Institution: The University of Huddersfield

Unit of Assessment: 9 Physics

a. Overview

Physics was introduced at the University of Huddersfield in September 2008 with the appointment of Professor Cywinski as part of a five-year strategic plan to broaden and deepen the University research base. With major University investment, and under Cywinski's leadership, the Physics UoA has grown to 13 academics, all of whom are returned here as Category A staff. The staff are located in the two Schools (ie Faculties) of Applied Sciences, and Computing and Engineering. Research focuses in two specific areas, Applied Accelerator Science and Condensed Matter and Materials Physics, with significant collaboration and overlap between the two areas.

Staff have published over 550 refereed journal papers, 134 of which were published in high impact journals (eg PRL, Nature Materials, ACS Nano). A further 74 papers have been published in the Particle Accelerator Conference Series. Almost £3M has been awarded by external bodies to support research with £1.4M spent in the assessment period. A further £744K worth of instrument time has been secured at major national and international facilities (ISIS, ILL and PSI). The International Institute for Accelerator Applications has been established, and two major accelerator facilities, MIAMI and MEIS, with a total value of ~£10M, are now operational. The University has invested over £2M in physics laboratories and infrastructure alone.

All research is focused on global grand challenges. The UoA interacts strongly with national and international centres of excellence, policymakers, the public and media, whilst industrial collaborations are exemplified by the Official Technology Partner status awarded by Siemens.

Highlights during the assessment period include:

- developing and demonstrating the world's first ns-FFAG particle accelerator
- results from BaBar and LHCb, contributions to the DAEdALUS collaboration
- experimental proof of time reversal symmetry breaking in superconductors
- co-development of a proposal for a triple-beam accelerator facility (TRITON) for nuclear materials research submitted to Cabinet Office in September 2013
- influencing policy on the deployment of thorium as a cleaner alternative nuclear fuel
- a four month Science Museum Antenna Gallery exhibition of our research in accelerator driven nuclear power and nuclear waste management.

b. Research strategy

(i) Current position: Following RAE2008 a University-wide strategy has focused upon establishing Huddersfield as an internationally recognised, research-led institution. Substantial investments have been made in research infrastructure, a "world-class professor" scheme and University Senior Research Fellows. Guided by the University's strategy, Physics was introduced as a research discipline in late 2008 with the explicit aim of addressing specific global grand challenges (e.g. Energy, Healthcare Technology and Manufacturing the Future), with particular emphasis on energy generation, nuclear waste management, medical diagnostics and therapy, and advanced materials. As a result, there is now a vibrant physics research portfolio with a focus on two specific areas: Accelerator Applications (AA) and Condensed Matter and Materials Physics (CMMP). We have a staff of 7 professors, 2 senior lecturers, a senior research fellow, 3 early career research fellows, 3 postdoctoral researchers, 13 PhD students, an MSc student, a support technician and 3 international visiting professors (from Fermilab, University of British Columbia and Siemens). We also host 2 PhD students, from Oxford and Manchester, who are carrying out experimental work in our laboratories and we co-supervise 3 students from MIT. There is significant overlap, synergy and collaboration between AA and CMMP, with several researchers belonging to both groups either working in the application of accelerators in materials research, or on the materials-related problems in novel accelerator design. The research portfolios of AA and CMMP are detailed below.

Accelerator Applications: *Barlow (Group Leader), Bailey, Bungau, Cywinski, Edgecock, Hinks, Seviour, van den Berg, Ward, and visiting Professors Johnstone and Beasley*

The International Institute for Accelerator Applications (IIAA) is a focus for accelerator-based

science and engineering research across the University under the Directorship of Professor Roger Barlow. This outward-facing multi-disciplinary Institute has developed strong collaborations with major international accelerator projects, facilities and laboratories (e.g. CERN, TRIUMF, J-PARC, ISIS, Fermilab, PSI, ESRF, ESS, Daresbury) at the design, development, utilisation and advisory levels, and with industry (e.g. Siemens, Bartoszek Engineering, PAC and PAC(UK)). IIAA's focus on accelerator applications is unique in the UK and provides a direct two-way conduit for knowledge transfer between accelerator design and utilisation, in keeping with the University's and Institute's strategic goals.

