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**DEPARTMENT OF MATERIALS****Job description and selection criteria**

<b>Job title</b>	<b>Postdoctoral Research Assistants in Experimental Quantum Nanodevices (2 posts)</b>
<b>Division</b>	<b>Mathematical, Physical and Life Sciences Division</b>
<b>Department</b>	<b>Materials</b>
<b>Location</b>	<b>Department of Materials, Parks Road, Oxford</b>
<b>Grade and salary</b>	<b>Grade 7: Salary in the range £29,837 - £36,661 per annum</b>
<b>Hours</b>	<b>Full time</b>
<b>Contract type</b>	<b>Fixed-Term (up to 36 months)</b>
<b>Reporting to</b>	<b>Professor G A D Briggs, Principal Investigator</b>
<b>Vacancy reference</b>	<b>113940</b>
<b>Additional information</b>	

## Introduction

### The University

The University of Oxford is a complex and stimulating organisation, which enjoys an international reputation as a world-class centre of excellence in research and teaching. It employs over 10,000 staff and has a student population of over 22,000.

Most staff are directly appointed and managed by one of the University's 130 departments or other units within a highly devolved operational structure - this includes over 6,500 'academic-related' staff (postgraduate research, computing, senior library, and administrative staff) and over 2,700 'support' staff (including clerical, library, technical, and manual staff). There are also over 1,600 academic staff (professors, readers, lecturers), whose appointments are in the main overseen by a combination of broader divisional and local faculty board/departmental structures. Academics are generally all also employed by one of the 38 constituent colleges of the University as well as by the central University itself.

Our annual income in 2012/13 was £1,086.9m. Oxford is one of Europe's most innovative and entrepreneurial universities: income from external research contracts exceeds £436.8m p.a., and more than 80 spin-off companies have been created.

For more information please visit [www.ox.ac.uk/staff/about\\_the\\_university.html](http://www.ox.ac.uk/staff/about_the_university.html)

The University of Oxford is a member of the [Athena SWAN Charter](#) to promote women in Science, Engineering and Technology and holds an institutional Bronze Athena SWAN award. The Department of Materials was awarded departmental Silver Athena status in August 2012 in recognition of its efforts to introduce organisational and cultural practices that promote gender equality in SET and create a better working environment for both men and women. Job applications are particularly welcome from women and black and ethnic minority candidates, who are under-represented in research posts in the Department.



### Mathematical, Physical and Life Sciences Division

The Mathematical, Physical and Life Sciences (MPLS) Division is one of the four academic divisions of the University of Oxford. We have over 6,000 students and research staff, and generate over half of our funding from external research grants.

The MPLS Division's 10 departments and 3 interdisciplinary units span the full spectrum of the mathematical, computational, physical, engineering and life sciences, and undertake both fundamental research and cutting-edge applied work. Our research addresses major societal and technological challenges and is increasingly interdisciplinary in nature. We collaborate closely with colleagues in Oxford across the medical sciences, social sciences and humanities.

Today's scientific research not only crosses traditional subject boundaries, but also transcends national boundaries: MPLS scientists collaborate with researchers from around the world, and play leading roles in many international projects.

For more information please visit: <http://www.mpls.ox.ac.uk/home>

## Department of Materials

The Department is an exciting and vibrant place to work. *The Guardian* newspaper's 2014 University Guide has ranked Oxford second overall in its league table, and it is ranked first for the subject Engineering: Materials and Minerals. The key staff currently include fourteen Professors and twelve Lecturers. There are seventeen Senior Research Fellows including three Royal Academy of Engineering Research Fellows and one Engineering and Physical Sciences Research Fellow, around 60 Research Fellows, 40 visiting academics, 150 research students, 130 undergraduates, and 45 technical and administrative staff.

The Department has extensive laboratory space and supporting facilities spread over two main sites. The central main site, within the Oxford Science Area, Parks Road, has six buildings. The second site is the Oxford University Begbroke Science Park, located five miles north of Oxford. A minibus provides transport between the two sites.

