Institution: University of Cambridge

Unit of Assessment: B9

a. Overview

The Cavendish Laboratory and the Institute of Astronomy (IoA) are separate University Departments within the School of Physical Sciences with their own management structures, but increasingly linked research and teaching programmes. The UoA's research agenda is focused on enabling staff and students to deliver innovative research at the forefront of science and technology. The overall management of the Cavendish is through a Senior Management Group, chaired by the Head of Department, which meets weekly, backed up by termly meetings of the Cavendish Advisory Board. Services are provided at the group level plus centrally for workshops, cryogens, high performance computing, administration and library etc. The IoA also has a Senior Management weekly meeting and is run through a Departmental Staff Committee chaired by the Director. Both institutions are represented on the Council of the School of Physical Sciences, which meets twice each term, as the strategic planning and research allocation body for the physical science departments. Both the Head of Physics and the IoA Director also sit on the School Needs Committee, which balances the needs of different parts of the School in light of the overall budget.

The themes given below indicate the loose affiliations of staff and their research teams within the UoA and may comprise more than one group (the effective research unit within the Cavendish). These themes are not at all impermeable; collaborations within different parts of the enterprise are encouraged and there are cross-cutting programmes. As individuals come and go, groups grow and shrink accordingly. Each group has a head who takes local responsibility for many of the personnel, supervisory and resource issues the group faces. The overall strategy, and the way we approach these and other environmental factors, is given in more detail in later sections.

Themes

1. **Astronomy and Astrophysics**: Encompasses activity associated with both the Cavendish Laboratory and the Institute of Astronomy.
2. **High Energy Physics**: Includes theory (recently expanded and with strong links to DAMTP) and experiment, and is a key player at the LHC.
3. **Quantum Matter:** Covers a wide range of correlated electron systems; makes much use of national facilities and has received recent investment in materials preparation facilities.
4. **Atomic, Mesoscopic and Optical Physics (AMOP):** A relatively new grouping which has been extremely successful in obtaining funding from the UK and the EU; the department's investment in staff and equipment has proved highly successful.
5. **Optoelectronics, Microelectronics and Nanophotonics:** This group studies the optical and electronic properties of novel low-dimensional and nanostructured materials plus their application in devices. It has strong industrial links, and interacts closely with the Departments of Materials and Chemistry
6. **Semiconductor Physics**: Has a long track record in the physics and technology of semiconductor quantum structures and devices, strong links with the UK and international semiconductor community, and successful collaborations with industry.
7. **Materials Physics**: Covers magnetic materials, inorganics, fracture properties and surfaces and thin films.
8. **Theory of Condensed Matter and Scientific Computing:** Is building on its long-term strengths in electronic properties, computational physics and simulation, soft matter and increasingly biologically-related problems, and retains strong links to both quantum matter and AMOP.
9. **Biological and Soft Systems:** Activities span soft and biological matter; work is inherently interdisciplinary, linking closely to both the Schools of Biology and Clinical Medicine.

b. Research strategy

Our strategy is designed to deliver our primary aim, which is to remain world leading in all that we do (the department is currently ranked #2 behind MIT in the 2013 QS World rankings for Physics and Astronomy). Although characterised within the 9 themes above, the cross-fertilisation strategically encouraged between the themes results in a diversity of approaches to the 'big questions' in physics, from the formation of the Universe to the physics of new materials and life

itself. At one extreme, particle physicists and astrophysicists use giant colliders and telescopes to seek answers to some of the basic questions about the origin and nature of the Universe. At the same time the new Physics of Sustainability programme (which cuts across many of the nine themes we identify above) uses physics techniques and knowledge to address major problems of energy and the environment. Theoretical and computational studies complement many of the experimental activities. We support outstanding fundamental research in all these areas and measure success by our ability to attract and nurture the world's best researchers; by the impact of research as determined by a whole range of metrics; and by the volume of total research spend, currently exceeding £25M each year (including studentship funding). This wide scope of activity also offers the opportunity to invest in new and expanding areas, serendipitously or as part of our long-term strategy.

One embodiment of our strategy during the current census period can be seen in the inauguration of the **Winton Programme in the Physics of Sustainability** in 2011. This was made possible by a donation of £20M from David Harding, a Cavendish alumnus which is allowing us to pull together many different strands of research, drawing on a number of the research themes in condensed matter identified above. This programme will define one of the priority research directions of the department over the next ten years. The goal of the Winton programme is to deliver truly original research which builds on inter-disciplinary competences and networks. The emphasis is on fundamental research that will have importance for the sustainability agenda in the long-term, but its intention is to be transformational, not incremental, allowing risks beyond the normal scope of research grants. It will encourage innovative physics research that has the potential to address the important economic and environmental challenges in the generation and use of energy, materials and sensors.

Led by the Cavendish Professor Sir Richard Friend, with an International Advisory Board under the chairmanship of Professor Paul Alivisatos (Director of the Lawrence Berkeley National Laboratory), the programme is providing PhD studentships, research fellowships, and support for new academic staff, creating 2 new lectureships. It includes investment in research infrastructure of the highest quality, pump-priming for novel research projects, sponsorship for outreach activities, and support for collaborations with academia and industry, including companies that have been spun-out from the Cavendish itself (see impact statement). Physics leads the activity, which spans several departments.

Other strategic plans include the consolidation of astrophysics research in the Cavendish and IoA onto a single site, which began with the construction and opening in 2009 of the Kavli Institute for Cosmology in Cambridge (KICC), which brought together cosmologists and extragalactic astrophysicists of the Cavendish Laboratory, the Institute of Astronomy and also the Department of Applied Mathematics and Theoretical Physics (DAMTP) in a specially designed Centre. The second phase of this integration has recently been completed with the Cavendish Laboratory Astrophysics group's move to the new Battcock Centre for Experimental Astrophysics in August 2013, adjacent to the IoA and KICC.

These developments will enable integration of the University's research in astrophysics, astronomy and cosmology, allowing Cambridge to maintain pre-eminence in the field in the UK and allow for new collaborative projects to be developed. The integration has already begun with the establishment of the Centre of Excellence in Extrasolar Planetary Science following the appointment of Queloz (Professor, Cavendish 2013) and Nikku (Lecturer, IoA 2013), plus collaboration with DAMTP and Earth Sciences. Following the approval of the European Southern Observatory of the MOONS and 4MOST instruments, Cavendish Astrophysics and the IoA are instituting joint programmes to contribute to both projects. Although Cambridge has traditionally concentrated on relatively small-scale experiments, the new investment and appointments are changing this emphasis, with a major new optical instrumentation programme building towards a lead role (via Maiolino who arrived at the Cavendish as the new Professor of Experimental Astrophysics in 2012) in a key ESO E-ELT instrument, HiRES, and with Cambridge leading the design of the software and computing for the Square Kilometre Array, widely regarded as the defining ICT science infrastructure project for the next decade or more. At the same time we continue to invest in smaller-scale experiments -- for example, the 2013 appointment of Carilli to a 20% position at the Cavendish will strengthen Cambridge's role in experiments to study the Epoch of Reionization.

Position in the context of the 2008 submission

Building a group in **Atomic, Molecular and Optical Physics** was a key strand in our previous strategic plans in 2008, with 3 new hires (Atatüre, Hadzibabic and Köhl). This enterprise has proved scientifically extremely fertile, with several significant 'firsts', a string of highly regarded papers and significant funding awards: Atatüre and Köhl have both been awarded ERC Starting Grants and Hadzibabic has received a series of EPSRC grants totalling more than £1.8M, all within the census period. All three have been promoted; Köhl, to a Professorship and Atatüre and Hadzibabic to Readerships. The research of these 3 PIs neatly complements one another. Köhl, and also Guck (below), having been awarded prestigious positions in Europe, still hold 20% appointments to continue the work established here and to build up collaborations with their new host institutions. A new AMOP hire is planned within 2014 to consolidate research activities after Köhl's departure.

