

PhD Advert Template – 2021 entry

Supervisor name/s	Dr. Adelina ILIE (Lead), Prof. Alain Nogaret (Co-Supervisor)
Email contact	a.ilie@bath.ac.uk
Department	Physics
Title of project This should be as specific as possible. Generic titles such as PhD in Computer Vision will not be accepted.	Van der Waals 2D systems with spin texture, and their manipulation
Preferred start date	Monday 4 October 2021
Overview of the research Max 350 words (do not include scientific characters or pictures)	<p>Materials and more complex systems able to sustain local, non-colinear spin texture (where the electron spin changes orientation within a localized region) are hailed as game changers in spintronics and information storage based on spin; as well as platforms for quantum computation implementations. Such textures are promoted by chiral magnetic interactions – these can originate in systems with large spin-orbit coupling with breaking of inversion symmetry. Add to this two-dimensional (2D) confinement, and the region within which the spin inversion takes place localizes laterally within a few nanometers.</p> <p>2D van der Waals, graphene-like layers of two-dimensional materials, are by their nature atomically thin, while their stacking allows a plethora of unconventional interfaces to be created. In this project we propose to create and investigate two types of 2D van der Waals systems: (i) a multiferroic 2D, layered material, where the spin texture is linked to charge polarization within the layer; and (ii) an inversion-symmetry breaking heterostructure between a ferromagnetic 2D layer and another one with strong spin-orbit coupling.</p> <p>Experimentally, we will use multiple types of atomically-resolved Scanning Probe Microscopy (including spin-resolved, where necessary), at cryogenic temperatures, to reveal and investigate such localised spin textures; their relationship with charge polarization, where present; and to manipulate the spin textures with locally-applied electric fields. The latter would enable ways to control magnetism with electric fields, a route to develop energy-efficient devices. Finally, in selected systems the occurrence of such magnetic states will be probed also using magnetoresistance measurements of devices. The growth of the 2D van der Waals systems will build on various materials and methods experimented on in the group (including in ultra-high vacuum), and be supported by structural studies (by Angle-Resolved Photoemission Spectroscopy and diffraction techniques) at local and national/international facilities.</p> <p>The project affords an excellent opportunity for training at the interface between quantum technologies, condensed matter physics, and nanomaterials, and involves direct experience within the topical field of 2D materials, which is the most active field in solid state physics currently. It will be supervised by Dr. Adelina ILIE (Lead supervisor; atomic-scale investigations with STM/AFM, and growth of 2D layers and heterostructures) and Prof. Alain Nogaret (background in nanomagnetic and spin-related devices).</p>
References (optional) If required, you may include a small number of recent publications	
Industrial partner (if any) Give details of any industrial collaboration in the project	
Candidate requirements Give details of academic background/experience required	
Application process	Formal applications should be made via the University of Bath's online application form for a PhD in Physics (full-time)

Funding eligibility <i>Note from the Doctoral College: this information is based on current expectations and we will ensure that the text reflects the latest government guidance at the time of advertising.</i>	This project is for self-funded students only.
Programme Please select ONE	<input type="checkbox"/> PhD in Biochemistry <input type="checkbox"/> PhD in Biology <input type="checkbox"/> PhD in Chemistry <input type="checkbox"/> PhD in Computer Science <input type="checkbox"/> PhD in Mathematics <input type="checkbox"/> PhD in Statistics <input type="checkbox"/> PhD in Pharmacy & Pharmacology <input checked="" type="checkbox"/> PhD in Physics

Continued on next page...

Discipline and subject (taken from FindAPhd)

Insert an X in the box next to all that apply (max 10)

Biological & Medical Sciences		Chemical Sciences		Physical sciences		Engineering	
	Agricultural Sciences		Agricultural Chemistry	x	Applied Physics		Acoustics
	Biochemistry		Analytical Chemistry		Astrophysics		Aeronautical, Maritime and Transport Engineering
	Bioinformatics		Biochemistry		Atmospheric Physics		Biomedical Engineering
	Biomedical Engineering		Chemical Engineering		Atomic Physics		Chemical Engineering
	Biophysics		Chemical Toxicology		Biophysics		Civil & Structural Engineering
	Biotechnology		Computational Chemistry	x	Condensed Matter Physics		Electrical & Electronic
	Botany / Plant Science		Electrochemistry		Fluid Dynamics		Energy
	Cancer / Oncology		Environmental Chemistry		Geophysics		Environmental Engineering
	Cardiovascular Science		Food Chemistry	x	Low-temperature Physics		Manufacturing
	Cell Biology / Development		Geochemistry	x	Materials Science		Materials Science
	Ecology & Conservation		Inorganic Chemistry		Medical / Biomedical Physics		Mechanical Engineering
	Endocrinology		Macromolecular Chemistry		Metrology	x	Nanotechnology
	Evolution	x	Materials Science		Nuclear Physics		Nuclear Engineering
	Food Science / Nutrition		Organic Chemistry		Optical Physics		Petrochemical Engineering
	Forensic Science		Pharmaceutical / Medicinal Chemistry		Particle Physics		Semiconductors
	Genetics		Physical Chemistry		Plasma Physics		Software Engineering
	Immunology		Synthetic Chemistry	x	Quantum Physics		Telecommunications
	Marine Biology	Earth Sciences			Radiation	Social Science & Health	
	Medical/Biomedical Physics		Agronomy & Soil Science		Semiconductors		Anthropology
	Medical / Clinical Science		Atmospheric Physics	x	Solid state Physics		Architecture & the Built Environment
	Medical Imaging		Climatology & Climate Change		Theoretical Physics		Education
	Microbiology		Ecology & Conservation	Maths & Computing			Gender & Sexuality
	Molecular Biology		Ecotoxicology & Pollution		AI & Machine Learning		Health Sciences
	Neuroscience / Neurology		Environmental Chemistry		Applied Mathematics		Psychology
	Obstetrics, Gynaecology & Reproduction		Environmental Engineering		Bioinformatics		Public Health & Epidemiology
	Ophthalmology & Visual Science		Environmental Science		Computational Chemistry		Social Work, Social Policy & Administration
	Palaeobiology		Geochemistry		Computer Science & IT		Sociology
	Parasitology		Geography		Data Analysis		
	Pathology		Geology		Information Science		
	Pharmacology / Toxicology		Geophysics		Mathematics		
	Pharmacy / Pharmaceutics		Hydrology		Operational Research		
	Physiology & Sports Science		Meteorology		Software Engineering		
	Psychology & Psychiatry		Oceanography		Statistics		
	Public Health & Epidemiology		Palaeontology				
	Structural Biology						
	Virology						
	Zoology/Animal Science						