

**THE UNIVERSITY OF MANCHESTER**  
**PARTICULARS OF APPOINTMENT**  
**FACULTY OF SCIENCE & ENGINEERING**  
**SCHOOL OF NATURAL SCIENCES**  
**DEPARTMENT OF PHYSICS AND ASTRONOMY**  
**RESEARCH ASSOCIATE IN ELECTRONIC PROPERTIES OF VAN DER WAALS  
HETEROSTRUCTURES**

**VACANCY REF: SAE-018695**

Salary:	£33,309 to £40,927 per annum, depending on relevant experience
Hours:	Full-time
Duration:	Fixed Term from 1 June 2022 until 31 May 2024
Location:	Oxford Road, Manchester

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**Enquiries about vacancy shortlisting and interviews:**

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**BACKGROUND**

**The University of Manchester**

The University of Manchester ([www.manchester.ac.uk](http://www.manchester.ac.uk)) enjoys a global reputation for its research and its innovative approach to learning, with an on-going £1 billion investment in facilities, staff and buildings. This builds on our tradition of success that stretches back over 180 years. The birth of the modern computer, the splitting of the atom, the founding principles of modern economics, the discovery of graphene, and the birthplace of chemical engineering – these and many more world changing innovations have their roots at our University. We are at the forefront of the search for solutions to some of the world's most pressing problems, boasting strong collaborative links with industry and public services.

Manchester has the largest student community in the UK, with more than 28000 undergraduates and 11000 postgraduates attracted by the high international standing of the academic staff, by the superb research and teaching facilities, and by the cultural assets both of the university and the city of Manchester itself. For further information, please consult [www.manchester.ac.uk](http://www.manchester.ac.uk).

**Faculty of Science and Engineering**

The Faculty of Science and Engineering is one of the largest in the UK with over 10,000 students, 2,000 staff and strategic links with over 300 industrial companies. We are leading research efforts

in energy, nuclear science and technology, computer science, atmospheric science, bioscience and biotechnology, photon science and photonic materials, imaging and visualisation, security, and advanced materials, attracting an annual income of over £200 million.

Founded in 1824, we have a history of breaking new ground in science and engineering. Rutherford began his work here on splitting the atom and later received the Nobel prize in 1908 for his work on radioactivity. The 'Baby', the world's first stored-program computer, and Manchester Mark 1 came into being here. It is the birthplace of Chemical Engineering. The world's first steerable radio telescope at Jodrell Bank was built here by Bernard Lovell. Since 1906, when former student Joseph Thomson won the Nobel prize for physics, the University has produced more than 20 Nobel Laureates, the most recent of which were Professor Andre Geim and Professor Konstantin Novoselov in 2010 - for their pioneering work with the world's thinnest material, graphene.

### **Department of Physics and Astronomy**

The Department of Physics and Astronomy is one of five Departments in the School of Natural Sciences which is in the Faculty of Science and Engineering. There are 95 academic staff in the Department with expertise in areas such as condensed matter physics (which includes Prof. Andre Geim and Prof. Konstantin Novoselov who won the 2010 Nobel Prize in Physics for their work on graphene), atomic physics, liquid crystal physics, biological physics, accelerator physics, nuclear physics, particle physics, astrophysics, astronomy, cosmology, complexity and theoretical physics. Jodrell Bank Observatory (part of Jodrell Bank Centre for Astrophysics) also forms part of our Department. We have approximately 150 research staff, 250 PGR students and 1200 UG/PG students.

The Department has ranked in the top fifteen in the Academic Ranking of World Universities for Physics since 2011. In the Research Excellence Framework (REF) 2014 the Department was in the top three institutions for its proportion of "world-leading" components and was first for non-academic impact.

The Department values teaching highly and scored 90% in the 2019 National Student Survey. The Department has the largest undergraduate intake of any Physics department in the UK. Student cohorts are around 1120 and 100 for undergraduate and postgraduate taught programmes respectively. Taught postgraduate courses include Masters programmes in Photon Science, Nuclear Science and Technology, and Radio Imaging and Sensing.

P&A research is based in four topical divisions: Accelerator, Nuclear and Particle Physics; Condensed Matter (which includes Prof. Andre Geim and Prof. Konstantin Novoselov who won the 2010 Nobel Prize in Physics for their work on graphene); and Jodrell Bank Centre for Astrophysics. The Department operates the world-renowned Jodrell Bank Observatory (JBO). The Jodrell Bank site also provides the permanent home for the international headquarters of the Square Kilometre Array (SKA) Organisation. The Department is deeply involved in the £61 million National Graphene Institute (NGI), opened in 2015. The NGI building has 7350 m<sup>2</sup> research space over five floors and includes 1500m<sup>2</sup> of cleanrooms, lab facilities, office space and seminar rooms.

The Department of Physics and Astronomy is committed to promoting Equality, Diversity, Inclusion and Access through contributing to the University's social responsibility agenda, demonstrating a commitment to its policies, activities and delivery of initiatives including the Athena SWAN charter

for promoting women's careers in STEMM subjects (science, technology, engineering, mathematics and medicine) in higher education. The Department has held JUNO Champion status since 2016 for its commitment to achieving gender equality which positively promotes inclusivity for all.

Further information on the Department of Physics and Astronomy can be found at [www.physics.manchester.ac.uk](http://www.physics.manchester.ac.uk).

