



## Heilbronn Research Fellowship in Quantum Computing

### 1. JOB DESCRIPTION

**Faculty / School or Division:** Faculty of Science, School of Mathematics

**Faculty/School or Division Address:** Fry Building, Woodland Road, Bristol, BS8 1UG

<b>Job Family:</b>	Research		
<b>Grade/Pathway:</b>	J/Pathway 2c	<b>Salary range:</b>	£38,587-43,434 per annum
<b>Hours of work:</b>	100% time	<b>Contract type:</b>	Fixed-term for 3 years
<b>Work pattern:</b>	Mon-Fri	<b>Vacancy Reference Number: ACAD105636</b>	

#### 1.1 Main Job Purpose

The Heilbronn Institute for Mathematical Research invites applications for a Research Fellowship in Quantum Computing in the School of Mathematics at the University of Bristol. The successful candidate must demonstrate prior evidence of relevant accomplishments, and/or an outstanding research track-record in a mathematical discipline (including Mathematical/Theoretical Physics or Theoretical Computer Science) with clearly laid-out plans to transition into Quantum Computing. Fellows divide their time equally between their own research and the classified research programme in Quantum Computing at the Heilbronn Institute, thus enjoying opportunities to engage in collaborative work as well as individual projects.

#### The Heilbronn Institute for Mathematical Research (HIMR)

The Institute was established in 2005 by UK Government Communications Headquarters (GCHQ) in association with the University of Bristol to conduct research in areas including, but not restricted to, Algebra, Algebraic Geometry, Combinatorics, Computational Statistics, Data Science, Number Theory, Probability, and Quantum Information. These areas are interpreted broadly: Research Fellows have previously been appointed with backgrounds in most of Pure Mathematics and Statistics, and several areas of Mathematical/Theoretical Physics.

The Heilbronn Institute has grown into a national research institute, with some of the leading mathematicians in the UK working in a highly stimulating research environment. It partners with the Alan Turing Institute, the Clay Mathematics Institute, the Isaac Newton Institute, and the International Centre for Mathematical Sciences. For more information about the [Heilbronn Institute](#), including its [workshops and conferences](#), [papers written](#) by its members, and current [fellows](#), please see our website at <http://heilbronn.ac.uk>.

The Institute's research programme is divided equally into 'internal' research on behalf of GCHQ, and 'external' research in areas of the Fellows' choice. The external research can be published in the usual way. Internal research may be externally publishable depending on its nature, but can only be published with GCHQ's agreement.

The Chair of HIMR, who is responsible for the external research and associated activities is Professor Geoffrey Grimmett FRS. Michael Groves, the Head of HIMR, is responsible for the internal research programme. The Associate Chair of HIMR is Professor Francesco Mezzadri, who is responsible for the Heilbronn Institute's activities and Fellows at the University of Bristol.

At any one time the Heilbronn Institute typically has over 100 members. These range from distinguished senior visiting academics to postdoctoral researchers holding Heilbronn Research Fellowships. Currently, around 40 Research Fellows are supported, for between one and seven years, and we currently support over 20 PhD students. Since it was established in 2005, over 200 mathematicians have been members of the Institute, including over 100 Research Fellows.

This post is funded through the [UKRI/EPSRC 'Additional Funding Programme for Mathematical Sciences'](#).

### **Research Environment**

You will join a cohort of over 40 Heilbronn Research Fellows that includes some of the leading early-career mathematicians in the UK.

Expert mentoring will be provided within the School of Mathematics, with a national programme of career development events organized by the Associate Chair, who is based in the School of Mathematics at the University of Bristol.

HIMR supports a large number of conferences, workshops and other research events, including our flagship event, the Annual Conference, and the Heilbronn Distinguished Lecture Series. For more information, see: <https://heilbronn.ac.uk/events/>

The internal research programme is determined by the Head of HIMR in conjunction with GCHQ. Fellows are presented with a range of challenging mathematical problems and are given the facilities and support to contribute to one or more of them, frequently as part of a collaborative team.

The Heilbronn Institute is a supporter of the LMS Good Practice Scheme aimed at advancing women's careers in mathematics and we particularly welcome applications from women for this post. For more information, please see <https://heilbronn.ac.uk/diversity/>

### **Quantum Computing at Bristol**

The post will be integrated within the interdepartmental Quantum Information Theory (QIT) group, one of the world's leading groups in quantum information theory. The group has members from the Schools of Mathematics (Prof Noah Linden and Prof Ashley Montanaro) and Physics (Prof Sandu Popescu FRS, Dr Tony Short and Dr Paul Skrzypczyk).

