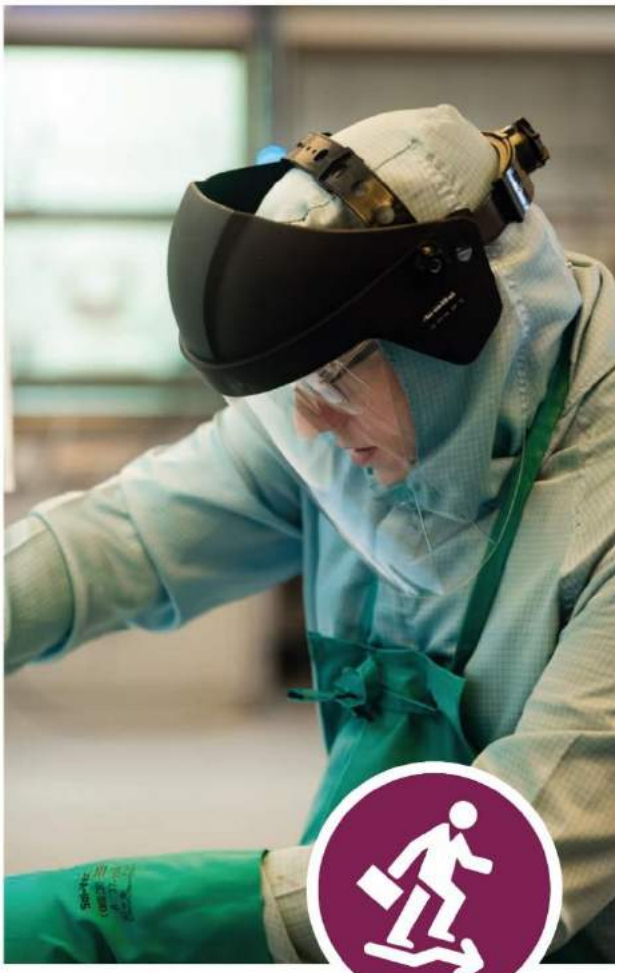
The Ogden Trust

making physics matter



Summer Internships Programme

The Ogden Trust Summer Internships Programme 2019

As part of its programme of continuing support for Ogden alumni, the Ogden Trust has arranged a series of internships for the Trust has arranged for a series of internships this summer in academic research and outreach.

Details of all available internships are given below. The level of detail varies depending on what the host organisation has provided. If there are links given, use them!

Unless otherwise stated, the following conditions apply:

Eligibility
Ogden undergraduates (including those in their final year) and those at the end of a gap year (either pre- or post-university) are eligible to apply. University research departments are likely to prefer students who have already completed one year of undergraduate study but may consider other enthusiastic but less experienced applicants. If there are any special requirements or exclusions, these will be noted as part of the internship listing.

Duration
Internships are six weeks long and will generally take place between mid-June and mid-September 2019.

Contract
Successful candidates will be required to co-sign an Agreement between themselves, The Ogden Trust, and the host organisation to confirm the terms of the internship and the responsibilities of all parties. On completion of the internship, the intern will be required to submit to the Trust a diary, explaining in layman's terms the nature of the work conducted and, more importantly, giving the intern's impressions of life doing that kind of work and the lessons learned over the internship period. In addition, the intern may be required by his/her host organisation to submit an academic paper, create resource material, or write a commercial report. The Ogden Trust does not require a copy of these documents but would be interested to know what the intern has completed.

Remuneration
The rate is £60 per day up to a maximum of five days per week. For Central London placements, the rate is £70 per day. This will be paid without the deduction of tax or national insurance but may form part of the student's overall taxable income for the year 2019/20.

Payments
Interns will be paid at the end of their internship once their diary, a timesheet and feedback form has been submitted on Flexigrant. An endorsement form also needs to be submitted from their host organisation to confirm appropriate conduct during the internship. **Internship payments will be processed by the Trust. We aim to make payment within three weeks of receiving the required paperwork (if paperwork is not received before 31 December 2019, the bursary will not be paid).**

Application and selection
Applicants must register for Flexigrant to enable them to submit an application https://ogdentrust.flexigrant.com/startapplication.aspx?id=3714 by the closing date. The Application form includes your reference, which must also be received by the closing date, so please invite your referee to participate with plenty of notice. If you have any difficulties with the form or think you have made a mistake after submitting it, please contact Veronica by email: **veronica.leacock@ogdentrust.com.**

Suitable candidates will be selected from the information provided, and their details passed to the appropriate host organisation for final approval. The host organisation will conduct a telephone interview with the candidate before making a final decision; some may request a face-to-face interview. Places will be offered in late April/early May and all applicants, successful or not, will be contacted.

Closing date
The closing date for receipt of applications at the Ogden Trust office is **Monday 1 April 2019.**

For more information about payments, accommodation, dress code, written submission, etc. please read the *Information for Ogden Trust Alumni Interns 2019* document.

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Research

UY2	Detection of Antibiotic Resistance	University of York
UY3	Optical engineering: designing a laser angle measurement tool for fluorescence microscopy	University of York
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	Outreach Opportunity	
O-EDI	Spreading the love for biophysics	Edinburgh
O-KEN	Science Outreach Internship	University of Kent
O-LU	Art of Isolation – Royal Society Summer Science Exhibition	Lancaster University
O-LEE	Physics Outreach Intern	University of Leeds
O-NU	Physics Outreach Summer Assistant	Northumbria University
O-NOT	Physics Outreach Assistant	Nottingham University
O-RHL	Exploring Physics Outreach & Public Engagement	Royal Holloway
O-UCL	Physics on Wheels Development Officer and Summer School Liaison	UCL
CYOI	**Create your Own internship/International internship**	

Research

UNIVERSITY OF BIRMINGHAM

UB1: Experimental Study of Novel Gaseous Detector for Dark Matter Searches

Gaseous particle detectors have played a crucial role in the development of our understanding of the microcosm in the last 100 years. The invention of multi-wire proportional chamber by G. Charpak (Nobel Prize in Physics 1992) in particular revolutionised the way gaseous detectors are used in particle physics experiments. Today, a novel invention the spherical proportional chamber (the "sphere") offers new opportunities for novel experiments and applications. Specific features of these kind of detectors – low capacitance, low threshold, excellent energy resolution, single readout channel in its simplest version, low cost, robustness, flexibility in gas choice and in operating pressure – have led to envisage various applications ranging from Dark Matter detection, Coherent Nuclear Neutrino Scattering study, Double Beta decay search to gamma ray and neutron spectroscopy. In this project, the sensitivity of a spherical detector to observe dark matter, as proposed by the NEWS experiment to be installed in SNOLAB, Canada, will be investigated with laboratory measurements.

Interest for practical work in the laboratory essential, familiarity with computer programming beneficial.

Understanding of the operation principles and physics of gaseous particle detectors. their applications in particle physics experiments and applications (e.g. medical imaging). familiarity with vacuum/gas systems, nuclear electronics, and data analysis software widely used in particle physics.

School of Physics and Astronomy:http://www.birmingham.ac.uk/staff/profiles/physics/navarro-cia-miguel.aspx, https://www.ee.ucl.ac.uk/~olegm/research/thzres/waveguides.html

Supervisor: Prof Kostas Nikolopoulos m.navarro-cia@bham.ac.uk
Dates: by mutual agreement

UB2: Simulation Study of Novel Gaseous Detector for Dark Matter searches

Gaseous particle detectors have played a crucial role in the development of our understanding of the microcosm in the last 100 years. The invention of multi-wire proportional chamber by G. Charpak (Nobel Prize in Physics 1992) in particular revolutionised the way gaseous detectors are used in particle physics experiments. Today, a novel invention the spherical proportional chamber (the "sphere") offers new opportunities for novel experiments and applications. Specific features of these kind of detectors – low capacitance, low threshold, excellent energy resolution, single readout channel in its simplest version, low cost, robustness, flexibility in gas choice and in operating pressure – have led to envisage various applications ranging from Dark Matter detection, Coherent Nuclear Neutrino Scattering study, Double Beta decay search to gamma ray and neutron spectroscopy. In this project, the sensitivity of a spherical detector to observe dark matter, as proposed by the NEWS experiment to be installed in SNOLAB, Canada, will be investigated with detailed simulations.

Familiarity with computer programming essential

Understanding of the operation principles and physics of gaseous particle detectors. their applications in particle physics experiments and applications (e.g. medical imaging). familiarity with vacuum/gas systems, nuclear electronics, and data analysis software widely used in particle physics.

