Title	**Sustainable Uranium production and processing**
Lead academic	Zara Hodgson
Additional academic leadership	Clint Sharrad, David Mills

Description

The global uptake of nuclear technology, as a clean and reliable energy source, and the growing interest in advanced fuels (with higher Uranium-235 enrichment levels of up to 19.75%) places an increased demand for uranium. This demand sets us the technological challenge of developing uranium production processes that are fit for the 21st century, ie sustainable, scale-able, commercial, and enabling of advanced nuclear technology. Sustainable uranium production is critical to the future of nuclear energy and rich with opportunities for innovation.

In the UK, investments in Conversion and Enrichment are being prioritised for resilient uranium supply to international utilities and to enable the deployment of advanced reactors, such as the X Energy Xe-100 system being proposed for Hartlepool; public and private investments likely over £1billion to fund design and build of new uranium production facilities in the North West of England. Advanced fuels need uranium at higher U-235 enrichment and in different forms – not just solid oxide. We are interested in development, design and operation of these advanced processing facilities, where the fellow will develop expertise in chemical process design, nuclear material safety and safeguards, and isotopic separations. Also, the UK has an inventory of uranium recovered from historic spent fuel reprocessing operations, which could be treated and returned to use in nuclear fuel; we are interested in increasing the sustainability of the uranium and fuel supply chain potential through reusing this uranium.

This fellowship is co-funded by the BNFL Endowment from the Dalton Nuclear Institute and will provide opportunities to collaborate with industrial partners and the nuclear industry.

Title	**Community regeneration and social value associated with nuclear projects**
Lead academic	Sasha Wynn Davies
Additional academic leadership	

Description

Civil and defence nuclear are undergoing a renaissance with increasing new nuclear build project development. Of particular interest to the Dalton Nuclear Institute is the role of emerging new nuclear technologies (i.e. Small Modular Reactors {SMRs}; other Advanced Nuclear Technologies {ANTs}) that are and will be entering the UK market, primarily to ensure that the UK has a sustainable, safe, secure and affordable domestic energy source. In order to enable delivery of expanded new nuclear build across the UK, there has been a number of recent key UK policy framework changes,

namely the UK's Nuclear Regulatory Reform (i.e. The Fingleton review), the National Policy Statement for nuclear energy generation (EN-7), the Civil Nuclear Roadmap to 2050, Government financing and ownership reforms, and the creation of Great British Energy.

Set within the UK's new nuclear policy framework and a better societal and business acceptability of what social value is, the development and deployment of new nuclear technologies can be a (if not the) key pillar of community regeneration in either an existing or new nuclear host community. However, therein lies many community, nuclear developer and operator challenges over the typical 60 to 100 year lifetime of the nuclear build project as part of the 'host community'. Communities must be listened to, included and a mutually sustainable trusting relationship developed during construction, operation and decommissioning stages. Clear, effective, impactful community regeneration benefits must be developed and agreed upon with 'host communities'. Quality local/regional jobs, skills development and economic growth must be an integral part of how nuclear projects can positively, from a socio-economic perspective, transform some of the most economically deprived communities in the UK. However, as the UK 'nuclear renaissance' matures, SMRs and other ANTs will provide additional societal challenges with the potential for siting within host communities new to nuclear that may be closer to urban and /or industrial areas. So what will the community regeneration and social value associated with these types of nuclear developments need to look like?

A fellow exploring this topic area will require the interest, passion and foresight needed to research community regeneration and social value associated to new nuclear projects across the UK, potentially drawing on comparators from specific regions within the UK and across the world. This is a fascinating and important area of research leading to improved understanding that could help shape the future of the societal impact of new nuclear in the UK.

Title	**Digital Technologies for Nuclear Safety and Regulation**
Lead academic	Andrew Sherry
Additional academic leadership	

Description

Rapid advances in digital technologies including data centric engineering, data science, machine learning, and artificial intelligence offer a major opportunity to transform how nuclear safety and regulation are conceived, delivered, and assured across civil, defence, and decommissioning programmes. Applied responsibly, within appropriate guidelines and by suitably qualified and experienced personnel, these approaches have the potential to strengthen confidence in safety cases, enhance regulatory effectiveness, and accelerate the safe deployment of nuclear technologies.