The QIT group has interests in all theoretical aspects of quantum information science, including fundamental aspects of quantum mechanics; mathematical underpinnings of quantum information theory; quantum algorithms; quantum computation; quantum nonlocality; and applications of quantum information theory to other disciplines. We frequently collaborate with our colleagues at the

Quantum Engineering Technology Labs (QET Labs), an internationally leading experimental quantum information group spanning the faculties of Science and Engineering and encompassing the activity of over 100 researchers and students, 12 core academics and 40 associated academics.

We also have extensive external collaborations and partnerships with top UK and international groups. Our current activities include a major project on quantum software for modelling and simulation, in collaboration with the Google Quantum AI Lab and UCL, and funded under the EPSRC Prosperity Partnership scheme; and membership of the European “QuantAlgo” consortium, developing quantum algorithms in collaboration with leading groups at CWI, Atos and the Universities of Brussels, Latvia, Paris Diderot, and Copenhagen.

Quantum Information is a strategic priority for the University of Bristol. This was recognized by the creation last year of the Bristol Quantum Information Institute, one of only seven such institutes in the University, in areas where the University is already internationally-leading and is looking to develop capacity. The Institute, whose director is Prof Linden, crystalizes our quantum information research across the entire spectrum, from theory to technology.

The University also recently announced its plans to develop the Quantum Technologies Innovation Centre (QTIC). This £43 million Centre has been funded in partnership by £15 million from the West of England Local Enterprise Partnership (LEP), £21 million from industrial partners and £7 million from the University of Bristol. It will be based in the University’s new enterprise campus, to be built in the heart of the city.

### **Facilities and Research Support**

Excellent facilities are provided for both the external and the internal research. Fellows have access to the University’s Advanced Computing Research Centre which operates a number of different [High Performance Computing](#) systems. In addition to work space at the Institute, Fellows also have desks in the School of Mathematics, which they can access 24/7. The University of Bristol invested £33m to transform the Grade II listed Fry Building, which has been the new home for the School of Mathematics since 2019.

Fellows work flexible hours, and are able to split their time between internal and external research in whatever way suits them best.

The Chair holds a generous budget for research activities such as travel and organising workshops and visits to the University of Bristol by collaborators from other institutions. Fellows may expect research expenses of up to £2.5K pa, and are able to bid for further sums from the Chair’s fund for special projects. They may also bid for external funding.

### **Terms and Conditions**

Terms and conditions of employment for Research Fellows will be based on those applicable to fixed-term externally-funded researchers in the University of Bristol.

The salary range is £38,587-£43,434, depending on experience, plus a salary supplement of £3.5K pa, in recognition of the distinctive nature of a Fellowship. Payment of this supplement is conditional on a PhD thesis having been accepted in final form.

## Intellectual Property Rights

The Institute acquires all IPR in the internal research. Rights in the external research are subject to the normal arrangements between the University of Bristol and its employees, subject to GCHQ acquiring a royalty-free license on any exploitable invention.

## Security

Some of the Institute's work is highly confidential and subject to formal security procedures. All the internal research must be carried out within the Institute and not discussed, even in general terms, elsewhere, without explicit GCHQ permission. Fellows need to acquire, and continue to qualify for, a national security clearance (Developed Vetting) from GCHQ; they are subject to provisions of the Official Secrets Acts and restrictions on travel to certain countries. UK resident UK nationals will normally be able to meet this condition. Non-UK citizens and UK citizens who are not UK residents should contact the Heilbronn Manager, [himr-recruitment@bristol.ac.uk](mailto:himr-recruitment@bristol.ac.uk) about eligibility before applying. Information on the process can be found on the UK Government security vetting website:

<https://www.gov.uk/government/publications/united-kingdom-security-vetting-clearance-levels/national-security-vetting-clearance-levels#developed-vetting-dv>

The University and the Heilbronn Institute reserve the right to terminate the fellowship in the event of loss of security clearance.

## Teaching

This Fellowship is a research position, and as such there are no formal specified teaching duties required of the role-holder. However, other commitments permitting, the role-holder may be offered development opportunities to undertake activities such as teaching on undergraduate programmes and/or supervising final year projects, as appropriate.

