

Post Details		Last Updated: 28/09/2016	
Faculty/Administrative/Service Department	FEPS/ATI Physics		
Job Title	Post Doctoral Research Associate in THz properties of single dopant devices in silicon		
Job Family	Research & Teaching	Job Level	4
Responsible to	ADDRFSS PI (Prof B N Murdin) or his delegate (Dr B Redlich)		
Responsible for (Staff)	n/a		
<b><u>Job Purpose Statement</u></b>			
<p>The Postholder will characterise few and single dopant atom devices, such as single electron transistor structures at millikelvin temperatures, via THz, electrical and microwave measurements, with the aim of using them for applications in quantum information and spintronics. The post falls within the ADDRFS project, an £8.1M EPSRC funded Programme Grant, a collaboration between UCL, the University of Surrey, and the Free-Electron Laser Facility "FELIX" at Radboud University Nijmegen, The Netherlands. The post will be based at FELIX.</p>			
<b><u>Key Responsibilities</u></b>			
<p>The post-holder will</p> <ol style="list-style-type: none"> <li>1. Manage the installation of a new dilution refrigerator for THz/electrical and microwave experiments</li> <li>2. Develop new optical/electrical measurement techniques for millikelvin measurement of single electron/single atom devices in the dilution refrigerator.</li> <li>3. Establish the properties of atomic scale dopant devices by performing THz and microwave spectroscopy at low temperatures and high magnetic fields</li> <li>4. Work closely with scientists at Surrey and UCL performing the sample production and other characterisation experiments, exchanging scientific knowledge and technical expertise.</li> <li>5. Following understanding developed above, design new devices at the scale of individual atoms and molecules for fabrication by collaborators at Surrey and UCL using ion beam implantation/hydrogen lithography and electron beam lithography.</li> </ol> <p>N.B. The above list is not exhaustive.</p>			
<p><b>All staff are expected to:</b></p> <ul style="list-style-type: none"> <li>• Positively support equality of opportunity and equity of treatment to colleagues and students in accordance with the University of Surrey Equal Opportunities Policy.</li> <li>• Work to achieve the aims of our Environmental Policy and promote awareness to colleagues and students.</li> <li>• Follow University/departmental policies and working practices in ensuring that no breaches of information security result from their actions.</li> <li>• Ensure they are aware of and abide by all relevant University Regulations and Policies relevant to the role.</li> <li>• Undertake such other duties within the scope of the post as may be requested by your Manager.</li> <li>• Work supportively with colleagues, operating in a collegiate manner at all times.</li> </ul> <p><b>Help maintain a safe working environment by:</b></p> <ul style="list-style-type: none"> <li>• Attending training in Health and Safety requirements as necessary, both on appointment and as changes in duties and techniques demand.</li> <li>• Following local codes of safe working practices and the University of Surrey Health and Safety Policy.</li> </ul>			
<b><u>Elements of the Role</u></b>			
<b><u>Planning and Organising</u></b>			
<p>The post-holder will</p> <ul style="list-style-type: none"> <li>• Plan the installation of the dilution refrigerator</li> <li>• Design device layouts for electrical, optical and microwave devices which exploit single and few atom doping techniques</li> <li>• Prepare specifications, procurement, commissioning and maintenance of instruments, fabrication tools, cryostats and magnets</li> <li>• Contribute to the preparation and drafting of research bids and proposals. Specifically, assist the PI in development of beam-time proposals for FELIX in respect of the dilution refrigerator</li> <li>• Plan and execute beam-time campaigns using FELIX, and assist visiting ADDRFS scientists in the performance of THz or millikelvin experiments.</li> </ul>			

### **Problem Solving and Decision Making**

The post-holder will

- Prepare progress reports on research for collaborating project partners and funding bodies as required.
- Prepare manuscripts for submission to peer-reviewed journals, and receive good referees reports; Prepare invention disclosures
- Prepare presentations, including text and images, for delivery by self as well as others
- Travel to meetings and conferences both domestically and abroad to discuss results and to learn about related developments elsewhere
- The post holder operates within established University policies and procedures for example Health and Safety and Equal Opportunities and must ensure that decisions and most critically, advice and guidance provided to colleagues and external third parties, fall within these.
- Failure to make appropriate and timely decisions has the potential to delay the successful operational completion of strategically important projects, affecting productivity and the reputation of the University. Referral to the PI would be expected where the decision making would have a significant impact that could not easily be resolved by the post holder.

