented in academic posts in Science, Technology, Engineering, Medicine and Mathematics (STEMM) at Sussex.

“Please note that this position may be subject to [ATAS clearance](#) if you require visa sponsorship.”

For full details and how to apply see our [vacancies page](#)

The University of Sussex values the diversity of its staff and students and we welcome applicants from all backgrounds.

2. The School / Division

The [Ion Quantum Technology Group](#) is part of the [Sussex Centre for Quantum Technologies](#). Significant investment by the University, along with a multi-million pound grant portfolio, has transformed Sussex into one of the leading incubators for a broad range of quantum technologies. At the Sussex Centre for Quantum Technologies (SCQT) our research groups work hand-in-hand with leading industry partners in carrying out and commercializing our groundbreaking research. The critical mass of seven research groups allows us to tackle challenges and invent technologies that will change the way we work and live. The Centre carries out research in the areas of quantum computing, quantum simulation, quantum sensing, quantum imaging, quantum clocks and quantum networks. The SCQT Doctoral and Industry Training Academy provides authentic quantum technology training for a wide range of stakeholders including industry short courses, undergraduate training, our pioneering Quantum Technologies MSc. and a comprehensive doctoral training programme. The Centre has given rise to a number of world-leading achievements and records. We run the largest number of ion trapping experiments in the UK, we are one of the largest ion trapping centres in the world. Leading an international consortium including Google, Aarhus University, Riken, and Siegen University, the Sussex IQT Group created the first nuts-and-bolts construction plan to build a practical quantum computer. Previous ideas for

building practical quantum computers with trapped ions involved aligning billions of laser beams to execute computations. The Sussex IQT Group invented a new approach replacing these laser beams with voltages applied to a microchip. Quantum networks can be created by coupling photons and ions. The experimental work in building practical quantum computers is complemented by the theory group of Dr Niel de Beaudrap working on quantum information theory and quantum error correction. The Sussex ITCM group have realized as a world first the strong coupling between and trapped ion and a photon, a key milestone towards an advanced quantum networks and distributed quantum computers. Prof. Garraway's theoretical research on trapping atoms in new shapes and topologies has been taken up by the International Space Station. Experimental Groups worldwide have been using his techniques in their experiments for over a decade. Dr Jacob Dunningham works on the theory of entangled quantum sensors. Dr Jose Verdu's research miniaturized a particular type of electron trap onto a microchip. This will have implications for making mass spectrometry devices much cheaper and may give rise to a new generation of quantum radar. Fedja Orucevic and Peter Krueger's group works on quantum imaging and quantum sensing, for example, imaging current densities in batteries or processes in the brain.

Please find further information regarding the school/division at www.sussex.ac.uk/mps

3. Job Description

Job Description for the post of: Research Fellow in trapped ion quantum computing

Department: Physics and Astronomy

Section/Unit/School: Mathematical and Physical Sciences

Location: Pevensey 2

Grade: Research Fellow, Grade 7

Responsible to: Prof Winfried Hensinger through to Head of School

Responsible for:

PRINCIPAL ACCOUNTABILITIES

To engage in individual and/or collaborative research activity resulting in high-quality publications; and to develop research funding and knowledge exchange income individually or in collaboration with others, as appropriate, depending on the size and scope of the bid. To contribute to School teaching activities.

KEY RESPONSIBILITIES

1. Research, Scholarship & Enterprise

- 1.1 Develop research objectives and implementation strategies for research, at acceptable levels, with assistance if required.
- 1.2 Conduct research projects individually and in collaboration with others.
- 1.3 Analyse and interpret research findings and draw conclusions on the outcomes.
- 1.4 Produce high-quality research outputs for publication in monographs or recognised high-quality journals, or performance/exhibition, as appropriate, and contribute to the School's REF submission at acceptable levels of volume and academic excellence.
- 1.5 Contribute to the preparation of proposals and applications to external bodies, for example for funding purposes.
- 1.6 Individually or with colleagues, explore opportunities for enterprise activity, knowledge exchange income and/or consultancy, where permissible.
- 1.7 Build internal contacts and participate in internal networks and relevant external networks in order to form relationships and collaborations.
- 1.8 Continually update knowledge and understanding in field or specialism, and engage in continuous professional development.

2. Teaching & Student Support

- 2.1 Undertake teaching duties, if required.
- 2.2 Assist in the assessment of student knowledge and supervision of student projects if required.
- 2.3 Assist in the development of student research skills, for example as part of a postgraduate supervision team.