At the same time, the sector faces increasing pressure to deliver complex nuclear programmes at pace while maintaining the highest standards of safety, security, and public trust. The speed of digital innovation, coupled with the growing scale and pace of nuclear activities across the full lifecycle, creates a strong case for ambitious, evidence-based research that rethinks established practices. This need is reinforced by the 2025 Fingleton Report's call for a "radical reset" of the UK's nuclear regulatory landscape including Recommendation 41 on establishing a nuclear digital programme to accelerate the take up of digital technologies, including AI, as tools for experts to modernise approaches to whole-life safety and regulation.

In response, the University of Manchester's Dalton Nuclear Institute is supporting a new research fellowship to establish a pioneering programme of research in digital technologies for nuclear safety and regulation. Working closely across the Dalton Nuclear Institute's leading academic capability, industrial and regulatory partners, the fellowship will help shape an emerging field of national and international importance.

The research could be relevant to any aspects of the nuclear lifecycle, from fission and fusion reactor design, advanced materials and manufacturing, and plant operations, through to life extension, decommissioning, and waste management. Importantly, there will be flexibility in the specific area of focus, allowing the fellowship's research agenda to be shaped by the successful candidate's background, expertise, and long-term vision, while aligning with the overarching goal of advancing nuclear safety and regulation through digital innovation.

Title	**Critical Material/Radionuclide recovery and recycle**
Lead academic	Clint Sharrad
Additional academic leadership	Robin Taylor

Description

The recovery and recycle of critical materials and radionuclides from various nuclear feeds and streams has generated recent significant interest across the nuclear sector motivated by the needs of enhancing the security of supply of such valuable materials, and elevating the financial and environmental sustainability of nuclear energy generation. Spent nuclear fuel, for instance, contains a wide variety of elements/isotopes that are highly valuable not just in recycled nuclear fuel for fission but also in general applications such as catalysis (e.g. platinum group elements), electronics (e.g. rare earth elements) and medicine (e.g. medical isotopes like ^{137}Cs and ^{106}Ru). Feeds of interest from various stages of the fission and fusion fuel cycles can be considered in this exciting area of research that cuts across various disciplines. Key challenges include developing recovery processes that are economically viable and sufficiently flexible to accommodate variable feed compositions, and ensuring the delivery of product elements/isotopes to a sufficient purity for its intended (re)purpose. A variety of process operations can be considered

across the likes of ion-exchange, liquid-liquid extraction, electrodeposition and precipitation using aqueous and non-aqueous media (e.g. organic solvents, molten salts). Research in this area offers opportunities to work across a range of projects from advancing fundamental scientific understanding to directly supporting industry needs. Therefore, this theme offers the fellow the ability formulate a research vision from a wide canvas of possibilities directed by the candidate's background and expertise, and we encourage candidates to consider the wider network of expertise and capabilities likely to be needed to successfully deliver research in this field.

Title	**Future energy systems integrating nuclear with renewable technologies**
Lead academic	Laurence Stamford
Additional academic leadership	

Description

Under current policies and targets, UK electricity generation should be broadly decarbonised in the 2030s, with many developed economies following a similar timeline. Much of this is being achieved via renewable capacity deployment, which accounted for >90% of total global power installations in 2024, predominantly using solar PV and wind power. Consequently, existing and new nuclear plants will function within grids dominated not by thermal capacity but by variable output renewable generation. The integration of nuclear power – traditionally a baseload technology – with this new grid paradigm is a key technical challenge in the UK and abroad. Challenge areas include methods to enable modulation of nuclear power output, storage technologies, use of AI and data-driven models for grid integration, power network infrastructure technologies, and optimisation, among others. The wider systems planning approach for low-carbon energy is identified as a challenge area of particular interest, as current approaches can be considered piecemeal or neglect nuclear energy (heat and electricity) entirely. Consideration of technoeconomic, social and/or environmental issues is encouraged where applicable, with reference to GW scale, SMRs, AMRs and the flexibility offered by some designs for load-following and/or grid balancing.

