Dalton Cumbrian Facility
Paid Summer Research Placements

Start date: From June 2022 (dates negotiable) **Duration:** 4 -13 weeks, by agreement

Location: Dalton Cumbrian Facility (DCF), Westlakes Science Park. Those taking up the placements will have an opportunity to engage in using our world-leading radiation equipment and purpose-built facilities situated in the exceptionally scenic West Cumbrian countryside. This is a stunning and special environment in which to work, with a low cost of living and easy access to the coast and Lake District National Park.

General requirements:

- Applicants should be studying a STEM subject at University or recently graduated from the same and also be eligible to work in the UK. A-Level students may be considered in exceptional cases.
- Good laboratory/computer and analytical thinking skills.
- Patience, dedication, time management skills and the ability to work under one's own initiative.
- Effective communication skills and the ability to work as part of a team.

Salary: The successful candidate will be paid £9.90 per hour based on a 35-hour working week. Depending on candidate's circumstances we might also be able to offer a subsidy towards the cost of accommodation – Summergrove Halls is within easy walking distance of the laboratory.

How to apply: To apply, please send a current CV (2 pages max), a list of the projects you wish to apply for in order of preference, your preferred start and finish dates, and a single paragraph outlining what qualities you have which will make you particularly successful in your time with us.

Applications should be sent by email to dcfreception@manchester.ac.uk with the subject header <Summer Placements> for consideration by 5pm Tuesday 7th June 2022.

Shortlisted candidates will be invited to interview in mid-June, dates can be flexible to accommodate exams and other commitments. Interviews may be in person at the Dalton Cumbrian Facility or via an appropriate digital platform, e.g. Zoom or Teams.

As an equal opportunities employer we welcome applicants from all sections of the community regardless of age, sex, gender (or gender identity), ethnicity, disability, sexual orientation and transgender status. All appointments are made on merit.

If you have any questions please contact dcfreception@manchester.ac.uk or visit our website www.dalton.manchester.ac.uk/dcf

Dalton Cumbrian Facility
Paid Summer Research Placements

Projects Available:

1. Automated control of radiation driven processes (up to 2 posts)

Summary: When conducting research involving radiation beams, practically a considerable amount of time is used changing samples or doing other pre/post-irradiation processing steps. For radiation safety reasons the samples are in an interlocked room which researchers enter/leave through a time-consuming search process. In order to over-come this limitation in a flexible manner, we wish to develop a number of low-cost, interchangeable sample control components such as syringe pumps, sample carrousels, movable sample stages etc. Examples of these components can be found in [aip.scitation.org/doi/full/10.1063/1.4914054]. The successful candidate(s) will be involved in designing some of these elements, possibly 3D printing the sub-assemblies which are not commercially available. Control software and interfaces will be developed with the goal being to provide a user-friendly library for the components developed for future researchers. Experience of Arduino programming, the CAN bus standard and python programming will be an advantage in this project.

2. Infrared imaging of samples

Summary: This is an Optics project, well suited to a Physics student. The aim is to design and build an infra-red imaging system for the radiation hotcell we have at DCF for high dose radiation damage experiments for materials relevant to next generation nuclear power plants. The irradiations have to be done at elevated temperatures, to replicate the temperature conditions the materials will have to function at in service. To determine and control the sample temperature an infra-red camera is used, however the high radiation fields generated during ion beam irradiation mean that the sensitive camera must be mounted outside the hotcell and view the sample though a magnifying periscope and IR transport system. The project will be to design the infra-red imaging system based around standard optical components and the physical constraints of the hotcell. Once the optical design has been signed off by our team, the candidate will procure the relevant optical components and assemble and test the resulting optical system in the hotcell. As the sample stage to be imaged is due to be replaced this summer, there will also be an opportunity to work alongside the DCF accelerator technical team in fitting and commissioning the new sample handling stage as well.

3. Long working length visible microscope for in-situ measurement

Summary: This is an Optics project, well suited to a Physics student. The aim is to design and build a visible microscope and associated sample cell for use in a radiation cabinet. This microscope will then be used to capture real-time images of radiation damage and corrosion processes relevant to nuclear fuel pin crack initiation. The sample will need to be in an intense radiation field which would damage the optical components of the microscope. Therefore, the optical arrangement will need to have a long working distance and possibly radiation shielding. Once the optical design has been signed off by our team, the candidate will procure the relevant optical components and assemble and test the resulting optical system in our cabinet irradiator. There will also be an opportunity to work alongside the gamma/X-ray irradiation technical team in fitting and commissioning the new microscope and sample cell.

4. X-ray detection using 2D materials (up to two posts)

Summary:

The aim of this project is to investigate the use of 2D material-based devices, produced from corresponding inks, for the detection of X-rays. The project will focus on the sensing proof-of-concept, which is capacitive. This project will initiate the development of a conceptually novel sensor for X-ray detection, fabricated with low costs techniques and on cheap and flexible substrates. The research will include: (1) 2D-material ink production and fabrication of prototype sensors; (2) gamma and X-ray irradiations of the printed devices, in combination with in situ monitoring of the changing impedance; (3) development of a LabView routine, aimed at gating and synchronisation of the X-ray exposure and electric measurements with LCR meter; (4) determination of the overall robustness, radiation hardness, and sensitivity of prepared sensors; (5) characterisation of produced defects in irradiated samples; (6) development of effective encapsulation of the electrodes. The project is complex in nature and requires a diverse skillset available in research team. We offer two positions, well suited for candidates with background in Physics, Electrical Engineering or Physical Chemistry. The successful applicant will be able to demonstrate strong experimental skills and knowledge in impedance measurements using LCR meter and/or ability to develop and test LabView codes. Good knowledge and understanding of effects of ionising radiation on matter would be an advantage. By the end of the placement, successful candidate(s) will be expected to produce a brief report summarising obtained results and derived conclusions.

5. Tracking Radioactive Decay of a multi-isotope inventory.

Summary: At DCF, we have the capability to transmute elements to make short-lived radioisotopes of medical interest using protons or alpha particles. We are currently developing the necessary infrastructure to manufacture these isotopes and process them chemically towards making new nuclear medicines. As part of this infrastructure, we wish to create a software tool through which we can create records of the amounts of several isotopes which will be created during transmutation events and then track the activity as the isotopes decay. In some cases, the isotopes will decay down a short decay chain before forming stable isotopes. The software tool will need to access a database of the possible transmutations and produce reports of the predicted radioisotope inventory at any time with a simple and convenient user interface. An important aspect of the project will be providing well documented validation, which will be achieved through testing again a set of known scenarios. This project would be well suited to someone with a computer science/programming background with instruction being given in the relevant physics of radioactive decay if necessary.