Job Description and Selection Criteria

<table>
<thead>
<tr>
<th>Job title</th>
<th>Postdoctoral Research Assistant in Soluble Semiconductor Display, Lighting and Optical Gain Technologies</th>
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</thead>
<tbody>
<tr>
<td>Division</td>
<td>Mathematical Physical and Life Sciences</td>
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<tr>
<td>Department</td>
<td>Physics</td>
</tr>
<tr>
<td>Location</td>
<td>Clarendon Laboratory</td>
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<tr>
<td>Grade and salary</td>
<td>Grade 7: £31,604 - £38,833 per annum</td>
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<tr>
<td>Hours</td>
<td>Full time (37.5 hours per week)</td>
</tr>
<tr>
<td>Contract type</td>
<td>Fixed-term for 2 years (with possibility of extension for further year) funded as part of the Oxford – JITRI Institute for Innovative Materials and Processes for Advanced and Critical Technologies (Oxford-JITRI IMPACT Institute)</td>
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<tr>
<td>Reporting to</td>
<td>Professor Donal Bradley CBE FRS, Head of the Division of Mathematical, Physical and Life Sciences and Professor of Engineering Science and Physics.</td>
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<tr>
<td>Vacancy reference</td>
<td>136391</td>
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<tr>
<td>Additional information</td>
<td>Closing date – midday (UK time) on Monday 17th September 2018</td>
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</table>

Research topic | Postdoctoral Research Associate in Soluble Semiconductor Display, Lighting and Optical Gain Technologies

Principal Investigator / supervisor | Professor Donal Bradley CBE, FRS

Funding partner | Jiangsu Industrial Technology Research Institute (JITRI)

Relevant publications


Technical skills

- Optical device physics modelling and measurement.
- Fabrication and optical and electrical characterization of semiconductor optoelectronic devices, preferably including those based on microcavity formats.
- Set-up and management of experimental facilities for the fabrication and characterization of thin film semiconductor materials and devices.
- Implementation of health and safety procedures.
- Data collection, analysis and archiving.
- Report writing and preparation of journal articles and publicity materials for website and other dissemination channels.
- Proposal writing for grant funding applications.
The role

The Postdoctoral Research Assistant in Soluble Semiconductor Display, Lighting and Optical Gain Technologies will work with Professor Donal D.C. Bradley CBE, FRS, Head of the Division of Mathematical, Physical and Life Sciences and his research team studying the science and application of soluble semiconductors (in both Oxford and Suzhou).

The successful candidate will have demonstrated expertise in the set-up and management of experimental facilities for the fabrication and characterization of solution-processed semiconductor devices, including the implementation and documentation of health and safety and data protection requirements. The successful applicant will work with chemicals (solvents, cleaning agents, semiconductors, etc) subject to COSHH regulations and will need to comply with the associated requirements for COSHH risk assessment, establishment of safe handling procedures and use of appropriate PPE. They will need also to undertake the related University of Oxford safety training.

Expertise in fabrication and optical and electrical characterization of semiconductor optoelectronic devices, for example LEDs, amplifiers and lasers, is also required, as is an understanding of optical device physics modelling and measurement. The successful applicant will work with lasers and will need to undertake the associated University of Oxford safety training to ensure that they are aware of statutory requirements and local policies on safe handling, including the use of appropriate PPE.

In addition, she/he will need to undertake report writing and preparation of journal articles and publicity materials for website and other dissemination channels and to contribute to the development of grant funding applications.

Research will be undertaken predominantly within the Department of Physics at the University of Oxford but some time will likely also be spent in Suzhou within the Nanotechnology and Functional Materials theme laboratories at OSCAR. The appointee is therefore expected to be willing to travel to China.