### TEACHING

The teaching in the Department is regularly rated as high quality. We teach two four-year undergraduate degree programmes (M.Eng level). The joint intake for these courses is around 35 per annum. Around 36 graduates are accepted each year to study for research degrees.

### RESEARCH

The Department has an outstanding record for world class research. In the UK Government's most recent assessment of research excellence in UK universities, the 2008 RAE <http://www.rae.ac.uk/>, Oxford Materials was one of the top-rated materials departments in the country. All eligible academic staff and fourteen early career researchers were submitted for assessment and 80% of our activity was judged to be in the highest categories of excellence (Grades 4\* & 3\*; respectively 'world-leading' and 'internationally excellent'). Annual research funding in the Department is approximately £4.5million, coming mainly from industry, research councils, the EU and charities.

For more information please visit [www.materials.ox.ac.uk](http://www.materials.ox.ac.uk)

## Quantum Nanotechnologies Laboratory

The research will be undertaken in the Quantum Nanotechnologies Laboratory, which plays a leading role in the strong concentration of quantum research in the University. This is a highly interdisciplinary community, involving materials scientists, chemists, physicists, computer scientists, mathematicians, and philosophers. The Laboratory includes scientists working on the synthesis of materials, their characterisation by aberration-corrected transmission electron microscopy, nanofabrication of devices and their measurement at millikelvin temperatures, electron and nuclear spin resonance, materials modelling, and theory of quantum control and architectures for quantum technologies. The unifying aim is to develop technologies which will exploit controlled superposition and entanglement, and simultaneously to explore foundational issues of quantum reality.

### Grant overview

These posts will be part of a highly interdisciplinary project funded by Templeton World Charity Foundation entitled *Experimental Tests of Quantum Reality*, together with a related project funded by Oxford Martin School entitled *Bio-Inspired Quantum Computing* and an EPSRC Platform Grant entitled *Molecular Quantum Devices*. The purpose of the TWCF project is to investigate foundational questions about the nature of quantum reality, which were formulated at an international conference held in Oxford in 2010, to celebrate the eightieth birthday of Sir John Polkinghorne, as *The Oxford Questions on the foundations of*

*quantum physics*.<sup>1</sup> The grant supports research for three questions concerning experiments to probe the foundations of quantum physics, namely:

- (a) What experiments can probe macroscopic superpositions, including tests of Leggett–Garg inequalities?
- (b) What experiments are useful for large complex systems, including technological and biological?
- (c) How can the progressive collapse of the wave function be experimentally monitored?

The current posts are primarily to address Question (b), including applications to increase the impact of the results such as sensors and genome sequencing. Candidates will also be considered who are able to contribute to Questions (a) and (c).

## Job description

### Quantum interference in single molecule devices

In seeking to understand how quantum reality extends to ever more macroscopic systems, one direction in which to push ‘macroscopicity’ is towards complex molecular systems. Quantum chemistry is well established, and our aim is not to explore what is already well-mapped territory. Rather, we shall seek to investigate how quantum interference can be observed and controlled in molecular systems. These have significance for technological and biological questions. The hypothesis for this investigation is that there is no limit to the size and complexity of molecular structures in which quantum interference can be demonstrated, provided the interference can occur within the coherence times and lengths of the molecular system being used.

### Role overview

The researcher will devise and conduct experiments which unambiguously demonstrate non-classical phenomena in charge transport through single molecules. A primary platform will be a carbon device into which molecules can be inserted that demonstrate quantum interference, either through Breit-Wigner or Fano resonances, or through spatially separated pathways in, for example, a porphyrin ring molecule. The device platform is an array of single layer graphene nano-gaps which are fabricated using a combined method of conventional lithography and feedback-controlled electroburning developed in our laboratory. Initial experiments have demonstrated the possibility of measuring single electron transport through individual molecules in these nano-gaps, and the first task of the researcher will be to identify signatures of quantum interference in the charge transport.