School of Physics and Astronomy

https://www.birmingham.ac.uk/research/activity/physics/quantum/cold-atoms/index.aspx

Supervisor: Prof Kostas Nikolopoulos m.navarro-cia@bham.ac.uk
Dates: by mutual agreement

UB3: Study of The Excited States of 44Sc

We are developing and improving our measurement of the life-time of the excited states of 44Sc. These experiments have been initially designed for the undergraduate

nuclear physics laboratory and involve precision timing with a combination of detectors. Moreover, there is a rich physics background supporting these experiments, which will further the knowledge of the intern. The Nuclear Physics laboratory at the University of Birmingham has a long tradition in teaching innovation, and we aspire to publish these studies, as we have done with previous internships, for the benefit of the community.

Interest for practical work in the laboratory is essential. some familiarity with computer programming would be beneficial.

Understanding of the operation principles and physics of particle detectors. their applications in particle physics experiments and applications (e.g. medical imaging). familiarity with coincidence techniques, nuclear electronics, and data analysis software widely used in particle physics. solid background for research in particle, nuclear, or medical physics, and in education.

School of Physics and Astronomy

https://www.birmingham.ac.uk/research/activity/physics/quantum/cold-atoms/index.aspx

Supervisor: Prof Kostas Nikolopoulos m.navarro-cia@bham.ac.uk
Dates: by mutual agreement

UB4: Characterising Components for a Portable Quantum Clock

In this project, the student will work on one or more selected components (e.g., atom source, magnetic shields, or vacuum system) of our ultra-precise atomic clock experiments. The student will help characterize the performance of the subsystem and its effect on the whole experiment. The project will involve hands-on work helping to build up the experimental setups as well as performing experiments aiming to trap cold atoms in the MOT. The work of the student is directly relates to the research work of the group (e.g., to our contributions to the EU Quantum Flagship project iq Clock).
working in a team and indecently; efficient communication
basic experience of working in an (optics) physics lab would be appreciated but are not required.
***Skills*:**
hands-on experience working in a newly set up physics/optics lab environment
hands-on experiences with CAD software
insights on working with ultra-cold atoms as a tool for quantum technologies
insights on optical clocks and their fields of application in science and industry
***Career perspectives*:**
PhD in Physics
Quantum technology
Engineering tasks in industry/ Specialised high-tech industry
Scientific journalism
https://www.birmingham.ac.uk/research/activity/physics/quantum/cold-atoms/index.aspx; www.iqclock.eu
Supervisor: Dr Markus Gellesch, Dr Yeshpal Singh (group lead) M.Gellesch@bham.ac.uk
Dates: by mutual agreement

UB5: Simulation of Thermal Transport in an Optical Clock

In this project, the student will use standard simulation software to investigate thermal transport of essential components of our optical clock experiments. A particular focus will lie on the heat transfer in the vacuum chambers where cold atoms are trapped and investigated. The work of the student is directly related to the research of the group (e.g., to our contributions to the EU Quantum Flagship project iqClock).
working in a team and indecently; efficient communication
basic experience of working in an (optics) physics lab would
would be appreciated but are not required.
***Skills*:**
hands-on experience working in a newly set up physics/optics lab environment
hands-on experiences with CAD software
insights on working with ultra-cold atoms as a tool for quantum technologies
insights on optical clocks and their fields of application in science and industry
***Career perspectives*:**
PhD in Physics
Quantum technology
Engineering tasks in industry/ Specialised high-tech industry
Scientific journalism
https://www.birmingham.ac.uk/research/activity/physics/quantum/cold-atoms/index.aspx; www.iqclock.eu
Supervisor: Dr Markus Gellesch, Dr Yeshpal Singh (group lead) M.Gellesch@bham.ac.uk
Dates: by mutual agreement

University of BRISTOL

UBR1: Testing Mu3e Pixel Modules Name of institution

Bristol has recently joined the Mu3e experiment, which will use the latest developments in silicon pixel sensors to track electrons from muon decays. The silicon pixel detector modules will be produced in the UK, and the Bristol group are responsible for testing the detector components during and after the production of the modules.

In this project you will work with the development test system which is set up in the lab in Bristol. You will use silicon modules to commission the test system and develop and implement test algorithms and procedures.

Good laboratory and computer skills are required. Experience with electronics would be useful.
Skills gained: computing (esp simulation) and analytical skills Career paths: academic, research, financial, engineering.
University of Bristol, QETLabs

Supervisors: Prof Joel Goldstein joel.goldstein@bristol.ac.uk
Dates: by mutual agreement

UBR2: Alignment of the SiD Detector at the ILC Name of institution

The International Linear Collier (ILC) is a proposed particle collider, currently under consideration for construction in Japan. The ILC physics programme will complement that of the LHC, focusing on precision measurements of the Higgs boson, top quark and other particles, looking for signs of physics beyond the standard model.

Experiments at the ILC will have to make measurements with unprecedented accuracy to reach the goals of the collider physics programme. One of the biggest challenges will be to know the locations of all of the particle tracking elements to an accuracy of a few microns, which will require the development of new techniques building on experience gained at the LHC.

This project will look at the Silicon Detector (SiD), using simulations to evaluate its tracking performance against the ILC benchmarks and to develop and implement new algorithms for ensuring the tracking elements are aligned.

Good computing skills are required

Skills gained: computing, laboratory, and analytical skills Career paths: academic, research, financial, engineering.
Supervisors: Prof Joel Goldstein joel.goldstein@bristol.ac.uk
Dates: by mutual agreement

UBR3: Rare Kaon Decays

The NA62 experiment at CERN is studying very rare decays of charged Kaons. https://na62.web.cern.ch/na62/Home/Home.html. The principle aim of the experiment is to measure the decay to a pion and two neutrinos that is predicted to occur ~1 in 10,000,000,000 events. NA62 has been taking data for a few years and will also be running this summer.

The NA62 data set can also be used to study medium rare kaon decays one example is the Kaon decay to a muon, two pions and a neutrino (the Kμ4 decay) that happens ~1 in 100,000 events. This project will look at algorithms to measure this decay with the main challenge being to discriminate the event from the much more common decay to three pions. This project will involve using the NA62 software frame work to refine selection algorithms on simulated events and then apply these to data.

Good computing skills are required

Skills gained: computing and analytical skills Career paths: academic, research, financial, engineering.
Supervisor: Dr Helen Heath helen.heath@bristol.ac.uk
Dates: by mutual agreement

DU1: Building Stimuli Responsive Droplet Tissues

Artificial tissues, akin to biological ones, can be made of individual interacting cell units. A relatively simple, yet versatile, system is the droplet tissue, whereby lipid covered droplets are connected via lipid bilayer interfaces [Villar G. et al., *Science* 340, 2013]. To date artificial droplet tissues fabricated and studied are mostly static, in contrast to the dynamic nature of their biological source of inspiration.

In this project, we will use experiments and simulations to study guided rearrangements of droplet tissues using chemical and mechanical stimulation. The project will underlie the future development of stimuli-responsive formulations for pharma, food or agriculture, whereby the particular arrangement and contacts between droplets at certain environmental conditions determine the function and activity of the tissue material. The experiments will be done in Staykova lab, which uses microfluidics and 3D printing to create droplet networks. We will collaborate with the lab of Dr. Kusumaatmaja (Durham Physics), who has provided simulation results on the reversible 3D transformation of droplet networks, by means of osmotic variation.

Skills required: The project is experimental and will suit students who like to invent things and be creative. Prior experience with the listed techniques is not required

Skills gained: In droplet microfluidics, 3D printing, optical microscopy and lipid interfaces, which can be used for future placements in both academia (biophysics, soft matter) and industry.

Supervisor: Dr. Margarita Staykov**a** margarita.staykova@durham.ac.uk
Dates: by mutual agreement

https://www.dur.ac.uk/physics/staff/profiles/?id=11834

DU2: Living Materials

The concept of “living materials” rests on recent ideas to combine the intelligence of living organisms and the robustness and designability of non-living matter [Nguyen P. et al., *Advanced materials* 30, 2018]. Living materials that grow and adapt to the user’s needs are clearly very different from the passive materials that humanity has used to date, and we are at the beginning of learning how to build and use them.

In this project we want to establish the proof of principle of a self-propagating bacterial factory. We will use microfluidics tools to encapsulate metabolically-active and proliferating bacteria into lipid vesicles (artificial bags). By varying the lipids and the bacteria strains we will learn how to enable these vesicles to *grow* and *replicate*, generating daughter vesicles with newly formed bacteria and bacterial products, potentially *ad infinitum*. The project will be conducted in collaboration with the lab of Gary Sharples (Biosciences), who will provide the bacteria strains.

Skills required: The project is experimental and will suit students who like to invent things and be creative. Prior experience with bacteria is desirable but not essential.