AA, within IIAA, carry out experimental accelerator research and simulations in their own extensive laboratories and through projects at international and UK facilities. AA's activities, all of which have appropriate financial and infrastructural support, include:

- RCUK/EPSRC-funded £7.5M CONFORM project, which built EMMA, the world's first non-scaling Fixed Field Alternating Gradient (FFAG) accelerator (led by Barlow)
- Installation of the £5M Medium Energy Ion Scattering Facility (MEIS), gifted to IIAA by STFC to be operated as a national facility for surface characterisation
- EPSRC-funded installation and operation of the Microscope and Ion Accelerator for Materials Investigations facility (MIAMI)
- EPSRC-funded development of accelerator-driven subcritical reactors (ADSRs) for exploitation of thorium nuclear fuel in energy generation and nuclear waste management
- Simulation of collimators at the Large Hadron Collider as a member of HiLumi FP7 project
- STFC-funded measurements of the mechanical properties of candidate materials for accelerator particle production targets, including for CERN and for Fermilab.
- STFC/CLASP-funded study of fertile-to-fissile thorium conversion using spallation neutrons
- STFC-funded project on a novel neutron target for $^{99\text{-m}}$Tc production for medical applications (with Manchester and Lancaster Universities)
- STFC-funded optimisation of muon and neutron production targets including ISIS and Fermilab targets
- Siemens-funded projects in: fast proton deflection for beam modulation (for medical applications); neutron production facilities for Boron Neutron Capture Therapy (BNCT); development of compact accelerator technologies for security applications; simulations of the low-energy proton production of medical isotopes
- ESS-funded research into RF sources for the European Spallation Source
- ESS-funded investigation of component activation at the accelerator target interface
- Exploration of compact powerful accelerators for proton and ion beam cancer therapy and radioisotope production with PAC (US and UK)

Condensed Matter and Materials Physics: *Kilcoyne (Group Leader), Bailey, Cywinski, Donnelly, Hinks, Jones, Sweeney, Seviour, van den Berg, and Visiting Professor Brewer*

CMMP researchers prepare and characterise materials of fundamental, technological and cultural significance, exploiting extensive in-house experimental facilities and internationally peer-reviewed x-ray, neutron and muon beam time to investigate the fundamental physics and/or to optimise the production, processing and functionality of the materials. Funded activities include:

- EPSRC-funded project on fundamentals of current and future uses of nuclear graphite (with Surrey, Leeds, Manchester, Salford and Nottingham)
- EPSRC-funded project on materials for fusion and fission power (with Oxford and Liverpool)
- EPSRC-funded project on Atomistic Scale Study of Radiation Effects in ABO_3 Perovskites (with Sheffield, Oxford and Imperial)
- EPSRC-funded project on Advanced Accident-Tolerant Ceramic Coatings for Zr-alloy Cladding (with a number of UK and US partners)
- EPSRC-funded "next generation user" muon and neutron studies of dynamics in spin glasses and spin fluctuating systems at ISIS and ILL
- DTRA-funded study on Ion Irradiation Effects in Graphene-Silicon Hybrid Devices (with Manchester)
- Studies of ion irradiation effects on semiconductors and nanostructured materials

- US Air Force-funded development of high-powered metamaterials with the USA MURI on 'Transformative Electromagnetic Media'
- KTP-funded development of new materials for engine turbine housings using neutron facilities at ILL and ISIS (with BorgWarner)
- Muon studies of time reversal symmetry breaking in unconventional superconductors at ISIS
- Neutron and synchrotron x-ray studies of biomaterials at ISIS, ILL and ESRF
- AHRC funded applications of CMMP techniques to materials of archaeological and cultural importance (with Mary Rose Museum, Royal Armouries, Bosworth Trust) at PSI and ILL

(ii) Vision and strategic plans: The first stage of establishing Physics as a discipline at Huddersfield has been achieved successfully in a short time, and the success of our strategy even at this early stage, is evidenced by our research outputs and our rapidly growing engagement with industry, policymakers, government agencies and politicians, the public and other academic institutions across the globe.

Our vision is to continue this strategic development and establish ourselves as an internationally recognised centre of excellence, delivering R&D in innovative accelerator technologies and applications and in advanced materials that are relevant to society and industry and fully aligned with the grand challenges defined by the UK and the EU. In so doing we are advised and informed by an international Science Advisory Committee (SAC) to evaluate progress and advise on the evolving research strategy. SAC met formally and in person for the first time in May 2013. With guidance from SAC we intend to:

(a) **become recognised internationally as a centre of excellence.** We have established two accelerator user facilities within IIAA (MIAMI and MEIS) and are in the process of commissioning in-house materials research facilities (see section d for details). Our partnership with Bruker has established the most advanced X-ray scattering laboratory in the UK. We will develop these facilities with MEIS becoming a national surface science facility for the UK, whilst MIAMI will be a focus for a range of international collaborative research programs. The CMMP laboratories will continue to be utilised both to underpin our programmes at international research facilities, and in our ever increasing collaborations with other world-wide institutions.