In the previous submission we were well on the way to achieving our vision of creating a new interdisciplinary and interdepartmental activity in the **Physics of Medicine**, with 4 new lecturers hired during 2006/7 to invigorate this activity, and a new building planned. The building was opened in late 2008, comprising 2500m^2 of predominantly laboratory space, including facilities for handling Class 2 organisms, a class of facility vital for work with biological organisms such as bacteria, with university funding of £2.5M to supplement a £10M donation from the Wolfson Foundation. Simons has been appointed to the Herchel Smith Chair in the Physics of Medicine. He has been awarded a Wellcome Trust Investigator award, as well as funds from the MRC, and works closely with the many relevant Institutes around the University, including the Stem Cell and Gurdon Institutes.

Of the 4 lecturers appointed in this field (Cicuta, Eiser, Guck, Keyser), all are now Readers, demonstrating the success of the hires. Eiser additionally forms a strong bond with the Interdisciplinary BP Institute, with activities in complex fluids bridging physics, chemistry and chemical engineering. In view of the continuing strategic importance of this whole field in the departmental plans, a new lecturer (Bohndiek) has been appointed to replace Guck from summer 2013; she has already won a CRUK Career Establishment Fellowship to kickstart her activities. She will be working closely with researchers in Biochemistry and in the Clinical School on imaging of tissues. Huppert was proleptically appointed to a Lectureship whilst holding an RCUK Fellowship, but is currently on leave of absence as Cambridge's MP. Finally, Teichmann is working with the department on a 25% position since 2012; a biochemist based at the MRC Laboratory for Molecular Biology, she has a strong collaboration with theorists here. All this activity is now linked with the **Physical Biology network** (spearheaded by Simons), which spans the University and arranges cross-departmental seminars and the annual Physics of Living Matter conference, bringing together researchers from all parts of the university and a programme of international speakers.

Identified in 2008 as a new focus of activity, the **Laboratory for Scientific Computing**, has been very successful under the leadership of Dr Nikos Nikiforakis, with strong interactions with and financial support from industry (over £1M in 2011/12). It offers a one-year Master's course, with around a dozen students taking this course in the current year.

Future Strategy

Decisions about changes in future staffing and major capital investment will be determined not simply by needs within the UoA, but also by how these fit into the wider School and University strategies. The University operates an annual planning round requiring the Schools to submit their strategies and forecasts. The School of Physical Sciences, which encompasses 8 departments and institutes, then discusses with each department its most pressing needs over a 5-year horizon, which informs the School's planning submission to the University. At University level large scale initiatives all go through the Research Policy Committee, chaired by the PVC for Research, on which both Friend (EPSRC Council member) and Donald (ERC Scientific Council Member) sit.

Initial aims going forward in our strategy will be to build up new activities in the **Maxwell Centre** and to deliver against the investments in the Physics of Medicine/Physical Biology and in Astrophysics. As the Department's new flagship initiative, the Maxwell Centre will host the active participation of industry, both in the research itself and in its exploitation. Its new building (with ground-breaking due to start soon) is specifically designed to house innovative and interdisciplinary research programmes in physics and cognate disciplines and bring science and industry activities

together. A large number of national and international companies have already pledged their support. A core activity will be the Winton Programme, the primary strategic vehicle for much condensed matter physics in the Laboratory; projects are often carried out in collaboration with the Materials Science and Chemistry Departments. The goal of the Maxwell Centre will be to enhance and strengthen the long-term involvement of industrial partners in research for the benefit of British industry and society in general. The construction of the building is funded jointly by the University and a £21.6M award from the HEFCE Research Partnership Infrastructure Fund, and will be completed in 2015.

Along with the Maxwell Centre (see also Section E), other key strategic areas in the UoA's planning submission are the fulfilment of the new vision of Physical Biology across the University under Simons' co-leadership, which will provide an appropriate (but broader) framework to take forward the earlier Physics of Medicine plans; and the development of new and evolving joint research programmes involving Cavendish Astrophysics and the IoA. Big Data is central to the latter and is an emerging theme across the University in which Astrophysics will take a lead role. Looking forward, the long-term importance of the continuing research in Astrophysics is highlighted by the group's central role as leaders in the SKA project (Square Kilometre Array) with its lifetime projected until 2030 already.

Future strategy will continue to evolve against societal needs and developments both within and beyond the department, focussing on building on our existing core excellence. We will always aim to keep fundamental physics strong and sitting at the heart of our overall research programme, strengthening our research bases across the 9 themes identified above but also allowing serendipity to play its role in our developments as appropriate.

c. People, including:

i Staffing strategy and staff development

The UoA seeks to attract the very best from a world-wide pool of talent. To do this, we advertise internationally, explicitly seeking out a diverse field of candidates (e.g. by writing to female holders of Research Fellowships in the appropriate area) and providing start-up guarantees. Areas are identified in which to recruit according to the strategic directions identified (section B). After recruitment, we support new researchers with obtaining grants to build up sustainable groups, and have helped achieve ERC Starting Investigator Award funding of over £6M to Atatüre, Guck, Keyser, Köhl, Belokurov, Wyatt and Sebastian. Several recent appointments are international (noted in bold).

A series of new appointments has been made to capitalise on the investment in the newly co-located astronomy teams. In order to begin a viable new initiative in exoplanets, Professor Queloz, from **Geneva** and Nikku (**Yale**) have recently been appointed by the Cavendish and IoA respectively. The cosmology work of the KICC is strengthened by the appointments of Belokurov (Cambridge), a near-field cosmologist, to the IoA in 2011 and Sijacki, an expert in cosmological numerical simulations, in 2013 (**Harvard)**. Maiolino, an expert in galaxy formation, was appointed to the Experimental Astrophysics chair in Physics in 2012 from **Rome**. The University has extended Fabian's tenure for 2 years beyond the end of his Royal Society Professorship this year. Carilli has joined us with a part-time appointment from the National Radio Astronomy Observatory in the **USA** following a successful collaborative visit in 2012, contributing to the move into larger collaborations in radio astronomy.

Gripaios joined Stirling from **CERN** in 2011 to refresh the High Energy Physics Theory section, but Stirling has recently moved to Imperial College to be Provost, and his Chair (Jacksonian) will be filled in due course. To retain a strong presence in high energy theory a new post was created to which Mitov has been appointed (2013), joining us from **CERN**. A complementary appointment in experimental high energy physics is now in the appointment process.

Cowburn's arrival from Imperial in 2010 has further strengthened our research in experimental condensed matter research and associated disruptive technologies, enabling the work in the area, interrupted by the sudden death in late 2007 of Bland, to be sustained. Baumberg arrived at the start of the current period from Southampton to initiate a strong activity in Nanophotonics. Sebastian has recently been internally appointed from a URF to one of the lectureships associated with the Winton programme; the second is still to be filled.

Two new lecturers (Castelnovo from Royal Holloway and Lamacraft from **University of Virginia**) were appointed in 2012 to renew the Theory of Condensed Matter group. Artacho (currently on 80% leave) has transferred from Earth Sciences to strengthen this aspect of

theoretical work. Simons took up the Herchel Smith Chair in the Physics of Medicine in 2011, with a brief to involve biologists from throughout the university in the thriving biomedically-based activity in the Cavendish, principally located in the Biological and Soft Systems Sector. Teichmann's part-time appointment to work with theorists (although her main post is based in the Laboratory of Molecular Biology) strengthens the interdisciplinary links. In this field the UoA also welcomes the arrival of Bohndiek from **Stanford** as a new lecturer; Eiser arrived in 2008 (from **Amsterdam)** and not only is active in the biological physics arena but also acts as a key bridge to the interdisciplinary BP Research Institute, concentrating on colloids and tying in with industry.