Collaboration will also take place with colleagues in the Physics, Engineering Science, Chemistry and Materials Departments at Oxford, together with colleagues at the Institute of Advanced Materials in Nanjing Tech (Professors Jianpu Wang, Youlian Tao Jinyi Lin and Wei Huang) and Nanjing University of Posts and Telecommunications (Professor Wenyong Lai) who will provide materials for study in Oxford. Professors Lin and Lai have spent extended periods as visiting researchers in Professor Bradley’s group and we have published several papers together, also with Professors Wang and Huang. Further potential collaborators in China will include the research teams of Professors Yong Cao, Ruidong Xia and colleagues (SCUT, Guangzhou), Professor Xingyuan Liu (Changchun Institute of Optics, Fine Mechanics and Physics, CAS) and Professors Lixiang Wang and Jun Liu (Changchun Institute of Applied Chemistry, CAS).

Furthermore, through Nanjing Tech 111-project funding and a Jiangsu Province Double Creation Team grant we have funds to support workshop meetings in Nanjing and to support some of the synthesis activity that will feed into this project. As a consequence, we are able to focus on device physics and application in Oxford.

The post is funded by the Oxford-JITRI IMPACT Institute and will be available for two years in the first instance, extendable for up to one further year by mutual agreement following an eighteen-month review. The post is available on a full-time basis.

Further details of the project
**Resonant cavity light-emitting and laser diodes:**

Semiconductor microcavities allow control over emission characteristics - spectral and directional - and provide light sources that have attractive properties for communications, spectroscopy and imaging. Organic semiconductors additionally have strongly-bound, large-oscillator-strength excitons that are suited to strong and ultrastrong coupling, yielding cavity polariton states at room temperature that can show many interesting light-matter interaction phenomena. We are interested in the implementation of such phenomena for device structures that can be electrically pumped and also in the use of conformation control to partition the exciton population between strong and ultra-strong coupling regimes. The latter situation allows us to design cavity structures that combine highly narrowed emission spectra with a lack of angular dispersion (Figure 1). In the absence of strong coupling these structures may also function as conventional laser diodes, potentially using dielectric distributed Bragg reflectors (DBRs) instead of metal mirrors. Laser diodes may also be conceived in a planar distributed feedback (DFB) format with gratings etched into the substrate, formed of plasmonic disk arrays or patterned via conformation change, or indeed using an in-plane transport, normal-to-plane emission format. Our goal within this project will be to explore electrically pumped cavities and other laser diode formats. The achievement of low cost organic laser diodes would enable many exciting applications to come into view, including aspects of the internet of things, data communications and medical diagnostics.

![Photoluminescence emission spectra](image)

**Figure 1:** Photoluminescence emission spectra for thin film (black and blue lines) and metal - poly(9,9-dioctylfluorene) - metal (red and green lines) microcavity structures (at 10°) with 0% and 12.3% β-phase exciton fraction (F. Le Roux & D.D.C. Bradley (2018)). The table records CIE(x, y), dominant wavelength and saturation for the spectra in the panel, together with the corresponding data for cavity emission at 60°. The 12.3% cavity shows highly saturated violet emission with negligible angular dispersion.

<table>
<thead>
<tr>
<th>Sample</th>
<th>0% film</th>
<th>0% cavity @ 10°</th>
<th>0% cavity @ 60°</th>
<th>12.3% film</th>
<th>12.3% cavity @ 10°</th>
<th>12.3% cavity @ 60°</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIE (x,y)</td>
<td>(0.164, 0.090)</td>
<td>(0.167, 0.025)</td>
<td>(0.168, 0.010)</td>
<td>(0.153, 0.094)</td>
<td>(0.161, 0.018)</td>
<td>(0.161, 0.017)</td>
</tr>
<tr>
<td>Dominant λ (nm)</td>
<td>467</td>
<td>445</td>
<td>435</td>
<td>470</td>
<td>447</td>
<td>447</td>
</tr>
<tr>
<td>Saturation (%)</td>
<td>84</td>
<td>96</td>
<td>99</td>
<td>87</td>
<td>99</td>
<td>99</td>
</tr>
</tbody>
</table>

**Responsibilities**

- Carry out original research in the science and application of solution-processed semiconductors, primarily by designing and performing experiments at the University of Oxford’s Department of Physics and undertaking detailed analysis of the results. Fabrication and optical and electrical characterisation of devices and thin films; optical device physics, modelling and measurement; data management; regular report writing and effective and timely communication with collaborators will be required. A portion of time
may also be spent working within the laboratories of our external collaborators and at the OSCAR Research Centre in Suzhou.