(b) **grow our research programmes and diversify our income** through targeted responses to Research Council, EU Horizon 2020, US, charity and industrial opportunities. Immediate specific aims in AA include: expanding our roles in the ESS project; formalising our involvement in the MYHRRA project; and leading the UK in building the first FFAG. In CMMP we are establishing programmes of commercial relevance in nuclear materials, engineering materials and characterisation of heritage artefacts.

(c) **increase our impact beyond academia.** Our SAC is to be extended to include industrial membership to ensure that we are delivering not only internationally recognised scientific excellence but also research with socio-economic impact. Our international Visiting Professors and industrial partners will also provide a continuing and independent perspective. Finally we are already engaging with the 3M Buckley Innovation Centre (3M-BIC http://hud.ac./n7), which provides a bridge between University expertise/facilities and regional companies.

(d) **continue to develop the next generation of physicists** to address the grand challenges by securing further external funding for PhD students, and encouraging and supporting our postdoctoral staff in applications for Fellowships (eg Research Council, Royal Society, Leverhulme, 1851 etc) or permanent positions in the University sector.

c. People, including:

(i) Staffing strategy and staff development: Whilst in the early stages of development Physics appointed research leaders at the Professorial level, with the professoriate being attracted from the Universities of Leeds (RC), Manchester (RJB), Lancaster (RS) and Salford (SED, SHK, JvdB). TRE was appointed as Professor jointly with STFC's Rutherford Appleton Laboratory. Having thus established a research leadership framework later appointments have been primarily at the ECR level. Future recruitment aims to increase junior staff (lecturers, readers and postdoctoral

researchers) initially linked to our two research groups, although in the longer term opportunities may arise to establish new but cognate areas of activity, particularly associated with interdisciplinary programmes.

Huddersfield has a comprehensive support and staff development scheme for all career stages. The seven principles of the Concordat, to which the University is a signatory, are implemented as a framework of good practice for the management of all researchers and their careers, including research-only employees on short contracts, part-time staff and all other research-active academic staff. Huddersfield holds a Human Resources (HR) Excellence in Research Award from the European Commission in recognition of its implementation of the Concordat. It also engages with many external organisations that support researchers, including Vitae and the European Commission's HR Strategy Group. We are signatories to the UKRC CEO Charter advancing gender equality in science, engineering and technology (WISE) and members of the Stonewall Diversity Champions Programme. Physics is an IOP Project Juno Supporter.

The University and Schools provide a researcher-centric environment within which staff can conduct academic research and achieve exceptional levels of career and personal development. In recent years several new initiatives have promoted attainment in research, and these will continue through strategy-related measures including the creation of internationally recognised research Institutes such as IIAA; the creation of the £12.4 million ERDF-funded 3M Buckley Innovation Centre; and the opening of a £2.6 million Researcher Hub, with state-of-the-art facilities available to all researchers for meetings, collaboration and private study.

All researchers are encouraged to engage internationally and visit international institutions. For example, Seviour was awarded a one-year fully funded visiting Lise Meitner Professorship for Distinguished Female Researchers at the University of Lund (Sweden) between July 2012 and July 2013, whilst also seconded to ESS in Lund during 2012.

Visiting Professorships are offered to exceptional individuals who collaborate in a significant way with University research staff to produce measurable outcomes. Within Physics there are three visiting professors: Carol Johnstone, Fermilab (US), inventor of the non-scaling fixed field alternating gradient principal; Jess Brewer, University of British Columbia (Canada), recipient of the Yamazaki Prize for μSR spectroscopy; initially Oliver Heid, Top Innovator, Siemens (Germany) held a visiting chair which has transferred to Paul Beasley, Head of Strategic Development at Siemens, UK. Researchers from other UK and International institutions also spend time at Huddersfield (eg Peggs, BNL, US).

(ii) Research students: Postgraduate education at Huddersfield is strongly supported, and we strive to maintain our substantial lead in the Postgraduate Research Experience Survey and continue to outperform the sector on every scale. There are currently over 1000 postgraduate research students (PGRs) at the University, with 13 allocated to physics. All our PGRs have been recruited from outside the University with undergraduate or Masters degrees from Cambridge, Lancaster, Manchester, Salford, or international Universities. All have been subject to personal interviews. Our PGRs are funded by an EPSRC-CDT, Siemens-STFC CASE and BorgWarner-KTP. One EPSRC PhD student has already graduated. PGRs are fully integrated into the research groups. They have access to powerful, high quality IT and computing facilities. They are encouraged and expected to attend and present at international conferences and workshops.