Staff Development:

Our ambition is to support and develop all academic and research staff, both as individuals and as members of thriving research groups (included in the 9 themes listed above), whatever the stage of their career trajectory. All academic appointments below Readership level at the University of Cambridge are subject to a period of **probation,** during which the Head of Department arranges for career guidance and support to be provided to the new member of staff. This involves inductions at both departmental and University level and the appointment of a **mentor**. More experienced academic staff can also draw on a local **peer-mentoring system** to share skills and provide mutual support.

All staff are encouraged to take advantage of the numerous University-run courses, which range from advice about EU funding procedures to supervisory best practice, and include courses run by the **University Language Centre, Computing Services** and **Library. ECRs** can not only take advantage of all training for Research Staff (see below) but also of training specifically designed for new lecturers and seminar tutors through the **Academic Practice** programme and the **Pathways in Higher Education Practice**, which provides orientation and development courses during the probationary period of newly appointed Lecturers.

Academic Staff: The UoA fully supports all academic staff who wish to participate in the University's annual exercise to consider applications for promotion to Professor, Reader or Senior Lecturer. Decisions on promotion are made according to clear advertised criteria. Part-time staff are treated equally in both academic and contract research promotion and career progression. The Heads of Department and the IOA are always available to provide informed advice concerning both timing of an application and other strategic aspects, and CV Mentoring is available through the University. Over half our academic staff have received promotion to full professor. Staff are entitled to one sabbatical term for each 6 terms of teaching (37 teaching staff have taken advantage of this scheme during the census period).

Staff Development: Research Staff/Postdocs

In 2012 postdoctoral research workers became the largest staff group in the University (now over 37%). In response to this growth the University has embarked on a major property development in **North West Cambridge (NWC)**. In the first £300M phase, due to open in 2016, housing will be provided for over 500 postdocs and their families, together with retail and social facilities, homes for 300 graduate students and also private sector housing. In addition, the University has created the new role of **Director of Postdoctoral Affairs**, who will coordinate and develop strategy for the entire postdoctoral community, spearhead fund-raising for further NWC facilities, and act as an advocate for postdocs in the governance machinery of the University. The aim is to transform the postdoctoral experience in Cambridge.

All our planning for recruitment and development is guided by the principles of the Concordat to Support the Career Development of Researchers, and supported by both University and departmental initiatives. We have a school-based HR adviser provided by the University, as well as advisers from the **Cambridge Personal and Professional Development (CPPD)** and **Careers** services. In the Cavendish we have had a departmental **Personnel Committee** (including support staff representation) for about 7 years, which itself set up a **Research Staff Committee** in 2010 and a **Postdoctoral Researchers Forum.** The **Graduate Student Consultation Committee** provides a forum for discussion of matters concerning graduate students (see more below). A senior Professor (Cowburn) acts as a **Researchers' Champion** who can be approached by researchers with concerns. This means that all members of the department have a route for communication regarding specific issues, and a voice which feeds into departmental management. A staff meeting for all members of the department is held by the Head of Department termly, at

which important matters about developments can be discussed by everyone.

In the IoA, senior academics have oversight of the well-being of postdoctoral staff and graduate students, with designated individuals acting as communication routes should postdocs be unclear where to obtain advice or help. The IoA is particularly cohesive and individual members of the postdoctoral and postgraduate communities run mailing lists and support systems covering all aspects of research and life in Cambridge.

The **Career Management Processes** web-resource provides detailed guidance on career progression to research staff, bringing all the information on career development, promotion, HR processes and Personal Development Planning together for ease of access. Contract research staff seeking promotion need a recommendation supported by the research sponsor and head of institution. Promotion to Senior Research Associate requires approval by the relevant Faculty Board. The University's **Human Resources Division** provides extensive online guidance on career progression for all staff, including clear role descriptions, pay scales, and guidance on progression through pay grades. The **Careers Service** provides an opportunities database and runs careers partnership and employer mentoring schemes to assist research staff in accessing employment. The University runs an **Employer Forum** focused on postgraduate researchers and research staff incorporating training and development initiatives from around 20 different employers from across all employment sectors. **Cambridge Enterprise** arranges meetings of early-stage researchers with companies to discuss projects, identify problems and provide industrial R & D links for future career paths.

The University **Staff Review and Development Scheme** appraisal system has been adapted to fit the UoA's needs. All researchers have a structured probationary period with support provided to both researchers and supervisors to make it successful, and with a clear framework for induction, probation and appraisal developed through the University's **Employment and Career Management Scheme** (implemented in 2011). All staff are reviewed on the completion of their six-month probationary period and at least every two years after that (annual review is available for contract research staff and ECR's on fellowships). Each review consists of a self-assessment by the individual; assessment by a reviewer appointed by the Head of Department; a face-to-face meeting to discuss progress, training and development needs, and the creation of a written record (including an action plan). A summary of these reviews is reported annually to the **University Human Resources Division**. Identified training and development needs can then be met through courses offered by the University's **Cambridge Personal and Professional Development** service and the courses detailed in the Academic Staff section above. Academic staff have comparable appraisals.

The IoA runs a specific annual seminar series on careers and job-applications in Astrophysics which is approaching its thirtieth year. Available to graduate students and postdoctoral researchers across the UoA and DAMTP, the format and content has been adopted widely across astronomy groups in the UK and throughout the world.

Postdocs Of Cambridge (PdOC*)* is a University Society for early career researchers which offers guidance to ECRs on opportunities within and outside Cambridge. The Society also organises a monthly meeting to enable new ECRs to socialise and network with their peers and represents postdocs in matters of career development and employment conditions.

In recognition of its work fostering good working conditions and career development for researchers, the University has received the European Commission's **HR Excellence in Research** badge.

Equality and Diversity

Issues surrounding Equality and Diversity are taken seriously in the UoA, and Physics is proud of the fact it is both an **Athena SWAN Silver** award holder and a **Juno Champion**. The department is applying for an **Athena SWAN Gold** award, an action led by **Gibson** (who was granted time out of teaching for a term to enable her to concentrate on the submission) and the Administrative Secretary for the department. (Plans for the IoA to apply to the scheme are under discussion.) The University has granted significant funding for these activities through the **EPSRC Developing Leaders** grant. We benefit greatly from the University Equality and Diversity team, who assist with legal matters formally through the recently updated **Equal Opportunities Policy** (in line with the Equality Act 2010), in all matters relating to staffing. A **Dignity@Work** policy clearly sets out University procedures for dealing with harassment, bullying and other inappropriate

behaviours drawing on specialist advisors, with identified individuals available for advice across the UoA. In October 2009, the University approved the appointment of **3 Equality Champions** (around Gender, Disability and Race) to demonstrate leadership and support the **University Diversity Networks**. As the Gender Equality Champion, **Donald** can ensure best practice is well-embedded in the department's activities. She also sits on many of the relevant University Committees, and chairs the **Gender Equality Group,** which is leading an analysis of the University's equal pay practices.

The University offers a range of **equality and diversity training opportunities**. There has been a strong push from within both the School of Physical Sciences and the UoA itself for all staff to complete the two online training modules, which have already been completed by all members of the Senior Management Group, all chairs of appointments panels and the REF UoA team. In 2012 the University won the Employee Engagement award from the Employers Network for Equality and Inclusion for "instilling its core values on the running of the University" and in 2012 and 2013 the University was ranked 11th on the **Stonewall** Top 100 Employers workplace equality list, the highest for any UK HEI. The University won a number of other awards (2011-2013) for engaging and working with staff. The University's Personal and Professional Development team run two **gender-specific staff and graduate student training programmes**: Springboard for women and Navigator for men.