- Help to establish new research facilities and up-grade and maintain existing shared-use facilities. Good working relationships will need to be established with the other groups in Oxford Condensed Matter Physics and in the Nanotechnology and Functional Materials theme at OSCAR. There will be a need to set-up and manage experimental facilities for the fabrication and characterization of solution-processed semiconductor devices. Close liaison with technical and administrative staff in Oxford and at OSCAR and with external suppliers and contractors will be required.

- Support the implementation of health and safety procedures.

- Maintain a current and up-to-date knowledge of the relevant research literature and contribute to the development and writing of new funding proposals deriving from the research carried out.

- Prepare oral and poster presentations for conferences and workshops and draft publications for dissemination of results. Attendance at conferences and workshops to present results will be encouraged where merited by the results.

- Assist in the consideration of intellectual property arising from the research undertaken. Assessment of potential IP protection, agreed with the Principal Investigator, will be required before any public disclosure of results.

- Work with other members of the group to support the establishment of a considerate and effective working environment. Contribute to group outreach and dissemination activities via preparation and maintenance of web-based and other media (e.g. posters) and conducting lab tours. Actively participate in group meetings, journal clubs and social events.

- The post-holder will have the opportunity to teach. This may include lecturing, small group teaching, and tutoring of undergraduates and graduate students.

**Hazard-specific / Safety-critical duties:**

This job includes the following hazards or safety-critical activities which will require successful pre-employment health screening through our Occupational Health Service before the successful candidate will be allowed to start work:

- Working with category 3b or 4 lasers (laser safety class)
- Work with any substance which has any of the following pictograms on their MSDS:
  - ![Pictogram](image)
- Travel outside of Europe or North America on University Business
Selection criteria

Essential

- Possess PhD/DPhil (or be close to completion) in Physics, Engineering, Materials Science or Chemistry
- Detailed knowledge and direct experience of:
  - Optical device physics modelling and measurement, preferably including microcavity structures.
  - The set-up and management of experimental facilities.
  - Characterization of semiconductor materials in thin film formats using optical, structural and electrical methods.
  - Design, fabrication and optical and electrical characterization of semiconductor optoelectronic devices.
- Knowledge and experience of health and safety procedures for chemical handling and disposal, risk assessment, and the preparation of associated documentation.
- Effective oral and written communication skills and willingness to contribute to outreach and dissemination activities.
- Ability to work as part of an effective team both within Oxford and with external collaborators and willingness to spend time working in collaborator laboratories in UK and China.
- Ability to work independently and to manage time efficiently towards agreed priorities.
- Ability and willingness to assist in the consideration of intellectual property arising from the research undertaken and in the assessment of potential IP protection.

Desirable

- Ability and willingness to contribute to the development of new funding proposals deriving from the research undertaken.
- Ability and willingness to support the establishment of a considerate and effective working environment.

About the University of Oxford

Welcome to the University of Oxford. We aim to lead the world in research and education for the benefit of society both in the UK and globally. Oxford’s researchers engage with academic, commercial and cultural partners across the world to stimulate high-quality research and enable innovation through a broad range of social, policy and economic impacts.

We believe our strengths lie both in empowering individuals and teams to address fundamental questions of global significance, while providing all our staff with a welcoming and inclusive workplace that enables everyone to develop and do their best work. Recognising that diversity is our strength, vital for innovation and creativity, we aspire to build a truly diverse community which values and respects every individual’s unique contribution.

While we have long traditions of scholarship, we are also forward-looking, creative and cutting-edge. Oxford is one of Europe’s most entrepreneurial universities. Income from external research contracts in 2016/17 exceeded £564m and we rank first in the UK for university spin-outs, with more than 130 companies created to date. We are also recognised as leaders in support for social enterprise.
Join us and you will find a unique, democratic and international community, a great range of staff benefits and access to a vibrant array of cultural activities in the beautiful city of Oxford.