The EPSRC Centre for Doctoral Training in Next Generation Accelerators (with the universities of Strathclyde, Surrey and Queens, Belfast) supports students on a four-year course leading to a PhD, offering a wide portfolio of projects and courses across a range of accelerators and their applications, radiobiology and health physics. Students have quarterly intensive training schools with cohorts from the other universities. There is an emphasis on practical experience, using equipment at all four institutions. Students also spend extended study periods carrying out projects at major international facilities (e.g. CERN, PSI).

PGRs are members of the University's Graduate School (Dean: Cywinski), which provides generic support and training alongside more specialist support from academic supervisors and Schools. All PGRs are required to use web-based software to record the outcome of monthly supervision meetings. The University's Progress Monitoring Calendar sets milestones for each stage of the PhD, from the initial outline of the research programme, through annual formal assessments, to

submission of the thesis. The student's personal development is reviewed quarterly.

d. Income, infrastructure and facilities

Since the introduction of physics in 2008, researchers have been awarded almost £3M, primarily from UK Research Councils and the EU, with £1.4M spent in the assessment period, and a further £744K of internationally peer reviewed instrument time at major international neutron and muon beam facilities (ISIS, ILL and PSI) awarded through international peer review. Our strategy of developing a research base capable of addressing specific global grand challenges has led to our inclusion in several major national and international consortia, including:

- EUCARD and EUCARD2, a series of FP6 and FP7 Integrating Activities in the area of accelerator R&D, coordinated by CERN (*total budget €23.4M*)
- The EU FP7 Preparatory Phase Project for ESS (*total value €8M*)
- USA-AFOSR funded MURI: Transformational Electromagnetics (*total value $7.5M*)
- The STFC-funded Particle Accelerators for Science and Innovation project (*total value £2.7M*)
- The EPSRC-funded project: The Non Scaling Fixed Field Alternating Gradient (NS-FFAG) Accelerator, initially led by Manchester and then Huddersfield (*total value £7.5M)*
- The EPSRC-funded, Oxford-led project: Materials for fusion & fission power (*total value £5.8M*)
- The EPSRC-funded CDT consortium, with Belfast, Strathclyde and Surrey: Application of Next Generation Accelerators (*total value £1.9M*)
- The EPSRC-funded consortium, with Sussex, Manchester, Leeds and Nottingham: Fundamentals of current and future uses of nuclear graphite (*total £1.2M*)
- The EPSRC-funded consortium, with Sheffield, Oxford and Imperial, Atomistic Scale Study of Radiation Effects in ABO_3 Perovskites (*total value £2M*)

Physicists at Huddersfield have a substantial equipment base: STFC has gifted the £5M accelerator-based Medium Energy Ion Scattering (MEIS) facility to run as a central facility for UK scientists investigating the surface structure and properties of crystalline materials using ion beam probes. One of only two such facilities in Europe, MEIS is run by van den Berg and Bailey. The Microscope and Ion Accelerator for Materials Investigations facility (MIAMI) is an *in-situ* transmission electron microscope / ion accelerator facility. Led by Professor Steve Donnelly and unique in the UK, MIAMI is used to investigate the performance of materials to be used in building next-generation nuclear reactors, as well as to explore damage resulting from ion-implantation of semiconductors and to engineer nanostructured materials. The University has invested over £2M to provide purpose-built laboratories to create the IIAA, and MEIS and MIAMI facilities.

Siemens have donated a £0.5M Dresden EBIS-A ion source to the IIAA (as a Siemens Official Corporate Technology Partner) on extended loan. This is being developed to include a prototype fast deflector system for controlling hadron doses during radiotherapy.

We have also entered a partnership with Bruker which has established a UK-leading X-ray scattering facility which includes 2 single crystal diffractometers, a protein crystal diffractometer, 3 powder diffractometers and a small-angle X-ray scattering instrument. Bruker XRF equipment is also available to all researchers.