### Responsibilities/duties

1. Fabricate gated graphene nano-gaps, suitable for measuring individual molecules.
2. Perform electrical measurements of candidate molecules with the aim of identifying signatures of quantum interference.
3. Identify aspects of molecular structure that affect interference in transport.
4. Undertake research to investigate quantum reality in condensed matter systems. The project will require [a] fabricating the materials and devices and [b] performing the

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<sup>1</sup> G. A. D. Briggs, J. N. Butterfield and A. Zeilinger. The Oxford Questions on the foundations of quantum physics. *Proc. R. Soc. A* **469**, 20130299 (2013).  
<http://rspa.royalsocietypublishing.org/content/469/2157/20130299.full>

experiments and making the measurements and [c] analysing and interpreting the results.

5. Developing practical applications that will enhance the impact of the research.
6. Engaging and working collaboratively with others involved in the project in addressing the guiding big questions, and participating in meetings with other project members in Oxford and elsewhere as required.
7. Responsible for planning and managing research and administrative activities, with the ability to co-ordinate all aspects of a project and to meet deadlines.
8. Instruction and day-to-day supervision of students and others, as required.
9. Writing research papers for internationally refereed journals and presenting results at national and international conferences.
10. Contributing to web site content and maintenance.
11. Writing reports as required, including a final report before the end of the employment contract.
12. Accepting delegated responsibility for safe laboratory practice.
13. Assisting with other reasonable practical and administrative duties as required.
14. If required, supporting the Head of Department and Director of Studies in the provision of teaching for the Department's undergraduate and postgraduate degree students. This may include, but is not restricted to, the delivery of lectures, practical demonstrating, tutorials, classes, and/or workshops and any associated responsibilities or administrative tasks (including the setting of examination questions). The post holder will not be expected to provide more than four hours of such tasks (on average) per week during the academic terms.

## **Selection criteria**

You should ensure that your letter of application, together with your cv, addresses how your experience and qualifications fulfil the following selection criteria, as your application will be judged on that basis.

1. A good first degree and a completed doctorate (by the start date) in the physical sciences.
2. Experimental expertise in one or more of the following is essential: carbon nanodevice fabrication and characterisation, molecular electronics, quantum electronics, cryogenic measurements, electron paramagnetic resonance. Experience in the preparation and characterisation of quantum nanomaterials (molecular or carbon) is desirable.
3. Evidence of ability to contribute at high level to experimental tests of quantum reality within the scope of the grant from TWCF, or to develop practical applications which could increase the impact of the results.
4. Evidence of interest in big questions beyond the immediate discipline, such as the fundamental nature of reality and our interaction with it. Applicants should demonstrate a willingness and ability to engage with others in deeper theoretical and philosophical questions, as well as complementary experimental approaches.
5. Evidence of innovative and effective research with a strong publication record (commensurate with stage in career) in peer-reviewed journals, books, or other appropriate media.

6. Give examples of your ability to work independently, and as an active collaborative member of a research team, who is well organised and self-motivated, while working cooperatively at all levels.
7. Good communication skills both orally and in written English, suitable for the preparation of scientific publications in world-class journals and presentation of research at international conferences.
8. These posts are available immediately, and as part of the timetable for this research, we plan to fill them by 1 October 2014, (or earlier if possible); therefore priority will be given to candidates who fulfil the above selection criteria and who can start on or before 1 October.

Please note that the appointment of the successful candidate will be subject to standard compulsory pre-employment screening, such as right to work checks.

Please [click here](#) to read the candidate notes on the University's pre-employment screening procedures.

## General information

Funding for these posts is provided by Templeton World Charity Foundation, up to 30 September 2016, together with additional funding from Oxford Martin School and from EPSRC. The salary offered for a full-time appointment to this job will be in the range £29,837 - £36,661 per annum, (University grade 7), depending on qualifications and experience. If you are appointed at a salary below the top of this range, your salary will automatically be increased each year until you have reached the top point. Pay and benefits for part-time appointments are worked out on a 'pro rata' basis.