For more information please visit www.ox.ac.uk/about/organisation

Department of Physics

Oxford Physics is one of the largest and most eminent departments in Europe – pursuing forefront research alongside training the next generation of leaders in Physics.

With an academic staff of almost one hundred our activities range from fundamental particles to the furthest reaches of the universe to manipulating matter on an atomic scale. Oxford physicists are probing new ways to harness solar energy, modelling the Earth's atmosphere to predict the future climate, exploring computation on the quantum scale and executing calculations that reveal the fundamental structure of space and time.

For more information please visit: http://www2.physics.ox.ac.uk/

Condensed Matter Physics Sub-department

The post-holder will be based in the Condensed Matter Physics sub-department, which is one of the six sub-departments that together make up the Department of Physics; these are Astrophysics, Atomic and Laser Physics, Atmospheric, Oceanic and Planetary Physics, Condensed Matter Physics, Particle Physics and Theoretical Physics, with a seventh function (Central Physics) providing administrative and technical support to these sub-departments. Members of all sub-departments take part in research, teaching and matters such as examinations, discussion of syllabi, lectures and liaison with undergraduates and postgraduate students.

Athena Swan Charter

The Department of Physics holds a silver Athena Swan award to recognise advancement of gender equality: representation, progression and success for all.

Mathematical, Physical & Life Sciences Division

The Mathematical, Physical and Life Sciences (MPLS) Division is one of the four academic divisions of the University of Oxford.

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 focused on key interdisciplinary issues. We collaborate closely with colleagues in Oxford across the medical sciences, social sciences and humanities, and with other universities, research organisations and industrial partners across the globe in pursuit of innovative research geared to address critical and fundamental scientific questions.

For more information please visit: http://www.mpls.ox.ac.uk/
Oxford Suzhou Centre for Advanced Research

The Oxford Suzhou Centre for Advanced Research in Jiangsu Province provides a new locus for MPLS researchers to pursue the aims of the Division within an environment that offers exceptional opportunities to:
- collaborate with Chinese Universities and Research Institutes.
- work on problems where a location in China offers specific contexts and benefits.
- to network with industry including the 90 Fortune 500 companies and more than 800 nano- and bio-technology start-ups based in the Suzhou Industrial Park.

For more information please visit: https://oscar.web.ox.ac.uk/home

Oxford – JITRI IMPACT Institute

The joint Oxford-Jiangsu Industrial Technology Research Institute for Innovative Materials and Processes for Advanced and Critical Technologies (Oxford-JITRI IMPACT Institute) was approved in March of this year. It is based in Oxford, with office space at the Begbroke Science Park, and acts as a bridge between Oxford University and Jiangsu Province to promote science and engineering research programmes that have the potential to create innovation opportunities of interest to Jiangsu-based industry and the global investment community. It also supports the broader engagement of Jiangsu-based industry with Oxford University and the UK more generally.

How to apply

If you would like to apply, click on the Apply Now button on the ‘Job Details’ page and follow the on-screen instructions to register as a new user or log-in if you have applied previously. Please provide details of two referees and indicate whether we can contact them now.

You will also be asked to upload a CV and statement of research interests. The supporting statement must explain how you meet each of the selection criteria for the post using examples of your skills and experience. This may include experience gained in employment, education, or during career breaks (such as time out to care for dependants). Your application will be judged solely on the basis of how you demonstrate that you meet the selection criteria stated in the job description.

Please upload all documents as PDF files with your name and the document type in the filename.

All applications must be received by midday on the closing date stated in the online advertisement.

Information for priority candidates

A priority candidate is a University employee who is seeking redeployment because they have 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.
If you are a priority candidate, please ensure that you attach your redeployment letter to your application (or email it to the contact address on the advert if the application form used for the vacancy does not allow attachments)

Should you experience any difficulties using the online application system, please email recruitment.support@admin.ox.ac.uk. Further help and support is available from www.ox.ac.uk/about_the_university/jobs/support/. To return to the online application at any stage, please go to: www.recruit.ox.ac.uk.

Please note that you will be notified of the progress of your application by automatic emails from our e-recruitment system. Please check your spam/junk mail regularly to ensure that you receive all emails.