## Informal Enquiries

Candidates interested in learning more about these Fellowships can contact Professor Ashley Montanaro: [ashley.montanaro@bristol.ac.uk](mailto:ashley.montanaro@bristol.ac.uk) or Professor Noah Linden: [n.linden@bristol.ac.uk](mailto:n.linden@bristol.ac.uk)

## 1.2 Main Statement of Responsibilities

### Research Responsibilities

- Please refer to main job purpose above.

### Administration Responsibilities

- Please refer to main job purpose above.

### Teaching Responsibilities

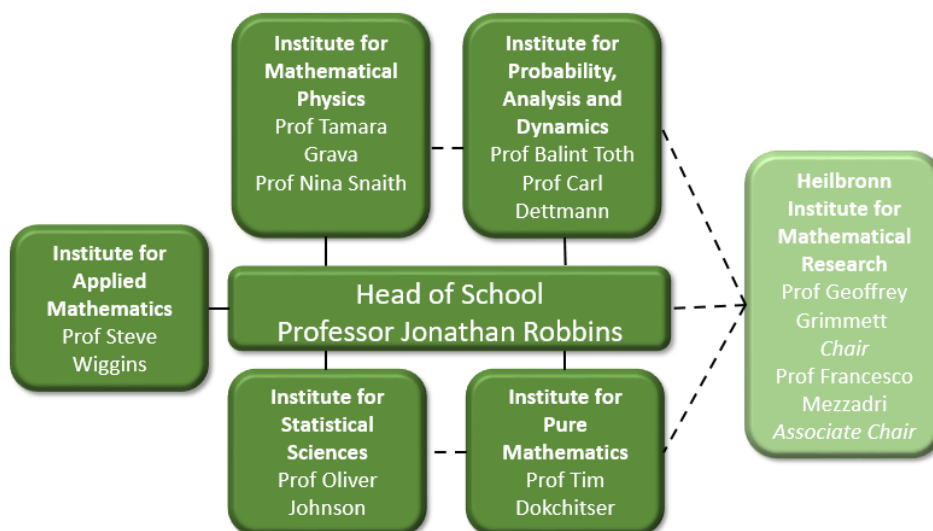
As this role is a Pathway 2 (Research) role, there are no formally specified teaching duties required of the role-holder. However, other commitments permitting, the role-holder may be given development opportunities to undertake activities such as teaching on undergraduate programmes and/or supervising final year projects, as appropriate.

### 1.3 Relationships

Line manager: Professor Francesco Mezzadri

Line manager to (where appropriate): n/a

### Organisation Charts



### 1.4 Job Hazards/Safety Critical Duties (Pre-employment health screening)

NOT APPLICABLE

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## 2 PERSON SPECIFICATION

### 2.1 Relevant Experience, Skills and Knowledge

#### *Essential*

- Experience of independent research in the theory of quantum computing / quantum information, and/or in a mathematical discipline (including Mathematical/Theoretical Physics and Theoretical Computer Science) with clearly laid-out plans to transition into quantum computing.
- A publication plan commensurate with career stage.
- Self-motivation, initiative, and organisational skills in planning and carrying out research.

## 2.2 Relevant Qualifications

### *Essential*

PhD or equivalent doctoral qualification in a relevant subject by the time you start this fellowship, or very close to completion.

## 2.3 Communication and Interpersonal Skills

### *Essential*

- Excellent written and oral communication skills in English.

## 2.4 Additional Criteria

### *Essential*

- Due to the nature of the Heilbronn Institute's work, Fellows will be required to obtain and maintain a Developed Vetting (DV) security clearance. UK resident UK nationals will normally be able to meet this condition: other potential applicants should consult the Heilbronn Manager, [himr-recruitment@bristol.ac.uk](mailto:himr-recruitment@bristol.ac.uk) about eligibility before applying.

## CAREER PATHWAY AND OTHER RELEVANT INFORMATION

### 1. Career Pathways

All members of academic staff have a clear career pathway involving a series of levels with distinct role profiles, each with its unique requirements. Each profile sets out what is expected of an academic at the particular level. The role profiles also set out a collection of competencies expected for each level. Progression or promotion to the next level will occur after these competencies have been attained and where a role at the higher level is available.