This appointment is subject to satisfactory completion of a nine-month probationary period, during which the notice period will be one month on either side. Midway through the probationary period there will be a review of performance. The appointment may then be confirmed or reviewed again in the remainder of the probationary period. Once the appointment has been confirmed, the notice period will be three months on either side.

Applicants will be asked to complete a brief and straightforward medical questionnaire, acceptance of which, by the University Occupational Health Physician, is required prior to appointment.

Candidates should provide details of at least two referees who would be willing to provide confidential letters of recommendation shortly after the application deadline. The University will assume that it is free to approach referees at any stage unless the candidate's application stipulates otherwise. Candidates who wish a referee or referees to be approached only with their specific permission and/or if they are being called for interview on the final short list or are in receipt of a conditional offer, are asked to state such requirements **explicitly alongside the details of the relevant referee(s). If at all possible, please avoid nominating referees who cannot be approached.**

It is essential that one of the references should be from a formal line manager or supervisor from the current or most recent employer, wherever possible. If a first job application, a teacher or course tutor would be appropriate. Normally the second reference should also be from a manager at a different level who is familiar with your work or from a different employer. Where an applicant has insufficient work references available, then a reference from a person of good standing in the community, or who has had a reasonable period of knowledge and professional interaction with the applicant, may be acceptable in some circumstances. This should be clearly stated.

The interview panel is expected to comprise Professor Andrew Briggs (Principal Investigator) Professor Andrew Steane, Dr Edward Laird and Dr Jan Mol (project collaborators) and Mrs Alana Davies (Departmental Administrator).

## Working at the University of Oxford

For further information about working at Oxford, including details of terms and conditions and requirements for pre-employment screening, please see:

[http://www.ox.ac.uk/about\\_the\\_university/jobs/research/](http://www.ox.ac.uk/about_the_university/jobs/research/)

## How to apply

Applications for this vacancy are to be made online (post reference **113940**). The closing date for applications is **midday on Thursday 31 July 2014** with interviews currently planned for early September 2014.

If you consider that you meet the selection criteria, click on the **Apply Now** button on the 'Job Details' page and follow the on-screen instructions to register as a user. You will then be required to complete a number of screens with your application details, relating to your skills and experience. When prompted, please provide details of two referees and indicate whether we can contact them at this stage. You will also be required to upload a CV and supporting statement. The supporting statement should demonstrate how you meet the selection criteria outlined above and explain your relevant experience which may have been gained in employment or education, or you may have taken time away from these activities in order to raise a family, care for a dependant, or travel, for example. Your application will be judged solely on the basis of how you demonstrate that you meet the selection criteria outlined above and we are happy to consider evidence of transferable skills or experience which you may have gained outside the context of paid employment or education. Please save all uploaded documents to show your name and the document type.

All applications must be received by midday on 31 July 2014.

### Information for Priority Candidates

*A priority candidate is a University employee who is seeking redeployment owing to the fact that he or she has been advised that they are at risk of redundancy, or on grounds of ill-health/disability. Priority candidates are issued with a redeployment letter by their employing departments and this letter **must** be attached to any application they submit.*

**The priority application date for this post is midday on Friday 18 July 2014.**

**Full details of the priority application process are available at:**

<http://www.admin.ox.ac.uk/personnel/end/red/redproc/prioritycandidate>

Should you experience any difficulties using the online application system, please email [recruitment.support@admin.ox.ac.uk](mailto:recruitment.support@admin.ox.ac.uk). To return to the online application at any stage, please click on the following link [www.recruit.ox.ac.uk](http://www.recruit.ox.ac.uk). Please note that you will be notified of the progress of your application by automatic e-mails from our e-recruitment system.

**Please check your spam/junk mail** regularly to ensure that you receive all e-mails.