Skills gained: Experience in droplet microfluidics, optical microscopy, lipid membranes and vesicles, and bacteria cultures. The focus of the project and the gained experience will benefit students looking for future placements in academia (biophysics, soft matter, material research), or in industry.

Supervisor: Dr. Margarita Staykova - margarita.staykova@durham.ac.uk **Dates:** by mutual agreement. **Website:** https://www.dur.ac.uk/physics/staff/profiles/?id=11834https://www.dur.ac.uk/physics/staff/profiles/?id=11834

DU3: Using machine learning to predict How many galaxies fit into a dark matter halo

Physical models of galaxy formation predict the number and properties of the galaxies that should be found inside a dark matter halo.

However, these models are computationally expensive which makes it hard to use them to populate large volumes of dark matter simulations with galaxies. Overcoming this problem is important to build mock galaxy catalogues to help analyse upcoming surveys

like those from Euclid and the Large Synoptic Survey. This project will use a galaxy formation model to train machine learning algorithms to put galaxies into halos.

Skills required: Basic knowledge of python

Skills gained: Experience of using machine learning; data scientist, research scientist

Supervisor: Prof Carlton Baugh - c.m.baugh@durham.ac.uk**Dates:** by mutual agreement. **Website:** http://www.icc.dur.ac.uk/

DU4: Ultra-Fast Terahertz Imaging Using Atomic Vapour

In this project we will develop Terahertz (THz) imaging techniques based upon efficient THz-to-optical conversion in atomic vapour. THz technologies, generally defined as operating in the 0.3—10 THz range, bridge the gap between electronic and photonic devices. Because THz radiation is non-ionising and passes readily through everyday materials such as plastics, paper and cloth, it is suitable for use in security and biomedical applications as well finding uses in telecommunications and industrial non-destructive testing. For all these applications, it is highly desirable to have sensitive detectors which are able to operate at high speeds; features that have so far proved elusive in conventional technologies. Atomic THz detectors developed in Durham have already been demonstrated to be faster and more sensitive than other room temperature THz sensors.

We would expect the student to be highly motivated, able to work in a team environment and interested in experimental physics. A good grasp of basic physics and computer programming skills would be an advantage.

The student would gain skills in experimental physics including, lasers and optics, electronics, data acquisition and image analysis.

The student would gain the experience of working in a professional research group, conducting world-leading research. They would be fully integrated into the team, attending all group meetings and seminars.

Supervisor: Kevin Weatherill - **Email:**k.j.weatherill@durham.ac.uk

Dates: by mutual agreement

https://www.jqc.org.uk/research/thz-sensing-and-imaging/

Imperial College London

ICL1: Magnetic Confinement Fusion– Tokamak Research Projects

Magnetic confinement fusion (MCF), uses deuterium and tritium plasmas heated to temperatures of tens of millions of degrees Celsius. The plasma is confined by powerful magnetic fields, holding it away from material surfaces, using the toroidal geometry of tokamak devices. A number of summer research projects will be offered linked to current research is strongly linked to the UK's national fusion research programme at the Culham Centre for Fusion Energy (CCFE), on both the Joint European Torus (JET) and the Mega Amp Spherical Tokamak Upgrade (MAST-U), through both experimental study, the development of theoretical models and simulation. We are looking for students to work on our current research projects this summer. Applicants should have a keen interest in fusion, good at working independently and as part of a team and patient with the inevitable delays and problems with cutting edge physics research.

We are looking for physics students with strong mathematical skills and some coding experience.

These projects will provide a realistic experience of working at the forefront of fusion research in a community of international physics collaboration.

Supervisor: Dr. Yasmin Andrew - y.andrew@imperial.ac.uk

Dates: by mutual agreement

ICL2: Making matter from light

My research group uses some of the world's most intense laser pulses to probe extreme physics environments. When photons collide, they can, in theory, create matter. The simplest way to do this is to collide two photons which have enough energy to create an electron-positron pair, but it can also be done by colliding a high energy photon with many low energy photons in an intense laser field. These processes are so extreme that the only place they occur is in very extreme environments such as those near black holes and quasars, and hopefully in our laser-based experiments. In this project you will get closely involved with the analysis and data from these experiments as well as the numerical modelling to help predict the outcomes of the experiments.

Skills gained: You will develop data analysis and visualisation skills that are important for a career in physics and are very transferable to "data science" careers.

Supervisor: Stuart Mangles - stuart.mangles@imperial.ac.uk
Dates: by mutual agreement

https://www.imperial.ac.uk/plasma-physics

ICL3: Identifying activity patterns from phone app-based tracking

The widespread use of smartphones and tracking apps provide novel and unique opportunities to study individual behaviours on a large scale. However the type of big data currently obtained from such approaches tends to be messy and may require judicious post-processing and interpretation to be usable. This project will explore the use of data collected from physical activity and geotracking apps such as “Moves” for research on travel behaviour and exposure science. Data from weeks of continuous tracking using Moves from approximately 500 individuals across 7 European cities obtained from the EU-funded PASTA project (http://www.pastaproject.eu/home/) will be made available. The student will develop methods to process the data and derive clean interpretations of the participants’ activity patterns, including recognizing recurring trips such as commute trips, estimating how many repeated data is needed before establishing patterns, and assessing any changes in mode choice or route choice over time. More details on Dr de Nazelle’s research can be found at http://www.imperial.ac.uk/people/anazelle.

The student should have excellent quantitative skills, with preferably previous experience in using R, spatial R, ArcGIS, QGIS, or Python. Students should be creative thinkers and able to work independently

The student will: improve quantitative skills in an applied setting using R; learn to exercise creativity to tackle a concrete problem; develop an understanding of major challenges of working with large data sets, interpreting geo-tracking data, and exposure assessment; discover and address issues of gaps, errors, and uncertainty in data; learn to work in a research team. Future career paths may include research or consultancy in environmental, transport or health fields.

Supervisor: Audrey de Nazelle- anazelle@imperial.ac.uk
Dates: by mutual agreement
http://www.imperial.ac.uk/people/anazelle

ICL4: Identifying deviations from recurring or pre-determined travel patterns

Novel methods of geo-tracking individuals throughout their daily activities using smart phones offer new opportunities to examine travel choices. This is particularly relevant for the under-studied area of understanding how pedestrians and cyclists choose their travel routes. For example, do cyclists typically choose the shortest path to reach their destinations or are they willing to deviate from the shortest path to use a cycle lane (and by how much)? To answer these types of questions, methods are needed to identify recurring or non-recurring trips, and to quantify deviations from a set path. This project will explore such methods making use of available data collected from the geotracking app "Moves" from approximately 500 individuals across 7 European cities were obtained from the EU-funded PASTA project (http://www.pastaproject.eu/home/). The student will first adapt a Python algorithm to automate Google-derived routes to use as comparison with actual route choices as identified by Moves. The student will develop methods to process automatically the large datasets from Moves and characterize route deviations between the participants own recurring choices and between Google-derived routes and actual routes. More details on Dr de Nazelle's research can be found at http://www.imperial.ac.uk/people/anazelle.

The student should have excellent quantitative skills, with preferably previous experience in using R, spatial R, ArcGIS or QGIS, and Python. Students should be creative thinkers and able to work independently.

The student will: improve quantitative skills in an applied setting using R; learn to exercise creativity to tackle a concrete problem; develop an understanding of major challenges of working with large data sets, interpreting geo-tracking data, and exposure assessment; discover and address issues of gaps, errors, and uncertainty in data; learn to work in a research team. Future career paths may include research or consultancy in environmental, transport or health fields.

Supervisor: Audrey de Nazelle - anazelle@imperial.ac.uk
Dates: by mutual agreement

http://www.imperial.ac.uk/people/anazelle

University of Kent

KEN1: A new multiferroics? Understanding structure, composition and properties

The project involves the study and characterisation of a new magnetic and polar Aurivillius material ($Bi_2CoO_2F_4$) [1] with the potential for ferroelectric properties.

Aurivillius materials are well known for their ferroelectric properties [2] but attempts to combine this property with long-range magnetic order haven't been successful until the report of $Bi_2CoO_2F_4$ [1] in July 2018. This new material, composed of fluorite-like $[Bi_2O_2]^{2+}$ layers, and perovskite layers of corner-linked CoO_4F_2 octahedra, orders magnetically below 40 K. This represents a huge step forwards in the drive to prepare new multiferroics (magnetic and ferroelectric) systems, but there are several questions we aim to answer with this project:

What are the precise anion locations and how do these change with temperature?

Given the oxidising reaction conditions, can the O:F ratio (and relatively low Co oxidation state) be confirmed?

What is the nature of the magnetic order?