Since 2009 Cywinski, as Dean of Applied Sciences, and Donnelly as Dean of Computing and Engineering, have committed ~ £5.6M to the overall research infrastructure of the Schools with NMR, x-ray diffraction, X-ray tomography, electron microscopy (TEM, SEM, STEM, AFM, MFM), Focused Ion Beam system, laboratory refurbishments etc. These complement existing facilities for sample preparation, structural characterisation and magnetic measurements, vibrating sample magnetometer, AC susceptometer, Mössbauer spectrometers and access to the IBM dataplex high-performance computing facility at Daresbury via an STFC/UoH partnership.

e. Collaboration or contribution to the discipline or research base

Researchers have engaged in a range of activities in the wider physics arena during the REF period locally, nationally and internationally as shown below.

International research collaborations: Argonne National Lab., Australian Nuclear Science &

Technology Organization, Brookhaven National Lab., CERN, European Spallation Source, ESRF, FermiLab, HMI Berlin, Institut Laue Langevin, Los Alamos National Lab., Paul Scherrer Inst., SLAC, US AirForce Research Lab. Kirkland, Nanyang Technical University, National Institute Frascati, MIT, Pennsylvania State University, TU Delft, and the Universities of Colorado, Columbia, Helsinki, Lund, Michigan, Poitiers, Rey Juan Carlos Tennessee.

National research collaborations: ISIS, Cockcroft Institute, Daresbury Laboratory, Univ. of Belfast, Bristol, Cambridge, Imperial, Kent, Lancaster, Leeds, Liverpool, Manchester, Nottingham, Oxford, Queen Mary London, Salford, Sheffield, Strathclyde, Surrey, Sussex, UCL and Warwick, the Weinberg Foundation and the All Party Parliamentary Group on Thorium

Interdisciplinary research: Although most of our collaborations are physics-based, several researchers in physics engage in inter-disciplinary and multi-disciplinary research. Examples include: Edgecock's work on Boron Neutron Capture Therapy; Cywinski's medical radioisotope production; Kilcoyne's non-destructive materials characterisation of artefacts of cultural heritage, and neutron residual stress measurements on engineering components. Kilcoyne and Cywinski lead materials characterisation studies in the University's Arms and Armour Research Institute. Jones is applying physics-based techniques to fingerprint research in forensic science. To support key collaborations within the department, and with other institutions and industry, and for conference attendance, visiting collaborators, sabbatical visitors etc the University provides funding through the Research and Enterprise Directorate.

Industrial collaborations: Huddersfield has built a strong reputation on its engagement with industry in the UK and abroad. In Physics strong collaborative links exist with *Siemens, BorgWarner Bradford, Bruker, Westinghouse Electric Company, Phase Focus* and *Huddersfield Textile Centre*, with funding from either research councils or the TSB through the KTP scheme. The Innovation and Enterprise team is responsible for helping researchers engage with industry and business, identifying opportunities for commercialisation and supporting graduate student enterprise and start-up companies.

Additional facilities are also provided through the £12M ERDF-funded 3M Buckley Innovation Centre (3M-BIC), an exemplar for engagement with business. The *National Physical Laboratory* has established its first outpost within the BIC and is now collaborating with Physics, particularly in the fields of accelerator physics and radioisotope production. Discussions are similarly underway with *3M* and *NHS*. The quality of the University's support for researcher-industry collaborations was recognised when Huddersfield was named the 2012 Times Higher Education Entrepreneurial University of the Year. A Queens Award for Enterprise Promotion followed in 2013.

The US company *Particle Accelerator Corporation (PAC),* has set up a UK subsidiary (*PAC(UK*)) within the 3M-BIC, strengthening their links to IIAA at a commercial level. Also in an international setting Bungau collaborates closely with *Bartoszek Engineering*, a US company that specialises in mechanical and electromechanical design for the nuclear and high energy physics community world-wide.

Contribution to the discipline: We have summarised the contribution of our researchers to the discipline below, indicating their status in learned societies, followed by three figures indicating the number of (i) memberships of national or international boards or committees, (ii) memberships of programme committees and/or conference chairs and (iii) invited lectures at national or international conferences. These are followed by a maximum of five esteem indicators. Research-informed teaching is emphasised at Huddersfield and all potential teaching staff are at least fellows of the HEA (as indicated). Early career researchers are indicated by *.

Professorial Researchers:

Barlow: *MInstP, FRSS, FHEA* (4,7,12), Member of EPS HEPP Committee; Plenary talk at ICHEP, Moscow; CERN academic training programme: 5 lectures on statistics; Co-ordinator of LHCb statistics group; Member of FCT (Foundation for Science and Technology, Portugal) Evaluation Panel on the Exact Sciences.