### **Continuous Improvement**

The post-holder will

- Contribute to the efficient running and overall development of the research environment as required.
- Develop, implement and maintain electronic apparatus data acquisition and high sensitivity electrical characterisation of macro- meso- and nano-scale device.
- Stay alert for opportunities to develop technical understanding of the rest of the project.
- Bring to the attention of the PI any improvements to the project delivery or governance processes identified and modify their working practices accordingly.
- Recommend major process and service improvements.

### **Accountability**

The post-holder will

- Be responsible for the maintenance and safety of the instruments used, in collaboration with both appropriate laboratory personnel and manufacturers' service engineers.
- Be directly responsible to the principal investigator or academic supervisor. The post holder may be asked to serve on a relevant project committee. There may be additional reporting and liaison responsibilities to external collaborators, funding bodies or sponsors.
- Be encouraged to develop his/her own original research activity with colleagues locally or in other institutions, within the project or independently so long as it does not impinge on the project deliverables

### **Dimensions of the role**

- The overall budget is £8.1M, and is split across 4 sites. There are 10 Investigators, 8 FTE of postdoctoral researchers and probably a similar number of students.
- Due to the nature of the accounting requirements of the sponsoring organisation (EPSRC) the employer will be the University of Surrey, but the post will be based in the Radboud University, Nijmegen. You will be expected to take significant responsibility for your own day-to-day activities as your formal line-manager will be the PI, based in Surrey. You will be expected to keep the PI and the rest of the team informed at all times of your activities and progress through written reports (e.g. via interaction with ADDRFS project collaboration software or other mechanisms determined by the PI). Day-to-day reporting will be through the local delegate of the PI (Dr B Redlich).
- The post holder does not have any direct line management responsibilities. The post holder is expected to act as representative of the PI in managing the team associated with the instrumentation in his/her remit. The post holder must track spend against the project budget in an accurate and auditable manner.
- This part of the project will concentrate on shallow group V donors. The aim of this part of the project is to develop low temperature electrical spectroscopies for the detection of the orbital excitation electrons orbiting donor impurities, to be integrated with techniques for coherent control of the orbital quantum number of the same electrons
- You, the Post-holder will have authority over some aspects of project work and must be capable of providing academic judgement, offering original and creative thoughts and be able to interpret and analyse results
- All staff are expected to undertake such other duties within the scope and spirit of the post as may be requested by your Line-Manager

### **Supplementary Information**

- n/a

<b>Person Specification</b>		
<b>Qualifications and Professional Memberships</b>		
A higher degree qualification (PhD) or equivalent in the experimental physical sciences or engineering		E
<b>Technical Competencies (Experience and Knowledge)</b>	<b>Essential/ Desirable</b>	<b>Level 1-3</b>
Millikelvin cryogenics using dilution refrigerators	E	3
Low-noise electrical device testing (i.e. using sophisticated source-measure methods)	E	3
Microwave spin resonance or other microwave spectroscopy	E	3
THz/far-infrared optics	E	3
Interfacing experiments using LABVIEW; computational software for analysing experimental data such as MATLAB, MATHEMATICA, FORTRAN etc	E	3
Planning and executing fieldwork experiments using competitive international facilities such as high magnetic field or laser facilities.	D	3
Time-resolved laser spectroscopy	D	3
<b>Special Requirements:</b>		<b>Essential/ Desirable</b>
The post holder must be willing and able to work flexibly. This may include working outside of regular office hours upon occasion.		E
Applicants must participate at the collaboration meetings as required by the specified research project.		E
The Postholder may be required to travel to partner organisations in the UK and the Netherlands on a regular basis, and the right to travel within the EU without hindrance would be a distinct advantage. Applicants should be aware that the United Kingdom Border Agency (UKBA) has currently imposed a limit on the number of migrants entering the UK. This limit is affecting the University's ability to sponsor staff under Tier 2 of the points-based system. Applicants should consider whether they can acquire the right to work in the UK on their own accord (e.g. EU national, Tier 1 or Tier 4 status).		D
<b>Core Competencies</b>		<b>Level 1-3</b>
Preparation of scientific papers for successful publication in high-impact journals	E	3
Presenting research to collaborators in progress meetings and/or to wider audiences at conferences	E	3
<ul style="list-style-type: none"> <li>• Fluency and clarity in spoken English with good oral presentation skills</li> <li>• Good written English</li> <li>• Ability/willingness to work as part of multi-institution team where credit is shared</li> <li>• Commitment to high quality research.</li> <li>• Well-organised, with attention to detail</li> <li>• Ability to meet deadlines.</li> <li>• Ability to think logically, create solutions and make informed decisions.</li> <li>• Ability to deliver adequate training and support to other lab users.</li> </ul>		<p>3</p> <p>3</p> <p>3</p> <p>3</p> <p>3</p> <p>3</p> <p>3</p> <p>2</p>
<b>Organisational/Departmental Information &amp; Key Relationships</b>		