We're grateful to collaborate with Johnsson et al to carry out further analysis on their sample as Neutron powder diffraction, titrations or reductive TGA among others, to answer these questions; this will make a significant contribution to the field and provide an exciting analytical research project for a student.

[1] E. Mitoudi Vagourdi, S. Müllner, P. Lemmens, R. K. Kremer, M. Johnsson. Inorg. Chem. 2018, 57, 9115.

[2] C. A-Paz de Araujo, J. D. Cuchiaro, L. D. McMillan, M. C. Scott, J. F. Scott. Nature, 1995, 374, 627.

Skills required/expected: awareness of some common structure types of extended solids as well as diffraction methods and their use in determining the structures of crystalline materials.

awareness of types of long-range magnetic order (e.g. antiferromagnetism, ferromagnetism) would be an advantage.

Skills gained: technical expertise (e.g. in the analysis of X-ray and neutron powder diffraction data, the analysis of magnetic measurements),experience of working in an academic research environment, time management, project management, presentation skills (from participating in research group meetings) and communication and scientific writing (from preparing progress notes with Dr Cascos, and reports for collaborators).

Future career path: Postgraduate studies and/or research within condensed matter physics.

Supervisor: Dr. Emma McCabe - McCabe@kent.ac.uk & Dr. Vanessa Cascos E.E. Vac23@kent.ac.uk
Dates: by mutual agreement

KEN2: High Pressure Raman Spectroscopy of Spin Crossover Materials

Spin crossover materials can change their colour, structure and magnetic properties in response to an external perturbation such as changes in temperature, application of pressure or light irradiation. These changes are caused by spin state switching of transition metal centres in the material, and potential applications include sensor and actuator technologies.

This project aims to probe the pressure-induced transition in these materials using high pressure and variable temperature Raman spectroscopy. A sample will be loaded into a pressure cell and compressed between two diamonds. The student will record the Raman spectrum and identify key changes resulting from the change in spin state. The student will correlate these results to existing high pressure structural data in an effort to understand how and why these materials respond to extreme conditions.

Skills required: A good working knowledge of data analysis programs such as Excel and/or Origin etc, good record keeping and organizational skills, the ability to learn new techniques and perform experiments independently

Skills gained during placement: Use of specialized scientific equipment (Raman spectrometer, diamond anvil cell etc), Experimental design, understanding of theory and concepts in condensed matter physics, data analysis

Future Career Path: Postgraduate studies and/or research within condensed matter physics.

Supervisor: Dr. Helena J. Shepherd =h.j.shepherd@kent.ac.uk
Dates: by mutual agreement
https://www.kent.ac.uk/physical-sciences/people/1029/shepherd-helena

KEN3: Exploring the molecules of life

The aim of the project is to study the routes of formation of molecules in the interstellar medium and on icy moons in our solar system.

The interstellar medium (ISM) is a rich chemical factory, with over 180 molecular species identified to date, mostly observed in star-forming regions. Star formation begins in dense molecular clouds, where cold (~10 K) interstellar dust provides the surfaces for atoms and molecules to “freeze-out”, forming icy mantles. These icy mantles are the largest molecular reservoirs where chemical reactions, driven by both non-thermal and thermal processes, produce more complex molecules that are subsequently released into the gas phase. Similarly many of the moons of the planets in the Solar system are covered in ice. Dust grains and these lunar surfaces are irradiated by ions and UV photons leading to the synthesis of larger more complex molecules from the fragmentation of simpler ices.

The student will investigate the physical and chemical properties of such ices in a controlled laboratory environment using ultra-high vacuum chambers and cryogenically cooled substrates to grow interstellar ice/Lunar ice analogues. The ices are characterised, in situ, using Fourier-Transform Infrared Spectroscopy with mass spectroscopy used to monitor the species released into the gas phase during processing. UV, electron or ion irradiation processing of such ices will be explored to determine the formation of larger molecules during processing. The results are compared both with observations and chemical models.

Please specify the skills required/expected from the students.

This is a spectroscopy-based project so some knowledge of molecular spectroscopy is welcome. It is an experimental based project so some basic knowledge of vacuum technology and infrared spectroscopy (e.g. experiments in undergraduate labs) would be an advantage but on the job training provided!

Note: some of these experiments may be performed at European facilities (e.g. Debrecen Hungary) and the student will be expected to participate (travel/subsistence costs will be met by existing grants) but student should ensure passport/visa is up to date for EU travel.

Skills gained

Experience of working on a larger scale collaborative research project both in University and national research laboratories. A good insight into PhD research. Experimental skills will include in spectroscopy and vacuum/cryogenic techniques.

Supervisor: Prof: Nigel Mason - n.j.mason@kent.ac.uk **Dates:** by mutual agreement

KC1: Development of a miniature pre-amplifier for ultrasound detectors in photoacoustic imaging

Photoacoustic (PA) imaging is a novel biomedical imaging modality which uses a pulsed (or modulated) laser source to excite acoustic waves from tissue chromophores, with image contrast derived from optical absorption (Figure 1). It is one of the fastest growing fields in biomedical imaging. A sensitive and broadband ultrasound detector lies at the heart of a PA imaging system. This project aims to develop a sensitive and broadband ultrasound detector for PA imaging, with a focus on developing a dedicated low noise pre-amplifier. We will integrate between design, numerical simulation, fabrication and performance evaluation to achieve an optimised preamplifier. The success of this project will set the stage for further development of a miniature photoacoustic micro-endoscopy system that will be useful for guiding minimally invasive procedures in a wide range of clinical fields including oncology, fetal medicine and cardiology.

Required skills: Motivated student will be required to work efficiently with a team of researchers with different background. Basic knowledge of electrical circuit design and ultrasound physics is a plus but is not required.

Skills that will be gained: Experience on the design and development of a miniature pre-amplifier board, experience on ultrasound transducer development, and performance characterization, photoacoustic imaging and potential publications in leading scientific conferences and journals.

Supervisor's name: Wenfeng Xia -wenfeng.xia@kcl.ac.uk, Tianrui Zhao - tianrui.zhao@kcl.ac.uk, Hubin Zhao - hubin.zhao@ucl.ac.uk Website: https://kclpure.kcl.ac.uk/portal/wenfeng.xia.html

LU1: Back in time with the largest telescopes: studying the ancestors of local galaxies

The Milky Way, our cosmic home, is just one among about a trillion galaxies in the visible Universe. Galaxies around the Milky Way show an incredible diversity in the number of stars, colours, shapes and sizes, which are a consequence of how they formed and evolved. How did they end up like this? How did our own galaxy form and evolve across almost 14 billion years? How do those processes affect the production of the ingredients necessary for life itself to exist and evolve? At Lancaster, our international team addresses these challenging questions by using some of the best telescopes and cameras, on Earth and in Space. Recently, we have been able to slice the Universe in cosmic time (going back up to 13 billion years) and we have discovered 4000 new distant galaxies (see https://www.youtube.com/watch?v=K9I469U_W5s) which are progenitors of the same kind of galaxies we can see at the present, but seen in a primitive Universe. The intern will join our team and work with this state-of-the-art dataset, discovering how these early galaxies looked like and how large they were (with Hubble space telescope data), what kind of stars were shinning in the past, how many stars they already had and how galaxies were distributed in 3D in the Universe. The research will also allow to explore how rapidly the early super-massive black holes were growing and to discover different paths through which galaxies form and evolve.

Proactivity, motivation, curiosity, passion to learn and figure out physical phenomena within our vast Universe, willingness to make new discoveries.

Skills gained: Programming (Python), producing attractive data visualisations/graphs, presenting research results, perseverance development, creative solutions, Astronomy knowledge, data-science basic skills.

Future career: Research (private or public sectors), higher-education, data science, consulting

Supervisor: Dr. David Sobral - d.sobral@lancaster.ac.uk

Dates: by mutual agreement

LU2: A portable planetarium for Lancashire and Cumbria: creating planetarium videos

The Observational Astrophysics and Space an Planetary Physics groups at Lancaster University have recently obtained funding to buy a portable, inflatable planetarium for Lancashire and Cumbria. This will be purchased in March and during the summer we will be advertising the planetarium and producing and gathering content for our new planetarium shows. This project will primarily involve developing and compiling the first planetarium shows our facility, including sourcing and editing videos and planning presentations. The intern will be involved in choosing key topics for planetarium shows and will help to guide the direction of this brand-new facility. The intern will be embedded within the Observational Astrophysics group and will have ample opportunity to talk with the researchers and PhD student at Lancaster University about ongoing research, day-to-day research, and career opportunities in Astrophysics.

Skills required/expected: An interest in astrophysics. Video editing background preferred.