Title	**Nuclear generated heat, storage and distribution networks**
Lead academic	Laurence Stamford
Additional academic leadership	

Description

Global demand for heat is approximately double that for electricity, yet the majority of low-carbon energy technologies generate only electricity. Nuclear is a key exception to this, providing ***a)*** an abundant resource of 'waste' heat up to ~300°C from existing reactor types, and ***b)*** the potential for higher temperature provision from reactor

designs such as HTGRs. These resources are currently underdeployed due to technical, economic and social barriers. Interdisciplinary research is therefore encouraged to enable broader innovation, where possible. Heat use cases of interest in this theme include space and water heating, heat networks, industry-focused high temperature applications, hydrogen production and heat-assisted negative emission technologies. The ability to store heat via multiple media (e.g. molten salts, latent and sensible heat storage materials) is also of interest, potentially including opportunities for such heat stores to interact with the wider decarbonising economy.

Title	**Nuclear Data**
Lead academic	Gavin Smith
Additional academic leadership	

Description

The Nuclear Physics Group at the University of Manchester is seeking a highly motivated Research Fellow to contribute to a broad programme of nuclear data research supporting industrial energy applications in both fusion and fission. The postholder will join an established team whose work underpins major international nuclear databases and informs the safe and efficient operation of current and future nuclear technologies.

The Fellow will play a key role in experimental and analytical studies of fission yields, neutron-induced reactions, scattering and transfer-induced fission. A central component of the role involves contributing to high-accuracy measurements of neutron cross-sections and fission fragment properties, feeding directly into internationally recognised evaluation efforts such as the JEFF nuclear data library. The researcher will engage with experiments at world-leading facilities including CERN's n_TOF and Isolde Solenoidal Spectrometer (ISS), the ILL High-Flux Reactor, as well as partner laboratories in the USA.

The group has a strong track record in the development of instrumentation, including advanced full detector systems such as STEFF (Spectrometer for Exotic Fission Fragments) and systems for transfer-induced fission at the Argonne National Laboratory and ISS. The successful applicant will have extensive experience in the development and deployment of nuclear radiation detectors, as well as the processing and analysis of large sets of experimental nuclear data. The research will improve the current understanding of fission and neutron-induced reaction processes, as well as providing valuable benchmarking data for industrial applications.

Title	**Fission and fusion fuels**
Lead academic	Joel Turner & Phil Edmondson

Additional academic leadership	

Description

The nuclear fuels group at Manchester explores all aspects of fission fuels on the pellet scale. Work in this the current group is typically based on the materials science of uranic compounds, but could extend to transuranic materials or modelling and simulation of materials or fuel systems. Existing capability in the Henry Royce fuels labs includes the ability to manufacture, characterise and test uranium compounds on the pellet scale. It includes advanced manufacturing technologies (SPS, HIP, FAST), state-of-the-art characterisation (SEM, FIB, TEM, Raman, XRD) and testing facilities (steam exposure, autoclaves, high-temperature thermal analysis). The use of these facilities to advance the UK's nuclear missions in the civil and defence areas through a greater understanding of current fuel behaviour, advanced or accident tolerant fuels and fuels for Generation IV reactor concepts (TRISO) are all areas of potential interest.

The Tritium Research Group undertakes a comprehensive programme of research spanning key aspects of the fusion fuel cycle. Core activities include tritium recovery from breeding materials and metallic waste streams, the investigation of permeation and retention in structural materials, the development of advanced tritium barrier coatings, and the design and optimisation of breeder blanket systems. The group also addresses challenges associated with tritium inventory accumulation and management within future fusion power plants. These research areas are explored through a combination of experimental and modelling approaches, enabling fundamental understanding alongside application-driven innovation leveraging unique capabilities at the University of Manchester, complemented by strong collaborations with partners such as UKAEA. Experimental facilities include a low-energy deuterium ion exposure system and a high-temperature, gas-driven permeation rig, providing essential platforms for studying hydrogen isotope behaviour under relevant conditions. In addition to these core areas, there is a particular focus on the development of hydrogen isotope separation technologies and advanced tritium detection and monitoring systems. These efforts are critical to supporting safe, efficient, and economically viable fusion fuel cycle operation.