The University's **Women in Science, Engineering and Technology Initiative WiSETI** (of which Donald is Director) promotes and supports women, from undergraduate to Professorial level, in Science, Technology, Engineering and Mathematics. It organises many activities including career development seminars for early career, postdoctoral and PhD level women scientists and annual talks by women scientists working in policy, industry and academia. This group led the successful process to renew the University's Bronze **Athena SWAN award** in 2009 (renewed in 2012). The University has taken specific steps in the last year to support women in a number of ways. These include running a series of workshops for women at all levels to help them progress their careers; open fora on the promotion process; focus groups to identify the main items of concern for women of different grades including researchers; and a **Returning Carers'** Scheme – open to both men and women – to provide grants to individuals returning after periods of parental or carers' leave, to facilitate their return to research.

The University has generous maternity/paternity leave policies (including paid Keeping in Touch Days during leave) and all staff can request a career break, where there are exceptional family responsibilities, to care for young children, to provide full-time care to an elderly dependent relative, and for other unforeseen domestic situations. The University has two **workplace nurseries**, one of which is located very close to the UoA in West Cambridge. Nursery care costs can be paid as part of a **Workplace Nurseries Salary Exchange Scheme**. The University also participates in the Cambridge Universities' **Holiday Playscheme.**

We make sure that any staff or students who have a disability know that they can be assessed by the University's **Disability Resource Centre** (DRC), who then liaise with us to help us accommodate any special needs. The DRC also lends specialist equipment and co-ordinates the University's network of **Departmental Disability Liaison Officers**, who provide information about disability to staff. We also provide information to students and staff about the University's **Occupational Health** service, which promotes and preserves both the physical and mental well-being of all staff, and provides a free counselling service to all University staff.

Research Fellows

Our success in attracting research fellows and the subsequent appointments of many of these fellows to academic positions in Cambridge and elsewhere is evidence of the attractiveness and health of our research environment. The table below lists competitively awarded fellowships by grouping, simply identifying those who have either arrived or departed during the census period. A certain number have been here throughout this time and these are not listed.

Year (arr)	Name	Theme	Position	Coming From	Gone to (if applicable)
2007	Jonathan Gair	1	RS URF	Internal	
2008	Vasily Belokurov	1	RS URF	Internal	UL 2011

2010	Mark Gieles	1	RS URF	ESO/Edinburgh	Surrey (Prof)
2009	Andreea Font	1	RS DH	Durham	Birmingham
2010	Ben Davies	1	RAS	Leeds	Liverpool JMU (SL)
2012	Jay Farihi	1	Rutherford	Leicester	UCL (Lecturer)
2013	George Becker	1	Rutherford	Internal (Kavli JF)	
2013	Matt Auger	1	Rutherford	Internal	
2010	Camille Bonvin	1	Herchel Smith	Geneva	
2008	George Becker	1	Kavli SF	Caltech/CMU	
2008	IIan McCarthy	1	Kavli SF	Durham	Birmingham
2012	Mustafa Amin	1	Kavli SF	MIT	
2012	Michele Trenti	1	Kavli SF	Colorado	Melbourne (SL)
2013	Kazuaki Ota	1	Kavli SF	Kyoto	
2013	Ben Moster	1	Kavli JF	MPI Garching	
2009	Andrew Pontzen	1	JRF	Internal	Oxford (lecturer)
2011	Ryan Cooke	1	JRF	Internal	UCSC USA
2013	Susie Alaghand-Zadeh	1	JRF	Internal	
2010	Stefan Ask	2	STFC AdvF	CERN	
2009	Suchitra Sebastian	3	RS URF	Internal	Lectureship (internal)
2012	Sian Dutton	3	Winton	Princeton	
2012	Robert Smith	4	RS URF	Internal	
2009	Jenny Clarke	5	RS DH	Internal	Sheffield U Lectureship
2009	Anoop Dhoot	5	RS URF	Internal	
2009	Mark Buitelaar	6	RS DH	Internal	UCL Lectureship
2005	Andy Jardine	7	RS URF	Internal	Internal
2012	Alex Chin	8	Winton	Ulm University	
2012	Andrew Morris	8	Winton	UCL	
2013	Nicholas Hine	8	Winton	Imperial	
2008	Allon Klein	8	EPSRC Postdoc	Internal	Joint with Harvard
2009	Sebastian Ahnert	8	RS URF	Internal	
2006	Gunnar Moller	8	JRF	Orsay	RS URF (internal)
2010	Jonathan Biggins	8	JRF	Internal	Joint with Harvard
2011	Antonio Garcia-Garcia	8	EPSRC Adv F	Lisbon	
2011	Kevin Chalut	9	RS URF	Internal	
2008	Easan Sivaniah	9	EPSRC Adv F	Leeds	Tokyo

In this table JRF = Junior Research Fellow; Adv F = Advanced Fellow; RS URF = Royal Society University Research Fellow; RS DH = Royal Society Dorothy Hodgkin Fellowship Rutherford = STFC Rutherford Fellow. The Winton Fellowships are competitively awarded through the Winton Programme; the Kavli Fellows are associated with the Kavli Institute for Cosmology and are again highly competitive fellowships and are awarded at both junior (JF) and senior levels (SF); Herchel Smith Fellowships are University of Cambridge awards advertised internationally.

International Staff appointments (incoming and outgoing), international recruitment and visiting scholars

International staff appointments are detailed in sections B and C. Our postdoc community is likewise very international in its recruitment.

The IoA has a long-standing **Senior Visitor Programme** to bring senior scientists to the UK, who are also encouraged to visit other UK institutes. This is supplemented by specific **Sackler Visitors** and **Sackler Lecturers**: **Marcy,** Univ of California;.**Genzel,** MPE Munich; **Narayan,** Harvard; and **Kasting,** Penn State have all visited during the census period. Major international conferences are hosted at least annually, with more specific workshops equally often. Total visitor numbers, averaged over time, are equivalent to 6 FTE in total during the period. Similarly, in Experimental Astrophysics in the Cavendish, long-term visitors play a key role with averaged numbers of about 1.5 FTE pa.

The Cavendish hosts the annual **Scott Lectures: Sherrington**, Oxford; **Thorne,** CalTech; **Cohen-Tannoudji**, Collège de France; **Parinello,** ETH; **Yablonvich,** UC Berkeley have given these in turn over recent years. Additionally the recently established **Hewish Lecture** has seen **Manchester**, CSIRO; **Ekers,** CSIRO; and **van Dishoech,** Leiden visit. There is a fortnightly departmental **Colloquium**, and all research groups host their own weekly seminars. This generates a very dynamic environment, with our researchers exposed to leaders in their research fields from around the world and with many opportunities to listen to and interact with these international experts. Several collaborations (including **EU** programmes) have visiting student and researcher programmes, and there are many long-term visitors from abroad.

ii Research students

In the Cavendish the Graduate Student Office ensures that applications are directed to the areas in which the applicants are most interested/suited. All applicants are considered on academic merit and relevant experience. The UoA has at least 25 students p.a. funded from Cambridge sources, including Gates, the various trusts, the Isaac Newton studentships, Cambridge International Scholarship Scheme and Cambridge Home and EU Scholarship Scheme, the Winton Programme and other Department awards.

The IoA recruits an average of 13 PhD students a year to its world-renowned programme, from which three out of four students go on to positions within astrophysics research. The scheme for choosing a research topic, whereby students identify their supervisor and project from among the large number available once they have arrived in October, results in outstanding completion rates (within four years) and satisfaction levels among the graduate students. The IoA's long established online **'Postgraduate Handbook'** is a prime example of the collaboration and support between academics and the graduate student body.

In the recent call for new Centres of Doctoral Training by the EPSRC, the UoA has been awarded two: **Sustainable and Functional Nanotechnology** (which builds on the existing DTC), and **Computational Methods for Materials Science** -- both of which fit in closely with the strategic directions identified earlier. Additionally, the UoA is involved with several others led from both within the University and beyond.