Skills gained: Physics/astrophysics outreach, astrophysics research, video creation and editing, communication, team work, taking initiative, general research and presentation skills.

Supervisor: Dr Julie Wardlow - j.wardlow@lancaster.ac.uk
Dates: by mutual agreement

LU3: A portable planetarium for Lancashire and Cumbria: building a web presence

The Observational Astrophysics and Space an Planetary Physics groups at Lancaster University have recently obtained funding to buy a portable, inflatable planetarium for Lancashire and Cumbria. This will be purchased in March and during the summer we will begin gathering content for the planetarium and advertising it to the local community, schools, scouting/guiding groups, event's organisers etc. This project will primarily involve building a web presence for the planetarium to show off all that it can be used for. The intern will work with the University's basic web template to build an exciting and useable platform for people interested in planetarium visits and basic information about astrophysics. The intern will also help to build the social media footprint of the planetarium. They will be involved in choosing key topics for planetarium shows and will help to guide the direction of this brand new facility. The intern will be embedded within the Observational Astrophysics group and will have ample opportunity to talk with the researchers and PhD student at Lancaster University about ongoing research, day-to-day research, and career opportunities in Astrophysics.

Skills required/expected: HTML and website-building experience. An interest in astrophysics.

Skills gained: Web design, website creation, programming, physics/astrophysics outreach, astrophysics research, communication, team work, taking initiative, general research and presentation skills.

Supervisor: Dr Julie Wardlow - j.wardlow@lancaster.ac.uk
Dates: by mutual agreement Website: www.lancaster.ac.uk/physics/research/astrophysics/

LU4: A simulation for Particle Physics

The EPP group has a particle physics simulation (LPPP, http://lppp.lancaster.ac.uk) which is used mainly for outreach purposes in schools. The simulation starts with classical pool billiard and continues with fixed target and colliding beams. In the final modules neutrino oscillations and Higgs boson decays are simulated.

One of the main tasks of the successful applicant is to convert the software so that it runs as a stand-alone app on various platforms. As the software runs already on multiple platforms this will not be too hard. The candidate will also work on maintenance and development of the package. We also intend to add video

recordings explaining both, the simulation and the underlying physics. Students interested in recording and editing videos are welcome to apply as well.

Skills required/expected Experience in computer programming and basic knowledge of particle physics.

Skills that will be gained / future career path

The candidate will learn about computer programming, Monte Carlo methods used in physics simulation, interactions and decays of particles, and interactions of

particles in detectors. Also video work may be a skill gained.

Supervisor: Dr Julie Wardlow - j.wardlow@lancaster.ac.uk

Dates: by mutual agreement
www.lancaster.ac.uk/physics/research/astrophysics/

LU5: Electrical characterisation of prototype ULTRARAM™ memories

An ultimate or 'universal' memory concept is one that combines the best features of DRAM and Flash, i.e. is non-volatile, low-voltage, non-destructively read, fast, cheap and high endurance. Implemented as RAM, such a memory would allow instantly on/off boot-free computers with unprecedented reductions in power consumption for mobile devices and computers. Our patented non-volatile, low-voltage, compound-semiconductor memory cells with non-destructive read have the potential to fulfil all the requirements of universal memory. Due to the extraordinary combination of non-volatility combined with an ultra-low switching energy (100x lower per unit area than DRAM), our memories have become known as ULTRARAM™. The intern will be fully incorporated into the ULTRARAM™ research team, working at the forefront of this exciting research, and will be involved in one or more of the following: (i) further development of ULTRARAM™ testing equipment, (ii) electrical characterisation of single cell ULTRARAM™ devices and small (2x2) ULTRARAM™ arrays, (iii) further development of a highly-portable ULTRARAM™ demonstration kit.

Requirements: should be enthusiastic, reliable and highly motivated, with the ability to work independently as part of a team. Familiarity with any of the following will be advantageous: Raspberry Pi, Python, basic electronics, semiconductor physics/devices

Skills gained: the opportunity to further develop a range of research and transferrable skills widely valued by employers, including organisational and project management skills, hands-on use of equipment, personal, oral and written communication skills, networking skills, IT skills, data management and analysis. The intern will learn about the physics of semiconductor materials and devices, particularly semiconductor memories. The internship will be ideal training for anyone interested in a research career, in industry or academia, including via a PhD.

Supervisor: Prof: Manus Haynes m.haynes@lancaster.ac.uk **Dates:** by mutual agreement

LU6: Electron diffusion in a Liquid Argon Time Projection Chamber

The Liquid Argon Time Projection Chamber (LArTPC) is a technology currently being utilised by next generation neutrino oscillation experiments, whose goals are to address key questions about nature including the matter-antimatter asymmetry of the universe.
The technology relies on precise measurements of ionisation electrons, liberated by charged particles passing through the LArTPC, to infer information about neutrinos interacting in the detector. The ionised-electron clouds can diffuse before they are measured in the LArTPC, resulting in inference of imprecise or incorrect information about the interacting neutrinos.
The primary goal of the project is to further develop and test a method, currently under development at Lancaster University, for measuring electron diffusion in a simulation of a LArTPC. The intern will work closely with a team of neutrino scientists at Lancaster University with the aims of measuring the key parameters which drive electron diffusion in a LArTPC simulation, writing a report on the findings and presenting results to collaborators on a LArTPC experiment.

Skills required/expected: The candidates should have prior experience in coding (C++, Python, Java or others)
Skills that will be gained: Software development for existing experiment, short report writing, Work with a team of academics, postdocs and PhD students, Presentation skills.

Supervisor's name: Dr Jaroslaw Nowak - j.nowak@lancaster.ac.uk **Dates:** by mutual agreement

UNIVERSITY OF LEEDS

LEE1: Signs for Stars – Astrophysics for All

Most astrophysics words related to modern day research advances do not have an equivalent sign in British Sign Language (BSL), which poses limitations to the deaf community when engaging with modern astrophysics. Working with experts in developing signs for scientific terms, Dr Panic will develop 50 new signs, including terms like 'protoplanetary disc', 'exo-Solar planetary system' and 'interferometric telescope'.

As part of the project, the intern will be responsible for identifying the list of the most pertinent astrophysics words that will be included in the BSL glossary, as well as assisting in developing the project plan and organising content for dissemination of the project through print and online channels. The team hopes that this project will bring research closer to the deaf community and light pathways to a more inclusive research and higher education environment, and spur discussion about ways to tackle this problem.

Familiarity with current topics in inclusive teaching and learning

Aptitude for engaging with a variety of audiences in a professional manner

Excellent oral and written communication, interpersonal and organizational skills

Proven problem-solving skills when working both independently and in groups

Project management and scheduling skills to ensure deadlines are met

Strong research proficiency in gathering information, analyzing options and delivering solutions

Content creation skills for websites, articles, blogs and social media are highly desirable

Supervisor: Dr Olja Panic, Dorothy Hodgkin Fellow, o.panic@leeds.ac.uk

Dates: June/July – as early as possible following end of term activities

MANCHESTER 1824
The University of Manchester

UM1: Testing the giant horns for the L-Band All Sky Survey (L-BASS)

After many decades of radio astronomy activity are there any exciting discoveries to be made? Perhaps! An American experiment, ARCADE-2, consisting of carefully calibrated antennas flown on a balloon to get above most of the Earth's atmosphere, claims that there is an unexplained radio background emission which only becomes visible at low radio frequencies. L-BASS is a Jodrell Bank project designed to test whether or not this claim of an unexplained background emission is really true. The L-BASS project will produce a very accurately calibrated map of the sky at a frequency around 1.42GHz (L-Band). The mapping will be done using two 3m long horn antennas which are now being assembled.

An Ogden student would help measure the horn radiation pattern and join in the commissioning of the L-BASS telescope at Jodrell.

Required: Potential students should have some undergraduate experience and be happy to use test equipment under guidance and be able to carry out simple computer data analysis.

Skills gained: Student should have acquired a working knowledge of radio receivers and antennas. They will become confident with the use of sophisticated radio frequency test equipment, useful if they proceed to do other radio astronomy projects and, more generally, for any radio frequency measurements.

Supervisors: Prof. Ian Browne, Profs Spencer and Wilkinson. **Dates:** by mutual agreement

Jodrell Bank Observatory http://www.jodrellbank.manchester.ac.uk/research/

UM2: Developing an instrument to measure the composition of Cosmic Rays

The origin of cosmic rays has remained a mystery for over 100 years. Their composition – their mix of hydrogen nuclei with heavier elements – can provide us with valuable clues to basic unresolved questions, like whether they're coming from inside or outside our galaxy. The composition of cosmic rays is studied by measuring the charged particle showers they cause in the atmosphere. Promising results have been obtained recently by using a combination of particle detectors and a dense array of radio antennas.