The academic pathways are as follows:

**Career Pathway One** - academic roles that combine teaching, research and administrative duties.

**Career Pathway Two** - academic roles focusing on research and associated administrative duties.

**Career Pathway Three** – academic roles focusing on teaching and associated administrative pathways

This post is located on Pathway Two. Role Summaries setting out what is expected of an academic at each particular profile level on pathway two can be found below. Please note that an appointment may be made at any level of the pathway.

A schematic diagram of the career pathways can be found at <http://www.bristol.ac.uk/hr/grading/academic/>.

For Pathway Two roles progression to the next level will only occur where a role has been identified as being eligible for progression, having reached the relevant point on the salary scale and after the relevant competencies have been attained. A progressable role is a role at Level b or Level c that has been determined as being eligible for progression by the Head of Department, based on departmental needs, priorities and funds. Individuals in progressable roles at Level b or Level c are expected to develop their skills, knowledge and experience in order to ultimately progress to Level c or Level d, as applicable. A non-progressable role is one either at Level a (which are not subject to formal progression arrangements, although there may be opportunities to develop into a Level b role, based on departmental needs, priorities and funds), or at Level b or c for which the Head of Department has identified an ongoing need at that particular level. Movement to Level e will be by promotion only.

## **Role Summaries**

### **Research Associate (Level a)**

Role holders at this level are concerned with *assisting* an individual research leader or team to conduct a particular study (or group of studies). They will generally be involved in data generation and/or collection using standard and well-defined methods developed by others. They will be working under close supervision by, and direction from, a more senior researcher, who will be ultimately responsible for the project. This may be the entry level for some staff who are expected to train and/or develop to take on more senior researcher roles. Role holders will be provided with academic and pastoral support within the department (including counselling on realistic career opportunities) and training will be available designed to develop their competences and to prepare them to take on more responsibilities associated with a higher grade.

### **Senior Research Associate (Level b)**

Role holders at this level will be experienced and professional researchers (or have considerable professional experience) and will be specialists in a particular area or methodology, drawing upon knowledge gained from postgraduate research and/or working within a Level a role. They will be *associated* with a particular project (or projects) and will contribute ideas, and/or enhancement of techniques or methodologies. They will be expected to do some writing for dissemination outside the Department. They will still be working under supervision, but will be expected to take significant initiatives in their work and consult with the Principal Investigator over the details of the project. They may, where practical, contribute to the department's teaching, through supervision of projects, overseeing practical classes, or taking small group classes. They will be provided with academic and pastoral support within the department and training will be available designed to develop their competences (including counselling on realistic career opportunities) and prepare them to take on more responsibilities associated with a higher grade.

### **Research Fellow (Level c)**

Role holders at this level will have substantial experience of research (normally not less than six years). They will initiate and take responsibility for some research projects and may be Principal Investigators or, where a Research Council does not permit this, act as though they were Principal Investigators. They will be involved in administration relevant to their projects (e.g. helping to prepare bids for research funding), managing other researchers and monitoring research budgets. They will be expected to be undertaking research individually and/or collectively and to be advancing the state of knowledge and understanding within their particular area of expertise. They will be publishing regularly in high quality

outlets. They are likely to provide some teaching support for the department (consonant with the terms of their funding). They will be expected to be establishing a growing reputation within their particular research field and academic discipline and to be developing and demonstrating intellectual independence.

**Senior Research Fellow (Level d)**

Role holders at this level will have extensive experience in research and research management. They will normally be Principal Investigators, leading collaborative research bids and research teams, or driving forward innovative research themselves. They will be involved in scholastic projects (e.g. editing journals and academic books), and be making a significant leadership and/or management contribution within their department or the wider university, to be participating in national/international academic networks and conferences. They may be transferring their knowledge through some teaching and/or supervision to undergraduate or graduate students (consonant with the terms of their funding). Role holders at this level will be independent researchers and will have an established national and growing international reputation within their academic discipline generally and research field in particular.

**Professorial Research Fellow (Level e)**

Role holders at this level will have very extensive experience of research leadership and related management/administration. They will enjoy a wide recognition for their expertise within the academic community internationally (as evidenced by conference invitations, journal editorships, office holding in specialist groupings, associations with appropriate Research Councils etc.). They will have made recognised and significant contributions to the developing knowledge and understanding of their research area. They will already have responsibilities for the creation, initiation, development and overall management of significant research programmes. They will 'profess' their discipline within the Department, as appropriate and consonant with the terms of their funding. They may also carry significant leadership roles within the Faculty or University.