3. Contribution to School & University

- 3.1 Attend and contribute to relevant School and project meetings.
- 3.2 Undertake additional duties, as required by the Principal Investigator and/or Head of School.

4. Role-specific duties

- 4.1 Construction and operation of quantum computing related ion trap experiments
- 4.2 Participate in the development of group strategy and its efficient implementation.
- 4.3 Supervision of undergraduate and doctoral students.
- 4.4 Dissemination of research findings.

- 4.5 Assist and when required take a lead in the preparation proposals and reports to external bodies, e.g. for funding and contractual purposes.
- 4.6 Participate in shaping research directions and leadership making use of detailed expertise in the research area.

Specific Duties

1. **Operation and construction of ion trap experiments**

This involves work with a state-of-the art trapped ion based multi-module quantum computing experiments, operation of microfabricated ion trap chips, implementation of high-fidelity coherent quantum operations, ion shuttling operations, implementation of quantum error correction along with the day-to-day support of the experiment such as building and upkeep of electronics and other experimental components.

3. **Supervision of undergraduate and postgraduate students**

Helping in the supervision of the undergraduate and postgraduate students in the group, taking a lead in doing so when required.

4. **Dissemination of research findings**

Dissemination routes that the candidate is expected to assist in are: conference presentations; writing articles for physics journals.

5. **Assist in the preparation proposals and reports to external bodies, e.g. for funding and contractual purposes.**

This involves underlying physics calculations as well as the preparation of materials as well as any required developments for group strategy.

This Job Description sets out current duties of the post that may vary from time to time without changing the general character of the post or the level of responsibility entailed.

INDICATIVE PERFORMANCE CRITERIA

- Regular published output of original research at international level (refereed journal papers, monographs, book chapters, text-books).
- Other evidence of original research contribution to the field, such as through invited conference contributions, membership of editorial panels etc.
- Evidence of successful co-supervision of doctoral students.
- Evidence of the successful supervision of others within the research group.

- Evidence of contribution to the process of obtaining competitive/peer reviewed research support funding or collaboration in significant research projects with institutions of equivalent standing.
- Involvement in the creation, transfer and use of the results of research through a range of knowledge exchange activities.
- Success in transferring research results to commercial, professional, public sector or other practical use.
- Evidence of successful engagement in teaching or supervision.

4. Person Specification

ESSENTIAL CRITERIA

1. Normally educated to doctoral level, or other equivalent qualification.
2. Evidence of engagement in high-quality research activity.
3. Evidence of having worked with trapped ion systems
4. Excellent presentation skills, with the ability to communicate effectively, both orally and in writing, with students, colleagues and external audiences.
5. Ability to work individually on own initiative and without close supervision, and as part of a team.
6. Ability to exercise a degree of innovation and creative problem-solving.
7. Excellent organisational and administrative skills.
8. Ability to prioritise and meet deadlines.
9. Excellent IT skills.

DESIRABLE CRITERIA

1. Emerging track record of high-quality publications in reputable journals and other appropriate media of similar standing.
2. Experience of generating research or knowledge exchange income.

ROLE-SPECIFIC CRITERIA

SKILLS / ABILITIES

	Essential	Desirable
Ability to carry out original research in experimental cold atom / ion research	✓	
Skills working with optics and diode lasers		✓
Competence in using data acquisition software	✓	
Competence in using data analysis software	✓	
Good communication skills, written and oral	✓	
Electronics skills		✓
Writing journal articles	✓	
Skills in operating microfabricated ion traps		✓

Clear leadership potential in the specific research area	✓	
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KNOWLEDGE

	Essential	Desirable
Atomic physics, quantum information, quantum optics	✓	

EXPERIENCE

	Essential	Desirable
Experiments in working with trapped ion or cold atom systems		✓
Coherent manipulation of neutral atoms or ions		✓
Operation of microfabricated ion traps		✓
Handling of ultra-high vacuum equipment		✓
Experiments with cryogenic vacuum systems		✓
Proven record of writing journal articles	✓	
Proven record of writing high profile journal articles		✓

QUALIFICATIONS

	Essential	Desirable
PhD in experimental atomic physics or quantum computing or quantum sensing or similar	✓	
A proven track record of experience in experimental quantum optics, microfabrication or atomic physics	✓	

PERSONAL ATTRIBUTES AND CIRCUMSTANCES

	Essential	Desirable
Ability to work independently	✓	
Active commitment to teamwork	✓	
Demonstrated leadership abilities	✓	