We are developing a particle detector to be used in combination with new large-scale radio telescope arrays to study cosmic-ray composition. Our first full experiment will be at the Murchison Widefield Array (www.mwatelescope.org/) in Western Australia in a year or so, and later we will use the Square Kilometre Array (www.skatelescope.org/) at the same site. A press release showing the installation of our first prototype is here: https://www.manchester.ac.uk/discover/news/manchester-astrophysicist-to-help-unlock-mysteries-of-rare-cosmic-rays/

We would like one or two students to help us with developing the next version of the particle detector, to be deployed later this year. This will involve testing and characterising several prototype detectors in our lab at Jodrell Bank, and comparing their performance to the prototype deployed at the MWA site. They could also assist with development of the systems used to control the detectors and process the data from them. By the end of the project, we hope that they would be able to use our prototype systems together to detect extended particle showers from high-energy cosmic rays.

Skills required: Ability to set up test equipment and record data; simple computer skills (e.g. word processing, spreadsheets); ability to work both independently and in a team. Skills in programming and simple electronics are desirable but not essential.

Skills acquired: Setting up complex instrumentation systems, data analysis, computer simulation, analogue and digital electronics. Understanding the physics of particle detectors, cosmic rays and particle cascades. Future career paths might involve research in particle physics or astronomy, employment in the electronics and nuclear industries, and data analysis in the wider world of 'Big Data'.

Supervisors: Prof. Ralph Spencer and Dr. Justin Bray ralph.spencer@manchester.ac.uk, justin.bray@manchester.ac.uk

Dates: by mutual agreement

UM3: Tactile Collider

Tactile Collider is an initiative bringing the latest in accelerator physics research to blind and visually impaired children and adults (plus teachers and carers) around the UK. With funding from an STFC Large Award, Dr Rob Appleby and his team have worked with specialists and visual impairment consultants to develop special resources and activities that communicate the physics behind CERN's Large Hadron Collider through touch and sound – such as models of LHC equipment which can be handled, specially designed tactile magnets where the magnetic poles can be felt, and a demonstration of acceleration using balls that make a noise. So far Tactile Collider has reached over 200 school pupils and 100 teachers, and has been taken to festivals including bluedot and Womad.

This internship would involve working on the final development of the Tactile Collider teacher packs, specifically tactile workbooks for the project topics

communication skills – written and verbal
attention to detail and ability to work to a brief
enthusiasm for outreach and for engaging underrepresented audiences
able to work in a team but also without direct supervision all the time
Science communication to a range of audiences and in a variety of formats
Experience of working on a major public engagement project with a specialist focus
Knowledge of the needs of blind/VI students and their teachers and carers

This would suit a student thinking about careers around widening access to physics, possibly in university outreach; public engagement careers; teaching
Supervisor: Rob Appleby - Robert.Appleby@manchester.ac.uk

Dates: by mutual agreement

http://tactilecollider.uk/

OX1: Understanding systemic risk in the insurance sector: An agent-based modelling project with focus on calibration and visualization

Outline: Systemic risk is a phenomenon arising at the systemic level in many financial systems through various mechanisms. One such mechanism is the lack of diversity in risk models used in the insurance sector. While any individual large deviation of risk model predictions from reality is unlikely, it would, if it occurs, affect the entire sector. Agent-based models are able to conveniently include heterogeneous firms and agents, direct interaction, and heavy tailed distributions as they are typical for risk models. An agent-based model of the insurance sector is being developed at INET Oxford for this purpose. At the current stage, the main effort is to calibrate the model to empirical data and to improve visualization to facilitate the calibration process. Firm-level, industry-level, and contract- or line-of-business-level data are used. The student will work in collaboration with other researchers on the project.

Skills Required: Python programming skills would be welcome but can be developed during the project.

Skills/knowledge to be gained: Data analysis techniques, programming skills in python, techniques in building, calibrating, and visualizing agent-based models. The project will include aspects of financial economics and complexity economics (e.g. systemic risk, insurance systems, and agent-based modelling) and may be interesting for a student who aims to pursue a PhD in complex systems science, in computational economics, or in computational social science. However, it would also be useful for anyone interested in data science.

Supervisor: Prof. Dr. J. Doyne Farmer - doyne.farmer@inet.ox.ac.uk

Dates: By mutual agreement.

Queen Mary
University of London

QMU1: Space Sonification Summer Internship

Ultra-low frequency analogues of sound waves (fluid plasma waves) in near-Earth space can have effects on our technology and lives e.g. they can create “killer electrons” in the radiation belts which damage or “kill” the many satellites we depend on. One novel technique in navigating, mining, and analysing this data is through sonification, the process of converting an oscillatory time-series into audible sound. These audible datasets then lend themselves well not only to researchers but also citizen scientists. The internship will concern developing new tools to sonify data from numerous different space-based missions.

Skills required:
Computer programming (e.g. C++, Matlab, Python)
Self-motivation/independent organisation
Audio analysis (desired)

This placement would be beneficial to someone interested in pursuing research (time series analysis fields particularly space plasma physics or audio) or gaining experience in working with data.

Supervisor: Dr Martin Archer - m.archer@qmul.ac.uk
Dates: by mutual agreement

http://bit.ly/QMULRiS
http://ssfx.qmul.ac.uk

University of Central Lancashire

UCLan1: Investigating the host environments of Massive Stars

Evolved massive stars are thought to end their lives as explosions called supernovae. However, this has not been confirmed from direct observations and some observations have found no star at the location of a supernova, suggesting they are not responsible for these explosions. This project will address the question, “Why are these stars not detected?” You will use a catalogue of evolved massive stars in the M33 galaxy to investigate their environment. Using image display software such as GAIA/DS9 you will view the stars in M33 at a variety of resolutions and investigate how the resolution affects what is seen in the image.

Skills required: Knowledge of Astronomy is required either from a degree module or equivalent experience. Good computer skills and use of Excel is expected. Use of GAIA is not essential and can be taught during the internship. The student may be expected to use some existing IDL code but no coding experience is required. The student should have the ability to work independently during this internship.

Skills gained: This project would benefit any student undertaking a Physics/Astrophysics degree or related degree. The student will become proficient in using GAIA for image analysis and will also gain a basic understanding of coding. It will also benefit students looking to undertake a BSc/MPhys project or postgraduate degree. The critical thinking skills, team-work skills and experience of a working environment are valuable to all careers in science and engineering.

Supervisors: Dr Joanne Pledger - jpledger@uclan.ac.uk **Dates:** By mutual agreement

https://www.uclan.ac.uk/staff_profiles/dr_joanne_bibby.php

UCLan2: The bulge of the Milky Way in the era of Gaia

The goal of this project is to use state-of-the-art simulations with gas and star formation to understand the formation and evolution of the bulge of the Milky Way. The Gaia satellite is currently mapping the Milky Way in exquisite detail and this comparison of simulations and observations will allow us to understand, for the first time how the bulge formed. This is an important step in helping us understand how galaxies form in general.

Skills required: Programming experience, particularly in python would be useful though not necessary. Some knowledge of astronomy and the Milky Way would be particularly relevant, but not necessary.

Skills gained: Python programming, linux, the use of supercomputer simulations.

Supervisor: Victor P. Debattista - VPDebattista@uclan.ac.uk; vpdebattista@gmail.com
Dates: by mutual agreement

Jeremiah Horrocks Institute, University of Central Lancashire

http://www.star.uclan.ac.uk/~vpd/

UY1: Discovering new stars using TESS

Variable stars are used to give us a glimpse of the inside of a star- a region usually inaccessible to astronomers. This project will use the latest data from NASA's space telescope TESS (www.nasa.gov/tess-transiting-exoplanet-survey-satellite, tess.mit.edu) to investigate the pulsations in known variable stars and to search for new members. We will find some brand new pulsating stars!

This is a research project in which students will analyse data and match with the literature their observations. Good data and plotting skills are required as well as a willingness to learn new software. A desire to develop coding skills would be advantageous although the code to be used is flexible.

This project is a taster of academic research in all its forms. The students will develop skills in acquiring data from professional databases, analysing the pulsations present and presenting their work in both written and graphical formats. The student will thus experience real astronomy research and be able to contribute to developing our understanding in the field.