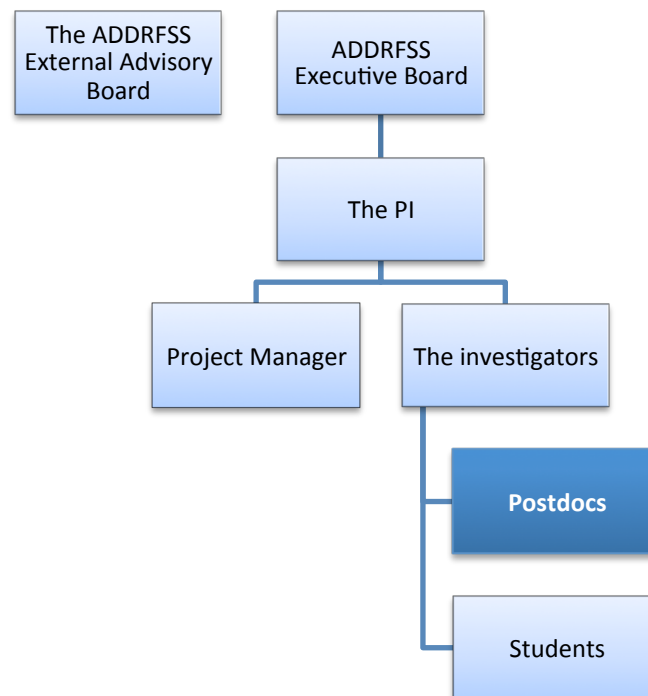
## **Background Information**

The ADDRFS project aims to develop new Quantum Science surrounding single atoms in silicon crystals. National public interest in Quantum Science generally is high, and this area is reaching the point where viable Quantum Technologies might be expected. The team has been formed to deliver a variety of projects involving single atom structures.

1. manufacturing single atom structures using atom-by-atom lithography with a Scanning Probe Microscope
2. electrical measurement and characterisation of single atom structures in very low temperatures (~30 millikelvin)
3. Control and read-out of single atom structures with laser pulses
4. Tuning the properties of single atom structures with external magnetic fields etc
5. Integration of several atoms together into a “molecule” for new Quantum scale functions

The programme sits within a UK lanscape that is determined by a recent injection of £270M into Quantum Technologies research in 2014, and likely further announcements that the consortium wants to be well placed to meet.

## **ADDRFS Project Structure Chart**



## **Relationships**

### **Internal**

- Members of the project team including the post-holder review progress typically via weekly project meetings at each site (either in person or with skype attendance) to ensure that effective communications within the team.
- Regular progress reports are made by team to the PI/Investigators/postholder, and this may take the form of oral presentations or written reports.
- Reports are made by the post-holder to the Boards for major initiatives and Change Programmes.
- Procurement, providing input into tender processes.
- All University Project Managers to share best practice.
- Central Faculty and University services for IT, marketing, finance, HR support.

### **External**

- External business partners and potential business partners are networked to maximise the impact of the work performed by the team.
- Users of outreach activities .