Title	**Metallurgy, and materials performance and manufacture, for the nuclear sector**
Lead academic	Dirk Engelberg
Additional academic leadership	Phil Frankel

Description

We have world-leading research programmes and expertise focusing on the performance and manufacture of materials for a wide range of demanding nuclear environments, contributing to both fundamental understanding and engineering

applications. Our key areas of research include structural materials (e.g. concrete in buildings and storage facilities; steels in reactor pressure vessels), in-reactor materials across fuel cladding, piping, and cooling circuits, and the storage and disposal of nuclear materials and products.

Manchester hosts Europe's largest and most integrated nuclear materials research activities with research spanning across metallurgy/microstructural design exploring the evolution of steels, zirconium, and advanced alloy systems, to materials degradation looking at irradiation damage, thermal ageing, creep, and environmental fatigue. Research interests also include corrosion and environmentally assisted cracking, focusing on stress corrosion cracking, high-temperature oxidation and hydrogen effects. Manufacturing, processing and inspection routes are further key interests, with coverage across welding, additive manufacturing, monitoring, inspection, and protocols for qualification of nuclear-grade components. We span the full range of experimental characterisation, simulation and modelling leading to, for example, integrity assessment and predictions for investigating materials degradation mechanisms across multiple length scales.

The University has access to world-class capabilities, including advanced microscopy, mechanical testing facilities, degradation suites, corrosion laboratories, and strong links to national and international research infrastructures.

Candidates may align with, or complement, existing strengths such as:

- Materials for advanced fission, fusion, and SMR technologies,
- Lifetime prediction and structural integrity of nuclear components,
- Advanced nuclear fuel cladding, irradiation effects, and modelling/simulation,
- Coupled degradation processes, such as corrosion–mechanical interactions,
- Impact of manufacturing processes on long-term integrity and performance,
- Materials for nuclear waste containment and decommissioning,
- Inspection, monitoring, and nuclear component verification routines.

Title	**Actinide Analysis and Spectroscopy**
Lead academic	Louise Natrajan
Additional academic leadership	Kath Morris, Clint Sharrad

Description

This industry fellowship is joint funded with AWE and will form part of the Actinides Centre of Excellence. Further details on this fellowship will be provided in a dedicated advertisement.

The focus of this fellowship is to develop advanced analytical and spectroscopic techniques, and methodologies for both solution and solid state samples that will support the future growth of the nuclear sector. This can be addressed by, for example, the application of innovative and highly sensitive analytical and

spectroscopic techniques for nuclear systems with an emphasis on plutonium, the development of bespoke chemical/isotope separations approaches to improve spectroscopic and radiometric measurements, the application of selective “dyes” that are compatible with nuclear systems to enhance spectroscopic responses and developing techniques for on-line and real time monitoring.

Techniques of interest include (but are not limited to) the following:

- Mass spectroscopy techniques
- ICP techniques (e.g. ICP-MS and ICP-OES)
- Radiometric techniques such as gamma spectroscopy and liquid scintillation counting
- Spectroscopic methods (UV/Vis, Raman, IR, luminescence)
- X-ray techniques (e.g. XRD, XPS, XCT)
- S/TEM imaging
- Laser-based approaches (e.g. LIBS)

Exploring the integration of these techniques with containment systems (e.g. gloveboxes) and novel sampling approaches (e.g. microfluidic devices), and the development of novel on-line and real-time process monitoring approaches with associated data processing methods will be encouraged. It is expected that multidisciplinary interests will emerge from these activities and this research fellow will develop new collaborations across experimental and computational pursuits.