### **Condensed Matter Physics Group**

The group comprises 12 academics and dozens of researchers and post-graduate students. It is highly collaborative and internationally-leading across the major thematic areas: graphene and 2D materials, superconductivity, plasmonics, spintronics, nanofluidics and superfluidity. The flagship activities focus on freestanding 2D crystalline materials, including graphene, hexagonal boron nitride, and MoS<sub>2</sub>, and their applications. The experimental research benefits from world-class cryogenic and nanofabrication facilities; active theoretical support is provided by theorists in the Department. Building on the Nobel prize-winning discoveries made at Manchester, many of these activities are based in the National Graphene Institute and the Henry Royce Institute - the international hubs for graphene and 2D materials research.

### **THE NATIONAL GRAPHENE INSTITUTE**

Website: <http://www.graphene.manchester.ac.uk>

The National Graphene Institute (NGI) has been established at the University of Manchester through a bespoke, fit-for-purpose, £61m building funded by the Engineering and Physical Sciences Research Council (EPSRC, £38m) and European Regional Development Fund (ERDF, £23m).

The NGI brings together a large, focused, interdisciplinary research community, acting as a sustainable incubator of new applications in all areas of graphene and 2D materials science, ensuring that national and international industries will have a major role in this radical technology shift in future years. An effective transfer of knowledge and technology to industries will enable product development and production. The NGI houses state-of the-art facilities, laboratories and business services, shared with commercial and academic partners to support and nurture application and commercialisation of on-going developments. This is an ambitious, large-scale, visionary research initiative, aiming at a breakthrough for technological innovation and economic exploitation based on graphene and related two dimensional materials and building on the discovery of graphene at the University of Manchester in 2004.

### **Overall Purpose of the Job**

The project(s) will focus on investigation of electronic, mass-transport and other properties of new and unique structures and devices made by van der Waals assembly of 2D materials. It is expected the project will lead to high impact scientific publications and technological developments.

### **Key Responsibilities, Accountabilities or Duties**

You will have, or be about to obtain a PhD or equivalent in condensed matter physics and will join a large and dynamic research group in Manchester to undertake a range of projects involving 2D materials. You will be expected to measure structures and devices made from a variety of 2D materials and investigate their electronic and other properties, with a view to understand their fundamental properties and develop near and future technologies and applications.

You will demonstrate significant experience in electronic, mass-transport and other properties of novel 2D materials and their van der Waals Heterostructures. You should have up to date experience in precision measurement techniques and equipment, including liquid-helium measurements and, where necessary, be able to modify and develop further the existing equipment.

Previous experience and understanding of microfabrication methods would be an advantage, as would experience in developing 2D technologies. Working in a team where the ability to collaborate with other researchers effectively is essential, you will need excellent communication skills, exchanging technical information with scientists from different disciplines.

Other duties include analysis of experimental data and writing scientific reports, presenting results at major conferences, outreach activities and preparing material for publication in high profile journals. You will need to possess a high standard of relevant computing skills and have strong analytical and problem-solving abilities. The role requires a well-organised, yet flexible, approach to working.

The responsibilities of the post will include:

- Adhering to all relevant health and safety procedures.
- Maintaining accurate, comprehensive and secure records of research data.
- Training students and others in skills appropriate to the project.
- Making presentations on the research project as directed.
- Preparation of regular oral and written reports.
- Contribution to project management and day-to-day laboratory management.
- Regular surveys of the scientific literature.
- Preparation of research papers for publication.
- Presentations at national and international meetings.
- Contribute to the social responsibility agenda of the University and demonstrate a commitment to Equality, Diversity and Inclusion policies and activities and support the development and delivery of related initiatives

### **PERSON SPECIFICATION**

#### **Essential Knowledge, Skills and Experience:**

- Hold or be about to obtain a PhD in condensed matter physics or equivalent
- A strong publication record in internationally peer-reviewed journals and an ability to write scientific reports and contribute to writing research papers.
- Demonstrate significant experience in all the following areas:
  - characterisation of 2D materials and devices by low-noise electrical measurements,

- use of low-temperature techniques,
  - good understanding of electronic properties of materials,
  - 2D electronic and/or molecular transport devices.
- Have excellent, up to date technical skills across a range of characterisation and measurement equipment (low-noise electrical and low temperature measurements);
- Ability to work collaboratively within a group and, also, to work independently, with minimal supervision.
- Experience in the most recent techniques, an interest in learning new techniques and a desire to undertake interdisciplinary research.
- Strong analytical and problem-solving abilities, with the ability to learn new skills quickly.
- Use of theoretical physics and statistical analyses.
- Good time-management skills and organizational abilities.
- Good written and oral communication skills, including communicating technical information effectively.
- Ability to communicate complex ideas and arguments and present research findings at national and international meetings and conferences.
- A high standard of computational skills.
- Contribution to laboratory support of PhD students and a desire to pass on skills and knowledge to PhD, MSc and project students.
- A flexible approach to working with the willingness to travel and work outside normal business hours as required.
- A strong personal commitment to equality, diversity, inclusion and accessibility.

**Desirable Knowledge, Skills and Experience:**

- Experience in nanofabrication techniques.
- Experience of working in a cross-disciplinary environment.
- Development of 2D materials technology.