Physics has taken the lead on the established **Nano Science and Technology Doctoral Training Centre**, which offers a four-year course. The first year is primarily training, incorporating seminars, practicals and projects designed to equip students to embark on a high impact interdisciplinary PhD in one of the Nano-related groups (based within the departments of Physics, Chemistry, Engineering or Materials Science). The students complete a series of courses in specialist Nano Science and Technology, media communication, business, and research and management of technology and innovation; this first year includes 26 practicals, providing hands-on training in a range of specialist techniques, two mini-projects (8 weeks duration) and a midi-project (13 weeks) to put their skills into practice. The positive experience of this DTC means it lends itself as a basic blueprint for the new CDT cases.

One of the first activities of the **Cavendish Graduate Student Consultative** committee was to initiate a **Graduate Research Conference** in 2009; this is now held annually, organised by students. This acts as a forum for students from across the very different research fields to meet and share experiences, but is also a window on their research which many faculty attend. All students are expected to present at appropriate conferences during their PhD course: funds of up to £300 are provided by the department to attend their first international meeting and are also

available to support students going through financial hardship.

Progress Monitoring/Training and Support

All PhD students are assigned an advisor/second supervisor, to act as an additional source of advice and support. Towards the end of the first year of their PhD, each student must successfully complete a **Certificate of Postgraduate Studies Report** and a viva voce involving two members of staff, only after which will they be formally registered for a PhD. Supervisors are required to submit a termly online report to the Board of Graduate Studies on the progress of each student, seen by the Degree Committee and the student's college, so that any potential problems can be rapidly picked up.

Each student is expected to spend 10 days per year undertaking training in transferable skills and to keep a skills development log. Relevant activities include safety training, presentation and writing skills, teaching (including small group supervisions), media training and CV writing. The School of Physical Sciences provides a School-wide programme of courses through the **Graduate Development Programme,** and the **Transferable Skills Newsletter** gives information about all relevant training provided by the School and the University. The **Cambridge University Skills Portal** is the hub for skills training at the University, enabling all research students to access courses offered by a range of University training providers, as well as online courses offering research, transferable and career planning skills.

All research students are encouraged to participate in the **GRADschool** programme, which is tailored to cover many of the skills training aspects recommended by the Roberts' Report but not covered by the University's transferable skills training programme. PPD, also offers **one-to-one skills analysis sessions** and other specialist skills training through the **University Language Centre**, the **University Computing Service,** and the **Cambridge University Library.** Doctoral students in their second and third years who wish to improve their teaching skills can join the **Teaching Associate Programme**. Further training is offered by the **University's Office of External Affairs and Communications**, which runs **Rising Stars,** a public engagement programme which offers the opportunity to receive training and experience in organising and delivering an outreach event. As well as skills training, the University offers comprehensive careers advice and support through the **Cambridge Careers Service**, complemented by the **Centre for Entrepreneurial Learning** (CEL), which offers a range of business and entrepreneurial skills courses, lectures and workshops, as well as direct support for doctoral students developing spin-off companies. Further business skills training is offered by the **Cambridge University Technology and Enterprise Club** (CUTEC), a student-run organisation that hosts a range of talks, workshops, mentoring and networking sessions to develop business insights, knowhow, soft skills and connections.

d. Income, infrastructure and facilities

As has been mentioned earlier, our total annual research income/expenditure exceeds £25M. During the census period we have built up a substantial ERC portfolio, with total EU funding doubling over the census period to around £4M pa. Seven ERC Starting Grant Awards (Atature, Belokurov, Keyser, Guck, Köhl, Sebastian, Wyatt) and six Advanced Awards (Baumberg, Clarke, Cowburn, Fabian, Gilmore, Haehnelt) have been awarded to UoA members. Research Council funding has been sustained, totalling around £17M pa with an additional comparable figure of in-kind funding. In addition, with the increasing activity in the biomedical arena we are starting to build up funding from medical charities, such as personal fellowships awarded from Wellcome to Simons and from CRUK to Bohndiek. Industrial income from a variety of collaborations averages over £1.5M pa. An endowment of £2M was received from the Sackler Foundation to support the Physics of Medicine, most notably through the funding of studentships.

Fund-raising has been – and will continue to be – crucial to our success and Longair (ex-head of department) was appointed in 2010 as our Development Director to spearhead our redevelopment project in tandem with Cambridge University Development Office. This has enabled major developments such as the Winton Physics of Sustainability project and the Battcock Centre for Astrophysics, described in section B.

Overall the UoA has exceptional levels of support at technical (including technician support) and administrative levels. It should be noted that new hires receive an average of £1M in start-up costs, mainly for capital equipment, to allow their research to hit the ground running. New space has been created for Baumberg's research on Nanophotonics and the expanding Atomic and

Molecular Physics group of Atature, Hadzibabic, Köhl and Philips. Investments made during the census period are tied to other staff appointments and are described in Sections B and C.

We continue to invest in **major characterization techniques**, including a recent £2.3M investment to update our Electron Microscopes across the School, which had already been strengthened (in 2009-9) by the donation of £850K worth of equipment from Hitachi, as part of its on-going collaboration with the Physics Department and over £1M directed towards refreshing X-ray equipment as part of a large initiative across the whole School. The electron microscope suite works closely with equivalent facilities in both Materials Science and Engineering, the latter facilitated by the recent move of the Institute for Manufacturing, where several microscopes are located, to West Cambridge.

The Cavendish invested ca. £1M in a new in-house Helium Liquefier in 2008 to increase the reliability of supply for low temperature work, particularly important for researchers in Themes 3-6. A high percentage of the gas can be recycled; further investment has been directed towards replacing the recycling pipework in order to improve this rate. Attempts to reduce the UoA's carbon footprint are ongoing, and the introduction of additional electricity meters to quantify energy use will be informative.

The Cavendish workshops (both electronic and mechanical) have been thoroughly overhauled, with major refurbishment and investment in new equipment, funded by a combination of central and departmental money. As a consequence it is now possible to run regular workshop training for research students – around 100 have taken this training so far and they have access to purpose-built student workshops during their PhDs. The cooling water system has been completely replaced to prevent failures and leaks; asbestos has been removed from ceiling voids, and the kitchen (which serves the whole West Cambridge site with daily hot meals) has been refurbished in 2013.

Both the Cavendish and IoA have libraries of international quality with printed texts and local access to journals. The Betty and Gordon Moore Library is a subsidiary of the University Library, specialising in journals and books relevant to our UoA. The UoA also benefits from the University Library, a legal deposit (copyright) library housing over two million volumes on open shelves and attracts researchers from across the world (enhancing the research cultures throughout the University).

The University's **Central IT section** is responsible for enterprise computing projects such as payroll, grants and graduate student records. The department has central and distributed computing support appropriate to the research programmes. The Cambridge High Performance Computing Service (HPCS) provides computational resources to researchers across the University and carries out research to accelerate technical capability and reduce the cost of e-infrastructure. The HPCS has been in the vanguard of developing the 'commodity' (as opposed to 'bespoke') model of High Performance Computing, with the Physics Department taking the lead role in validation and stress testing. The HPCS's expertise in computing and data storage, and its connectivity to relevant industrial partners, has been vital to Cambridge's leadership role in these elements of the Square Kilometre Array astrophysics project, demonstrating its widespread relevance and embedding in the UoA's overall culture.

The UoA benefits from the central administrative structures for assistance with applications for research funding. The PVC for Research has ultimate oversight of major initiatives, coordinating actions across the University. The Research Office provides administrative support both before and after grants are awarded.