Supervisor: Dr Emily Brunsden - emily.brunsden@york.ac.uk **Dates:** By mutual agreement

UY2: Detection of Antibiotic Resistance

Our project involves a highly interdisciplinary team of researchers working at the boundary between Physics, Chemistry and Biology on the development of diagnostic devices for the detection of antibiotic resistance. Antibiotic resistance currently poses a serious risk to public health and by helping with this project you would be actively contributing towards solving this. We are looking for a student to carry out a summer internship involving the designing and running of a biophysics assay for the detection of bacteria that are resistant to antibiotics such as penicillin, helping to inform our work on the development of a simple test for diagnosing resistant infections in the clinical setting. The work will include the use nanoparticles and spectroscopy in lateral flow devices, paper microfluidics and more sophisticated 3D printed microfluidics systems. The student will work along-side other researchers from all levels and from different scientific backgrounds (Physics, Electronics, Chemistry, and Biology) gaining a broader understanding of how these subjects interact and overlap with each other.

Attention to detail; ability to work in a multi-disciplinary environment; problem solving.

Future career path: This work provides an insight into the scientific research careers in both academic and industrial settings. It covers a host of topics including: biotechnology, medical engineering, and nanotechnology.

Supervisor: Dr Lisa Miller (Physics) and Dr Matt Simmons (Electronics) lisa.miller@york.ac.uk and matthew.simmons@york.ac.uk

Dates: By mutual agreement
For examples of work carried out in our lab please visit: http://www-users.york.ac.uk/~sdj507/BiomolecularElectronics/Home.html

UY3: Optical engineering: designing a laser angle measurement tool for fluorescence microscopy

Lasers are a byword for scientific precision. They are also an essential component of modern microscopy techniques used to discover the secrets of living cells. You will enjoy designing a safe and practical strategy for measuring the precise angle of a laser beam on a total-internal reflection fluorescence (TIRF) microscope. To support this you will employ simple ray-tracing or other simulations. You will then implement a prototype and test it experimentally in an active research setting.

Not suitable for pre-leavers (undergraduates only).

Ideally, you will have an interest in optical physics, astronomy and/or life sciences, specifically in the special properties of laser light and/or the use of microscopes.

Essential: Good record-keeping and data management. Enthusiasm and communication skills to discuss results informally with a scientific team. A keen sense of workplace safety, attention to detail and responsible time management.

Desirable: Awareness of laser-specific hazards (training provided). An affinity with materials or CAD/design work would be useful. Computational skills including programming or familiarity with scientific software.

Skills gained: The Scholar will gain invaluable early experience as a scientific researcher in an authentic setting. The tasks will evidence the candidate's capacity to review the literature, learn and apply core scientific principles, and to exercise strong problem-solving abilities. The Scholar will have the opportunity to develop proficiency in scientific software. Given sufficient progress, the candidate will also benefit professionally through presentation and written dissemination of their findings. The placement will build confidence with future employers (or future MSc/MEng/PhD supervisors) seeking industry, practical engineering skills and lateral thinking.

Supervisor: Alex Hargreaves (with Steven Quinn in the Physics of Life Group)
alex.hargreaves@york.ac.uk (alternatively steven.quinn@york.ac.uk
Dates: 16 July - 23 August 2019

UY4: Binding Blocks: Medical Nuclear Physics

Binding Blocks is a Nuclear Physics programme for school students. As part of this programme, we are developing a series of workshops for Nuclear Masterclasses that take place around the county for sixth-form students (years 12 and 13). This internship focusses on the development of these workshops, with particular emphasis on the applications of Nuclear Physics in medicine. As part of the internship, you will attend at least one Nuclear Masterclasses and assist in the delivery of the event. You will then develop an existing computer model of proton-beam therapy (in the computer package Geant4), with the opportunity to take the internship in a range of different directions depending on your interests. This could include: investigating and modelling different aspects of medical physics; producing resources for teachers; producing follow-up activities that school students can complete at home; developing the resource to make is accessible for year 10 students (as well as year 12 students). Please note that programming will be required to develop this computer model.

In addition, you will also assist in supervising A-level students who will be in the department for 4-week long Nuffield Research Projects. Working with an academic supervisor, you will support these students with their coding and their knowledge of Nuclear Physics.

Further information about the Binding Blocks programme is available at: york.ac.uk/physics/bindingblocks

You should be a motivated self-starter who is able to work well both independently and as part of a team. Good communication skills are important, and you must be able to explain complex ideas clearly in both written and verbal contexts. An interest in coding is essential: knowledge of C++ would be an advantage, but training can be provided on this language as needed.

Through the internship, you will gain experience of programming in C++, computer modelling, and project management. You will also develop your communication and leadership skills.

This would be excellent opportunity for someone interested in pursuing careers in medical or nuclear physics, or for those looking to apply their physics knowledge in educational contexts (including teaching and outreach work).

Supervisor: Christian Diget / Katherine Leech
christian.diget@york.ac.uk / katherine.leech@york.ac.uk

Dates: By mutual agreement

OUTREACH

THE UNIVERSITY of EDINBURGH

O-EDI: Developing Physics Wizardry Outreach

The intern will join the local Ogden Outreach Officer in developing a series of wizardry-themed Physics Outreach activities to bring to schools (targeting P6, P7, S1 and S2 school stages).

A one-hour workshop highlighting the science behind potions, developed as part of the “Harry Potter: A history of Magic” festival has turned out to be very popular in schools. Many schools have asked for a return visit, and it would be desirable to be able to offer follow-up activities, such as providing teachers with some potions-related activities they could deliver themselves, including a level of co-creation (the pupils are actively involved in the activities).

Activities to be done at home could be suggested. Ideally, some of these activities would be based on research conducted at the soft-matter physics research group (https://www.edinburghcomplexfluids.com/), where the Ogden Outreach Officer is co-hosted.

A “potion master certificate” could be delivered following an informal assessment, to be designed. These activities will be packaged by the intern in a way that would be easily and quickly usable by teachers and University students and staff willing to deliver it. Lastly, they would be publicised online by the intern.

Excellent communication skills (oral and written), organised and driven, with the ability to develop your own ideas as part of a team. Some knowledge of soft-matter physics and Harry Potter is highly desirable. Knowledge of the Scottish Curriculum for Excellence and the Scottish school system would be a plus but is not necessary.

Ideal placement to gain experiences in science communication (in particular activities design), school curricula and lesson planning, editing and graphic design, working in the Higher Education sector. The intern will also gain a greater understanding of soft-matter physics and research.

Supervisor: Dr Jean-Christophe Denis
J.C.Denis@ed.ac.uk

Dates: by mutual agreement, preferably around June

O-KEN1: Science Outreach Internship

This internship will be a hands-on introduction to science outreach at the University of Kent. The intern will be working with the School of Physical Sciences outreach team, primarily with the Ogden Outreach Officer. They will help with the organisation and running of two residential weekends, including the 20th anniversary Space School, and other outreach events.

We're looking for a student who could potentially bring new and exciting ideas to help create and develop new workshops alongside the team. The outreach team cover physics, forensics and chemistry, with the chance to work in all 3 disciplines over the internship.

The skills gained from outreach are becoming more important to employers and the intern will be able to play to their strengths at the same time as learning new skills. All activities will be fully supported. The intern will meet people from different scientific disciplines and backgrounds and will be exposed to different areas of science.

Skills required: Enthusiasm

Skills gained: Verbal communication, Written Communication, Organisation, experience developing workshops, public speaking

Supervisor's name: Hannah Tonry - h.l.tonry@kent.ac.uk **Dates:** 24th June – 4th August 2019

O-LU: Art of Isolation – Royal Society Summer Science Exhibition

We are looking for an enthusiastic, passionate student with great communication skills to work on a major outreach project in the Physics Department at Lancaster University. We are exhibiting at the Royal Society Summer Science Exhibition 2019 showcasing the incredible research taking place in one of the most advanced labs in the world, IsoLab. At the Art of Isolation exhibit we will introduce audiences to the weird and wonderful worlds of quantum mechanics and nanotechnology providing an opportunity to explore the concepts of 'noise' and 'isolation' in scientific measurement. Guided by researchers from Lancaster University, attendees will be able to learn about exciting research that will influence our day-to-day lives with accessible and interactive demonstrations.

The successful intern will work on preparing digital material, interactive games, and exhibits for the stand before joining the team to share this research with an audience of 14,000 at the Royal Society buildings in London from 1-7th July. Post event, you will help to continue engagement via producing online content, analysing the audiences reached during the event and helping to keep contact with key groups, e.g. schools, teachers and other partners

Skills required/expected: A background in Physics, familiarity with quantum technology, nanotechnology or low temperature physics preferred but not required. Excellent communication skills, willingness to travel to London to exhibit at the outreach event, good analytical and design skills.

Skills gained: The student will get the opportunity to contribute to one of the world's largest scientific festivals held by the UK's most prestigious scientific organisation, providing them with a fantastic opportunity to learn more about engagement and scientific communication.