**Important information for candidates**

**Pre-employment screening**

Please note that the appointment of the successful candidate will be subject to standard pre-employment screening, as applicable to the post. This will include right-to-work, proof of identity and references. We advise all applicants to read the candidate notes on the University’s pre-employment screening procedures, found at: www.ox.ac.uk/about/jobs/preemploymentscreening/.

**Data Privacy**

Please note that any personal data submitted to the University as part of the job application process will be processed in accordance with the GDPR and related UK data protection legislation. For further information, please see the University's Privacy Notice for Job Applicants at: www.admin.ox.ac.uk/councilsec/compliance/gdpr/privacynotices/job/. The University’s Policy on Data Protection is available at: www.admin.ox.ac.uk/councilsec/compliance/gdpr/universitypolicyondataprotection/.

**The University's policy on retirement**

The University operates an Employer Justified Retirement Age (EJRA) for all academic posts and some academic-related posts. From 1 October 2017, the University has adopted an EJRA of 30 September before the 69th birthday for all academic and academic-related staff in posts at grade 8 and above. The justification for this is explained at: www.admin.ox.ac.uk/personnel/end/retirement/revisedejra/revaim/.

For existing employees, any employment beyond the retirement age is subject to approval through the procedures: www.admin.ox.ac.uk/personnel/end/retirement/revisedejra/revproc/

Form 1 October 2017, there is no normal or fixed age at which staff in posts at grades 1–7 have to retire. Staff at these grades may elect to retire in accordance with the rules of the applicable pension scheme, as may be amended from time to time.
Equality of Opportunity

Entry into employment with the University and progression within employment will be determined only by personal merit and the application of criteria which are related to the duties of each particular post and the relevant salary structure. In all cases, ability to perform the job will be the primary consideration. No applicant or member of staff shall be discriminated against because of age, disability, gender reassignment, marriage or civil partnership, pregnancy or maternity, race, religion or belief, sex, or sexual orientation.
Benefits of working at the University

University Club and sports facilities

The University Club provides social, sporting and hospitality facilities. It incorporates a bar, café and sporting facilities, including a gym. Staff can also use the University Sports Centre on Iffley Road at discounted rates, including a fitness centre, powerlifting room, and swimming pool. See: www.club.ox.ac.uk and www.sport.ox.ac.uk/oxford-university-sports-facilities.

Information for international staff (or those relocating from another part of the UK)

If you are relocating to Oxfordshire from overseas, or elsewhere in the UK, the University's International Staff website includes practical information related to moving to and settling in Oxford such as advice on immigration, relocation, accommodation, or registering with a doctor. See: www.internationalstaffwelcome.admin.ox.ac.uk/

The University of Oxford Newcomers' Club

The University of Oxford Newcomers' Club is an organisation run by volunteers that aims to assist the partners of new staff to settle into Oxford and to provide them with an opportunity to meet people in the area. See www.newcomers.ox.ac.uk/

Childcare

The University has excellent childcare services with five University nurseries, as well as University-supported places at many other private nurseries. For full details including how to apply and the costs, see www.admin.ox.ac.uk/childcare.

Family-friendly benefits

The University subscribes to My Family Care (www.admin.ox.ac.uk/personnel/staffinfo/benefits/family/mfc/) and staff are eligible to register for emergency back-up childcare and adultcare services, a 'speak to an expert' phone line and a wide range of guides and webinars through a website called the Work + Family space.

Disabled staff

We are committed to supporting members of staff with disabilities or long-term health conditions. Please visit www.admin.ox.ac.uk/eop/disab/staff for further details including information about how to make contact, in confidence, with the University's Staff Disability Advisor.

Staff networks

The University has a number of staff networks including the Oxford Research Staff Society, BME staff network, LGBT+ staff network and a disabled staff network. You can find more information at www.admin.ox.ac.uk/eop/inpractice/networks/

Other benefits

Staff can enjoy a range of other benefits such as free visitor access to the University's colleges and the Botanic Gardens as well as a range of discounts. See www.admin.ox.ac.uk/personnel/staffinfo/benefits.