Use of major national and international facilities not supported by the Research Councils

National facilities are widely used, as can be seen from the metrics, with, for instance an average of around £250k p.a. in the value of beamtime awarded at **Diamond** and ~£150k p.a. at **ISIS**. In condensed matter research use is also made of the **National Centre for III-V** Technologies, of which Ritchie is a steering group member. Access to **CERN** for the work in particle physics is clearly key for research and a value of more than £3M pa is assigned to this access. Gibson was the UK spokesperson (PI) spanning 5 UK Universities for the LHCb experiment.

Research in astrophysics invariably necessitates significant international involvement in world-class facilities, normally with a leadership role. Recent highlights include: McMahon as PI of the **VISTA Hemisphere Survey** (VHS), the scientifically highest rated and largest public survey with

the **ESO VISTA** telescope; Kennicutt as PI of the **SINGS** and the **Local Volume** legacy surveys undertaken with the **Spitzer infrared satellite** (his award of 280.5 hours is conservatively estimated to be worth £4.2M) and major facilities at other wavelengths, and PI of the **Herschel KINGFISH Key Programme**; **Gilmore** as PI of the UK's contribution to the **GAIA satellite Photometric Analysis System**, which will provide the photometric and variability data to the project and the **ESO-GAIA Public Survey**; Efstathiou as a member of the **Planck Science Team**, co-PI of the **Cambridge Planck Analysis Centre** and co-Chair of the **Planck Editorial Board**; Fabian as Mission Advisor and Chair of the Science Advisory Group for the **Japan/USA ASTRO-H X-ray satellite**; Alexander as PI of the **Square Kilometer Array Science Data Processor** design work (global value €22m over 3 years); Lasenby as member of the **Planck Science Team**, co-PI of the **Cambridge Planck Analysis Centre**; Haniff and Buscher as system architects **Magdalene Ridge Optical Interferometer**; Maiolino as instrument scientist for **MOONS** and **JWST NIRSpec** instrument scientist; and Queloz in the **E-ELT** project science team.

Infrastructure Plans

A key factor in how the UoA envisages its future is the development of the site surrounding our buildings in West Cambridge and the ambitious University development for the new North West Cambridge (NWC) site. On the West Cambridge site, the Materials Science and Metallurgy Department has just moved to a new building close to the Cavendish, encouraging increasing collaboration and sharing of facilities. The new building for the Institute of Manufacturing is located even closer. On the biomedical front, strong links have built up with the Department of Veterinary Medicine, situated just a field away, and one BBSRC Research Development Fellow (a Professor from the Vet School) was funded to spend substantial amounts of time in the Cavendish. Links to the Vet School are also strong as part of the University-wide **Stem Cell Initiative**, to which both Simons and Guck belong. The Cavendish and other physics buildings are ideally situated to reap the benefits of these new developments; however, the main buildings of the Cavendish itself have reached the end of their useful working life and a major strategic aim for the department is the ultimate redevelopment of the whole site, a topic under active consideration by the University.

Turning to planned developments for the UoA, state-of-the art facilities and equipment are needed to maintain the tradition of world-leading research and teaching. To this end, the UoA has embarked on a long term programme of reconstruction of the entire laboratory complex. The first fruits of this development are already apparent with the construction of the **Physics of Medicine Building** (2008), the **Kavli Institute for Cosmology** (2009) and the **Battcock Centre for Experimental Astrophysics** (2013). Construction has recently started on the next building phase, the **Maxwell Centre** (see section B), which will house innovative and interdisciplinary research in physics and cognate disciplines and, in particular, will host active participation with industry, both in the research itself and in the exploitation of new knowledge. This project will deliver additional leverage to the **Winton Programme**, which already supports much work on basic science that has potential industrial and commercial interest. The facilities will include dedicated spaces for interaction, bringing Cavendish students and staff into easy contact with industrialists to mutual benefit.

e. Collaboration or contribution to the discipline or research base

Interdisciplinary Research

While the main aim of the UoA is to promote world-leading experimental and theoretical physics in all its diversity, it will increasingly seek and develop opportunities for interdisciplinary research. Collaborative research with other departments, universities and industry is strongly encouraged. Current collaborative partners at Cambridge include the Departments of Chemistry, Material Sciences and Metallurgy, the Department of Applied Mathematics and Theoretical Physics and the Schools of Biological Sciences, Clinical Medicine, and Technology. In the short and medium terms, high priority will be given to the UoA's three strategic research initiatives of **Astrophysics**, **Physical Biology** and industrial collaborations covered in the **Maxwell Centre**, discussed in section B, for which new partnerships with industry will be a key part. Companies such as **Toshiba**, **Hitachi** and **AWE** already work closely with the UoA.

Interdisciplinary research is carried out through a range of frameworks: **major interdisciplinary centres**, which may be virtual or actual but to which many staff belong (e.g., the Nanoscience Centre, Physics of Medicine, Winton Sustainability Programme, Stem Cell Institute, Infectious Diseases Consortium); shared facilities (High Performance Computing, e-Science, Electron Microscopy Suite); and fabrication facilities with a national footprint (high resolution e-

beam, III-V semiconductor MBE growth and device fabrication). Increasingly, cross-departmental activities are the norm, often supported by **Strategic Research Initiatives** such as the Energy@Cambridge, Stem Cell and Infectious Diseases Initiatives; these are all funded and supported by the University with the aim of ensuring coherency across many departments. There are also smaller Strategic Networks, in two of which the UoA is involved: NanoForum (nanotechnology) and CamBridgeSens (sensors).

All the **University's Strategic Initiatives and Networks** are funded for three years in the first instance by the University. Through their dedicated coordinators these groups seek to bring researchers together from across Cambridge to facilitate interdisciplinary research, and also arrange funding and events. Particularly relevant is one in **Energy**, which became a Strategic Initiative of the University in 2010. The initiative seeks to utilise the University's range of expertise through cross-disciplinary projects to tackle the grand technical and intellectual challenges in energy which require integration of science, technology and policy research. It ties in closely with the Winton Programme, which links to sustainability programmes around the world. In the tranche of Initiatives most recently funded in late 2013 the UoA is involved with several: it leads on **Big Data**, highly important for both its astrophysics and high energy physics research; and it is involved with the **Synthetic Biolo**gy and **Cardiovascular Health** Initiatives, bringing a physical perspective to these more biological topics. Less formally defined interdisciplinary groupings cover a wide range of activities, as described earlier. These include the **Physics of Medicine/Physical Biology** network, in which all 4 STEM Schools within the University are included. This work obviously has links to many other institutions in the UK and beyond. For instance, semi-formal links with the **Raymond and Beverly Sackler Institute for Biological, Physical and Engineering Sciences** at Yale exist through Sackler Funding to the Physics of Medicine. Donald sits on the Steering Committee for the recently-funded EPSRC **Physics of Life Grand Challenge** Network.

Interaction with other Research Users including Industry

The UoA has a long history of partnership with industry, both with large companies, and also spin-outs. Additionally, during this period the following companies have been successfully spun out: **Eight19, SciDiver, Cambridge Pressure Cells, Camcool Research, CantabrigiaAdvisors Ltd, Cambridge Biomagnetics**, and **Cavendish Nano Therapeutics**. These spin-outs are supported, financially and with professional advice, by **Cambridge Enterprise**, who work with members of the University to help them commercialise their research and provide consultancy services to industry. This means that vital support to early-stage companies can help them develop innovative technology ventures which benefit society and the wider economy. The Department has used funding from the EPSRC Impact Acceleration Account and similar funding awarded to the University to promote impact, through Knowledge Transfer Secondments of researchers (7.5 outward and 2 inward), involving both large (e.g. Toshiba, Hitachi) and small (e.g.GloveboxTechnology Limited) companies, which provide opportunities for the extension and exploration of results of EPSRC funded research projects to industrial/commercial projects. The Department is currently extending its Knowledge Transfer support by recruiting a further, full-time, Knowledge Transfer Facilitator to complement existing provision.