Cywinski: *CPhys, FInstP, SFHEA,* (14,10,15), Elected President of International Society for MuSR Spectroscopy, Europe, Russia and Africa and global Vice President of ISMS; Chair of Molecular and Materials Science Experiment Evaluation Committee, TRIUMF; Member of the Committee of

the International Kurti Prize for Low Temperature Physics; Member of the Muon Scientific Advisory Committee (MUSAC) of the Japanese Proton Accelerator Research Complex J-PARC; Member of the Editorial Board of Physica Scripta.

Donnelly: *CPhys*, *FInstP, FHEA* (2,3,6), Member of the scientific advisory committee of the French EMIR ion-accelerator network; Member of the user selection committee of the European SPIRIT ion-accelerator network; Chair of the Steering Committee of the EPSRC National Facility for Aberration Corrected STEM (SuperSTEM); consultant for the National Nuclear Laboratory for inert gases in nuclear materials (to 2011); Initiator and chairman of the TRITON group who developed a proposal for a triple-ion-beam facility for nuclear materials submitted to Cabinet Office by EPSRC.

Edgecock: (5,1,2), Project leader of the EMMA Work Package in the £5.2M CONFORM Project; Project Leader of the International EMMA collaboration of 8 institutes from Europe, Canada and the US; PI of the 13.5MEUR EUROnu FP7 Design Study (15 EU partners); PI of Particle Accelerators for Science and Innovation Targets Studies (£2.7M, 4 Institutions); Coordinator of Accelerator Applications Network, EuCARD2 FP7 Integrating Activity with 52 partner Institutions worldwide.

Kilcoyne: *CPhys, FInstP, FHEA*, (6,1,4), Chairman of the International Atomic Energy Authority "Panel of Experts" on Exotic Beam Research for Advanced Engineering Materials; Member of the Natural Sciences and Engineering Research Council of Canada International Advisory Committee to review the Center for Molecular and Materials Science at TRIUMF, Vancouver; Chairman of ISIS User Group and ISIS Ombudsman; Member and Chairman of STFC's ISIS Beam Scheduling Panel 6, Panel member of L'Oréal UK and Ireland Fellowships for Women in Science Awards.

Seviour: *MInstP*, (5,1,4), Lise Meitner Professor at Lund University; Member of the DoE INCITE panel; Secondment to the ESS project; Member of the STFC PPGP(E); Invited speaker at LINAC12 (Israel).

Van den Berg: *CPhys, MInstP*, (0,1,4), Member of the Steering Committee of the EPSRC funded Ion Beam Centre at Surrey University (£ 2 M grant); Elected member of the Executive Committee overseeing the 5.4 M Euros EU FP6 project ANNA.

Non professorial researchers:

Bailey: (0,2,3), Member of the organising committees for the International Workshop on High-Resolution Depth Profiling: HRDP-5, Kyoto and HRDP-6, Paris, and the 19th International Conference on Ion Beam Analysis, Cambridge; Invited talks at HRDP-5, HRDP-6.

***A Bungau**: (0,0,2), Two invited talks at DAEdALUS/IsoDAR International Workshops, Erice, 2012 and 2013; Target design package leader for the IsoDAR project - an international collaboration between US Universities and Labs, Univ of Huddersfield, PSI, INFN-Italy and Japan;.

***Hinks**: *MInstP*, (0,6,3), Organiser and co-organiser of 3 workshops on TEM With In-Situ Irradiation, (WOTWISI); Chair of session on Radiation Effects (He and H effects) at the 14th International Conference, on Fusion Reactor Materials, Japan; Opening invited speaker at the 21st International Conference on the Application of, Accelerators in Research and Industry, USA; Invited speaker and session chair at the Materials Research Society Fall Meeting, USA; Invited speaker session at the 22nd International, Conference on the Application of Accelerators in Research and Industry, USA.

Jones: *CPhys MInstP MFSSoc MIET FHEA*, (1,1,2) Institute of Physics/NanoKTN prize winner for applications of university science to industry; Invited speaker for Fingerprint Society; Invited Speaker and Member of International Fingerprint Research Group; Member of Home Office stakeholder groups; Chair of University, Industry and Impact conference.

***Sweeney:** Consultant for Phase Focus (Sheffield) in electron ptychography and diffractive imaging (2008-9); oral presentation at International Microscopy Conference, Kiel (2011).

***Ward:** *CPhys, MInstP, CITP, FBCS, PFHEA*, (2,0,0), Initiator and co-ordinator of the FASTEST Project, an international consortium from Western Australia, USA, Central Venezuela and UK; Best Paper (>500 entrants), 6th Saudi Scientific International Conference, (2012).