Date: 1-week major event from 1-7th July

Supervisor's name: Dr. Samuel Jarvis -Samuel.Jarvis@lancaster.ac.uk

UNIVERSITY OF LEEDS

O-LEE: Physics Outreach Intern(s)

The Physics Outreach Intern(s) will play an important role in the delivery of outreach events for the School of Physics and Astronomy in June and July 2018. The Year 11 residential Summer School and Year 12 Work Experience Week provide highly motivated students with an aptitude for maths and physics the opportunity to take part in labs, workshops and lectures with the purpose of learning what it's like to study physics at University.

Experience: Leading a team, Planning projects and/or events, Teaching or instructing. Working with youth aged 13-18.

Skills: Excellent oral and written communication skills and interpersonal and organisational skills, Proven leadership, supervisory, and problem-solving skills, Aptitude for development and coaching, Demonstrated conflict resolution skills, Comfortable working in an unpredictable and often stressful environment, independently and as part of a team of diverse individuals, Assertiveness, tact, sensitivity, initiative, flexibility, and enthusiasm, Familiarity with the buildings and labs at the University of Leeds, Well-developed computer skills (Microsoft Office, Google Drive, etc.), Aptitude for teaching and engaging with young people.

Other: Highly desirable that they are a fully licensed driver, Must pass a DBS check

Duties and responsibilities:

They will assist and support the Physics Outreach Officer in the development and delivery of the Physics Outreach Program primarily focused on the Physics Summer School (10-12 July) and the Work Experience Week (16-20 July), but could also include general outreach visits to schools during their placement.

They will assist in coordinating the daily activities, materials and equipment for the outreach programs.

They will work with the Physics Outreach Officer to ensure that all deliverables are met on time and in advance of the deadlines.

They will work with the Physics Outreach Officer to ensure that all purchasing and reporting priorities are completed on time and in advance of the deadlines.

They will work collaboratively with the Physics Outreach Officer in regards of the admission process, operations and logistics of the summer programs.

As part of the Senior Team, they will help to manage the day and evening student hosts, directing work as appropriate, and assisting with their training.

Supervisor: Erin McNeill - E.McNeill@leeds.ac.uk

Dates: by mutual agreement

www.stem.leeds.ac.uk/physics

O-NOR: Physics Outreach Summer Assistant

The Ogden Physics Outreach Assistant Summer Intern will involve supporting a range of physics driven outreach events targeted mainly at secondary school students and their teachers under the supervision of the Ogden Science Officer based at Northumbria University. The Intern will actively be engaged in planning and supporting delivery of activities in a range of diverse events such as the School Physicist of The Year Awards, Physics days in the University, as well as an Industrial visit under the Connect Physics programme targeted a female student keen on physics.

Examples of duties include, but are not limited to, management of data, evaluation form collection, simple data processing, brochures / postcards design and designing and delivering a short outreach activity.

NUSTEM is a university group aimed at encouraging more young people, particularly females and other under-represented groups, to choose physical sciences, technology or engineering as a career. The project works closely with the young people themselves and also their families and teachers (key influencers) to highlight the wide range of career paths and real-world applications of science, technology and engineering. To find out more about the group please visit nustem.uk

Students will have a physics background and good communication skills. They should be able to explain physics/science ideas to others and be able to develop practical resources to support their explanation. They should also be comfortable using software packages such as Excel and PowerPoint and a creative flare would be beneficial. Importantly, they will have enthusiasm and a genuine commitment to deliver positive results to young people

Awareness of their science communication skills through outreach activities.

Enhancement of presentation, data analysis and creative thinking skills.

Further understanding of different career paths related to physics, in particular the areas of teaching, academic research and science communication.

Salary

£300 per week paid at the end of the internship.

http://chrisnorth.github.io/classroom-rocket-scientist

Supervisor: Dr Antonio Portas - egomez@lco.global

Dates: by mutual agreement
http://lco.global/education/ - https://serol.lco.global

O-NOT Physics Outreach Assistant

You will be working with the outreach team (the outreach officer and 4 support staff) to develop, test, document and deliver outreach resources for primary and secondary audiences.

We have some tried and tested activities, but would we like to develop some new activities for primary with a fun / investigative element. Activities based on Physics toys and activities related to the moon are particularly relevant.

Skills required/expectations

An interest in outreach, Outgoing, flexible and adaptable. Practical and creative, Good record keeping. Some presentation skills (although this is an area you will have the opportunity to develop), Any experience of producing video/web blogging would be particularly valuable.

Skills gained

As well as gaining valuable experience in working both with colleagues and independently. You will gain experience of a Russell Group Universities outreach operation and an insight into the requirements of today's school pupils in terms of additional support with Physics based learning.

You will learn how to develop and evaluate resources and improve your communication and presentation skills, you will also learn how to plan deliver and assess activities as well as produce high quality documentation including risk assessments.

With the ever-increasing demand for STEM related learning, you will be in a position of first-hand experience of producing resources for this agenda whether in academia or industry where this is becoming increasingly important to meet the demand for STEM related professionals.

O-ROH: Exploring Physics Outreach and Public Engagement

This internship will be a hands-on crash course in Physics Outreach and Public Engagement. It will include going to school visits, hosting events at Royal Holloway and taking care of two summer residentials. There will also be the chance of co-creating specific educational activities.

This internship will be particularly suitable for students who are passionate about Physics and want to share their passion with a broader audience.

Skills gained through this include communication and presentation skills, organisation and project management skills, teaching and combining Physics/science with other disciplines and art.

Supervisor: Ms Anna Christodoulou - Anna.Christodoulou@rhul.ac.uk
Dates: July 2 – August 3

O-UCL: Physics on Wheels Development Officer and Summer School Liaison

The candidate for this project will gain valuable insight into Physics Outreach work at a World Leading Institution. The project is split into three distinct phases; first gaining experience as part of the team delivering a Widening Participation Summer School, the holder has the chance to be the main point of contact in supporting Phys Film Makers Non-Residential Program. The next stage is working with school's liaison officer to analyse data and create infographics that will allow others to quickly visualize the application and intake into the department. The third phase gives the intern the opportunity to develop new outreach material, evaluating the previous year's Physics on Wheels program, creating alternatives and improvements where needed. Finishing with drafting an application for future funding of the project to ensure its sustained growth. All these phases will be fully supported, and the intern will be able to play to their strengths at the same time as learning new skills and developing their career portfolio.

Skills required:

Data Handling: Ability to use Excel to sort and collate data, produce charts. Training will be given on Access/Database software if necessary to complete assignment.

Drafting Skills: Writing for a wide variety of audiences, including school pupils, teachers and fund holders.

Organisation: Ability to manage and coordinate activities, maintaining a tight schedule, supporting attendance at events.

Skills gained:

Communication with Students and Academics.
Initiative and Problem Solving when handling on the ground events.
Custom Relations & Service Experience
Creating Content with a strong educational Added Value.
Evaluating Projects and Learning
Creating Infographics for different audiences.

Many of these skills are key to a wide range of people-focused careers in marketing and project management, for IT-related Data Analytics, Supervisory roles, and inside educational like Teaching and Outreach.

CREATE YOUR OWN INTERNSHIP

CYOI: Create Your Own Internship/International Internship

Have you found the perfect summer work experience or research project but don't have the money to fund it? This year, the Ogden Trust is ring-fencing some of its internship budget for placements that you find yourself that relate to your degree, specialism, or future career plans.

These create your own internships will be funded on the same basis as the Ogden advertised placements - £60 per day for a maximum of 30 days during the summer. Internships located in central London will be paid at £70 per day, and there will not be any more supplements. The funds will be allocated on a competitive basis once all applications have been received – it is not currently possible to say exactly how many will be awarded. Funding for these internships is not available if the positions are paid or attract funding from another source.

Alumni may find placements or summer schools abroad during the break; these International Internships are not funded through an educational bursary. Instead, applicants can apply for a contribution of up to 50% of the travel costs, up to a maximum of £1,000.

You should apply for this funding using the same application form as the other internships. There is a space on the form for you to explain why the position you have secured will be useful to you, and to give the contact details of your host supervisor or organisation. The Ogden Trust will need to confirm the details and suitability of your placement.

Successful Create Your Own Internships applicants will be required to provide the same written work as the other interns. The terms of your payment will also be the same as other interns and will involve your host organisation signing a straight-forward Agreement to protect all three parties (you, them, us), and to complete a simple feedback form and a timesheet. Copies of all three are downloadable will be available on Flexigrant, so you can discuss this with your potential host organisation.

The closing date for these internships is later than the other ones, International Internship applications will be considered within three weeks of their submission and the applications for Create Your Own Internships will not be considered until after the closing date, which is **Sunday 14 April 2019.**