The **local Enterprise Champion** in Physics is **Payne (**see **Impact Template** for further information**).** We maintain links with previous spin-out companies including **Cambridge Display Technology, Plastic Logic, Teraview, Cambridge Positioning Systems, Cambridge Magnetic Refrigeration, Cavendish Kinetics** and **Dryogenics.** We also have links with many major companies (see the Impact Template for further details). For instance we have close partnerships involving exchange of staff with **Hitachi** (the Hitachi Cambridge Research Laboratory is co-located on the Cavendish site), with **Toshiba** (through their Cambridge Laboratory), and with Accelrys. We conduct research with substantial support from many other companies, as well as with government laboratories including **NPL** and **AWE**. Leading the **SKA ICT** development work has led to research collaborations with, among others**, Intel, IBM, Cray, SGI, Xyratex, ARM, Oracle** and **DELL**. Many of our graduate students and postdocs go on to join companies to which they have been exposed, in a variety of ways, throughout their PhDs. Since 2008 there have been over 28 CASE studentships with over 12 different companies, in addition to a few fully-funded studentships each year, as part of industrial collaborations, both national and international.

Major Research Collaborations including International

The Department is involved in a number of ongoing international partnerships (not including

international research collaborations at individual and research group level), the most important of which are:

- **Hitachi,** Japan (Sirringhaus, et al) collaborative activity with the embedded Hitachi Laboratory within the Cavendish Laboratory, with the aim of creating new concepts of advanced electronic and optoelectronic devices.
- **Toshiba**, Japan (Ritchie, *et al*). The Toshiba Research Laboratory was established at the Trinity Science Park in Cambridge in 1991. A major aim of this research centre is, in collaboration with researchers in the Semiconductor Physics group, to develop novel devices which directly exploit the laws of quantum mechanics in their operation.
- **New Mexico Institute of Mining and Technology** (Astrophysics Group) Collaborative research at the **Magdalena Ridge Observatory Interferometer** (MROI): the optical interferometry team at the Cavendish Laboratory are leading the system design for MROI. As there is concern over future funding, most of which comes directly from NMT, the immediate objective is to secure funds to take the Interferometer project from its current '1 telescope only' state to at least a '2-element working system' and preferably a '3-telescope working system' by the end of 2015.

Additionally, in the past year two new MoUs have been signed, with the **Saha Institute of Nuclear Physics** (Kolkata, India) and with the **National University of Defense Technology** (Changsha, China), under which the partner institutions will fund suitably qualified PhD students to study in Cambridge. We also signed a Letter of Intent with **KazAtomProm** (Kazakhstan), so far worth £240k, which will lead to funding to researchers in the Quantum Matter group, initially for four research projects.

Many staff are involved with substantial EU Consortia, through FP7 and **Marie Curie** network grants. FP7 grants, plus the very substantial ERC funding already mentioned, totals over £13M during the period. See also section d) on the collaborative use of international facilities, including the LHC.

Leadership

Staff and researchers are involved in leadership in many different ways, both nationally and internationally. Because so many activities could be listed under this heading only some of the most significant are highlighted, taking into account the different stages individuals may be at in their careers; there is pride in the fact that ECRs in the UoA are successful in winning awards and some of these are also highlighted below.

Fellowships of National Academies, Awards and Prizes

At the start of the period there were 10 members of academic staff who were FRSs (*Friend, Donald, Littlewood* (now gone), *Lonzarich, Longair, Efstathiou, Fabian, Rees, Gough, Stirling* (now gone)), and another 10 were elected during the census period (*MacKay* (since left), *Payne, Sirringhaus, Scott, Cowburn, Warner, Baumberg, Kennicutt, Pettini* and *Gilmore*). *Friend* is also an FRAEng, a Foreign Member of the NAS and an Honorary Fellow of the Indian Academy of Sciences; *Kennicutt* is a Member of the NAS. From 2005-10 *Rees* was President of the Royal Society; *Fabian* was President of the RAS (2008-10). *Longair* is an Honorary Member of the American Astronomical Society; *Scott* is a Fellow of the National Academy of Slovenia;

Royal Society Prizes and Medals: *Lonzarich* (Rumford 2010); *Mackay* (Clifford Paterson 2010); *Teichmann* (Francis Crick 2012); *Greenham* (Kavli 2012); *Sirringhaus* (Hughes 2013).

Institute of Physics Prizes: *Friend* (2009 Swan Industrial/Business award); *Donald* (Faraday 2010); *Köhl* (Thompson 2012); *Sebastian*, an ECR, (Moseley 2012); *Guck* (Paterson 2011); *Ritchie* (Tabor 2008); *Cowburn* (Paterson 2008); *Webber* (Dirac 2008); *Baumberg* (Young 2013). *Friend, Payne* and *Donald* have been elected Honorary Fellows.

Royal Astronomical Society Prizes: *Fabian* (Gold Medal 2012); *Gough* (Gold Medal 2010); *Pringle* (Eddington 2009); *Irwin* (Herschel 2008); *Pettini* (Herschel 2012); *Belokurov* (Fowler Astronomy 2011); C *Mackay* (Jackson-Gwilt Medal 2010); *Efstathiou*, *Hewett* and *Irwin* (Group Achievement Award 2008, 2012 and 2012 respectively); *Murdin* (Service to Astronomy and Geophysics 2012).

Additional significant National and International prizes:

Friend: Inaugural Award of the Rhodia-de Gennes Prize for Science and Technology 2008; International Medal for Materials Science and Technology, Materials Research Society of India (2013); Laureate, Millenium Prize of the Finnish Academy of Technology(2010); Harvey Prize of

the Israel Institute of Technology (2011; King Faisal International Prize for Science (2009); *Donald*: L'Oreal/UNESCO FWIS Laureate for Europe (2009); *Rees*: Templeton Prize (2011); Gruber Cosmology Prize was awarded to *Kennicutt* (2009) and *Efstathiou* (2011); *Lynden-Bell*: Kavli Astrophysics prize (2008); *Fabian*: AAS Dannie Heinemann Prize (2008), Mohler Prize, University of Michigan and Petrie Prize Lecturer, Canadian Astronomical Society (2011); *Sirringhaus*: Manfred-von-Ardenne Prize 2009 (European Society for Thin Films); *Teichmann*: Colworth Medal (Biochemical Society 2011); *Cooper*: Humboldt Research Award. (2013); *Scott* MRS Gold Medal;*Warner* was an EPSRC Senior Fellow

More junior staff, including those formally defined as ECRs, with awards including IOP awards (above) to *Guck* and *Sebastian*; the EPS Europhysics Condensed Matter Division Prize (2012) and the IUPAP C10 Prize (2013) both to *Castelnovo*; IUPAP Young Scientist Medal for Magnetism and L'Oreal/UNESCO FWIS fellowship to *Sebastian* (2012 and 2013 respectively); 2009 Springer thesis award to *Amalio*; *Zaccone* ETH Medal Award and the Salvatore and Rita Raeli Prize to *Ciccarelli*; RSC SAC Silver Award Medal (2009) and Fulbright Scholarship (2013) to *Cole*.

Honorary Degrees have been awarded to *Friend*: University of Hasselt (Belgium), University of Nijmegen (Netherlands), University of Montreal (Canada); *Donald*: UEA, Exeter and Sheffield; *Pettini* (UCL); *Longair* (Edinburgh). Additionally, *Crawford* holds the Gresham Professorship of Astronomy. *Cooper* is a Distinguished Fellow of MPI of Quantum Optics.

Visiting Professorships *Withington:* Oxford (and Visiting Fellowship at All Souls College) and Manchester; *Baumberg:* JILA Boulder; *Friend:* Department of Electrical Engineering, Technion (Israel), National University of Singapore and College of Materials Science,South China University of Technology; *Steiner:* Fellow Freiburg Institute for Advanced Studies; *Atature*: Visiting Professorship at the Chinese Academy of Sciences; *Pettini* UCL (Honorary Fellow); *Sirringhaus* Institute of Chemistry, China Academy of Sciences; *Greenham* Department of Chemistry University of Melbourne.

National and International Board Membership, including Research Councils and other Funders and Professional Bodies There are too many to list all individually, so here some key ones are given to indicate the breadth of activities:

Research Councils *Friend*: Member EPSRC Council; *Baumberg:* EPSRC SATs (Physics and Nanotechnology); *Donald* Chair (previously deputy chair) BBSRC Committee C; *Payne:* EPSRC DTC Review Panel and Steering Group for EPSRC/Jaguar Land Rover's Programme for Simulation Innovation; *Köhl:* EPSRC SAT; *Hewett:* STFC Education and Training Panel; *Clarke and Parry:* STFC Astronomy Grants Panel; *Parker, Lasenby* and *Gibson:* STFC Science Board; *Mackay* RCUK Energy Programme Scientific Advisory Committee; *Steiner:* Expert Committee on EPSRC Chemistry Grand Challenges; *Parker* Member of STFC EVAL review panel; *Wyatt:* Alma oversight committee STFC; 2 committees associated with STFC James Clerk Maxwell Telescope; *Kennicutt:* STFC Groundbased Astronomy Facilities review; *Thomson* Chair (previously deputy chair) STFC Peer Review Body and Member UK Particle Physics Advisory Panel; Chair of STFC MICE oversight committee; *Brown* Chair STFC Life Sciences and Soft Matter Advisory Panel; *Gibson* STFC Fellowships panel; *Payne* Chair of Steering Panel for Computational Science and Engineering Division Daresbury and Chair Research Councils' Applications Panel for High End Computing.

ERC *Donald:* Scientific Council; *Köhl:* Starting Grant Selection Panel; *Fabian:* Panel Member.

Facilities *Hills* was seconded to ALMA as project scientist, *Richer* was also a project scientist and *Maiolino* sat on the ESA Committee for ALMA; *Alexander* UK Science Director of the SKA organisation; *Ritchie* Steering Committee for National Centre for III-V Technologies; *Gibson* LHCb UK Spokesperson and Deputy Chair LHCb Editorial Board; CERN LHC Resource Review Board; *Haniff* US Committee on Ground-based Interferometry and European Interferometry Initiative Fizea Programme Selection Committee; *Maiolino* LBT Science and Technical Committee; *Gibson* and *Parker* members of CERN indefinite appointments panel; *Irwin* PI Involvement in Galactic Halo case for 4MOST.

Government-related work *MacKay* (now in Engineering) is CSA to DECC; *Payne* E-Infrastructure Leadership Council (with BIS); *Kennicutt* REF2014 B09 Panel; *Donald* member of Joint DfE/BIS Ministerial committee on STEM education.

International *Friend*: Chair International Advisory Councils for KAUST and National Research Foundation, Singapore; *Donald* ESPCI International Advisory Committee; *Payne* Singapore

Ministry for Education Grants Panel; *Withington* NSF Project Grant Panel; *Fabian* Chair visiting committee and Science Advisory Committee of IUCAA (Pune, India) and member of Kavli and Gruber Cosmology Prize panels; Smithsonian Astrophysical Observatory Review Panel; *Gilmore* NSF oversight panel for the US National Virtual Observatory, Chair IAU Executive Committee working group on Future Large-Scale Facilities; *Thompson* MINOS-UK Spokesperson and member of MINOS Executive Board; *Wyatt* ESO Observing Programme Committee; NAS Astro2010 Decadal Survey Reviewer; *Hewett* Chair of the High Scientific Committee Isle de Paris; *Kennicutt* International Advisory Board MPE; NAS Astronomy nominating committee and 12 other similar committees; *Ritchie* DoE review panel for Sandia National Lab., *Smith* Canadian NSERC grant awarding panel; *Steiner* Advisor to University of Mainz; *Terentjev* Member Al-Faisal University panel; *Brown* NIH Review Panel; *Warner* International Advisory Board Freiburg Institute for Advanced Studies and the MacDiarmid Institute for Nanoscience, NZ; *Cowburn* Faculty Appointment Committee KAUST; International Steering Committee Excellence Lab Nano Saclay, Paris; *Webber* Science Advisory Committee NiKHEF Amsterdam; *Grosche* Member of the Scientific Steering Committee for the Institute of Complex Adaptive Material; *Alexander* International Assessment Committee for CSIRO Astronomy and Space Sciences Division; *Sirringhaus* Scientific Advisory Board Dutch Polymer Institute; *Parker* Hong Kong RAE physics panel. *Longair* Chair ESA High-level science policy committee and Chair SUPA International Advisory Committee; *Hommels* UK Leader for ATLAS SCT upgrade off-detector and DAQ systems; *Hadzababic* EC Panel member assessing grants in 'Future and Emerging technologies'; *Greenham* Chair International Review Committee, Department of Physics University of Cyprus; *Scott* International Advisory Committee for Tyndell Institute, Cork and the Lippmann Institute (Luxembourg); *Payne* Director of CECAM-UK-Maxwell Node and Member of Board of Directors of CECAM; *Artacho* Member Scientific Advisory Committee Donostia International Physics Centre, Chair of the Council of ZCAM node of CECAM, member of selection panels of Spanish HP Computer Service and international recruiting ICREA, Catalan Research Foundation.

Royal Society *Donald* and *Friend* have both served/are serving on Royal Society Council; *Donald* chairs the Education Committee and served on the Physical Sciences Awards Committee; *Baumberg* Dorothy Hodgkin Panel of the Royal Society; *Mackay* International Fellowship Panel; *Thompson* URF panel.

Other *Friend* McRobert Prize Committee, Royal Academy of Engineering; *Payne* Jury for Award of Prix Dr A De Leeuw-Damry-Boulart (FRS-FNRS Belgium); *Ritchie* chaired the IOP's Semiconductor Group and *Donald* the IOP's Biological Physics Group committees.

In terms of leadership and esteem, the strength of the UoA's ECRs is also apparent, with *Hine* a runner-up in PSI-K Young Investigator Award for Excellence in Electronic Structure Calculations; *Morris* awarded a 2013 Nanoforum Fellowship; *Castelnovo* a member of the Helmoholtz Virtual Institute and *Singh* a Young Scientist participant at the World Economic Forum in Tianjin, China; and *Nugent* Coordinator for IOP's African Physics Education Programme

Staff have been involved in more than 540 keynote and plenary conference talks and likewise served on numerous conference organising committees. Highlights of plenary talks include *Warner* at the Brazilian and Chinese Physical Societies conferences; *Sirringhaus* giving the named lecture at the Chinese Academy of Sciences Molecular Science Forum and *Ritchie* at the Optical Society of America Optics and Photonics Congress and the International Conference on the Physics of Semiconductors in Seoul. Staff such as *Friend* and *Lonzarich* typically give several plenaries at international conferences a year and it is impossible to itemise their myriad contributions.. Again our ECR's perform well on the speaking front, with (as an outstanding example) *Sebastian* having spoken at 3 APS March Meetings and 3 Gordon Conferences during the census period. To highlight some examples of conference organisation *Friend* has co-organised two Royal Society Discussion meetings and *Steiner* and *Sirringhaus* each one; *Donald* co-organised a Faraday Discussion meeting; *Sirringhaus* organised an MRS Symposium Memberships of editorial boards are likewise too numerous to list individually, but amongst the UoA's staff 6 are journal editors including both *Scott* and *Payne* for Europhysics Letters at different time points. *Steiner* acted as the founder editor of Soft Matter when it was inaugurated.