Bumps along the road

The barriers to a successful academic career
Barnaby Rowe is a 29-year-old postdoctoral researcher at University College London. An astrophysicist by training, he came to London after a 19-month stint at NASA’s Jet Propulsion Laboratory in Pasadena, California, having previously done a two-year-long postdoc at the Institut d’Astrophysique de Paris in France. By the time his contract runs out in 2014, he will have spent nearly seven years in academia, chasing job opportunities and research funding across three countries and two continents. But his current academic post, Rowe has decided, will be his last. “Some of my colleagues laugh about this, because I’ve been saying it for a long time,” he explains. “But this time I think I’ll do it.”

Rowe’s story is not unusual. Statistics suggest that the vast majority of people who complete science PhDs will never obtain a permanent academic post. This is vividly illustrated in a diagram published in 2010 by the Royal Society as part of a report on the future of scientific careers in the UK (figure 1). Drawing on data from various UK sources, the diagram follows a “typical academic career” through a series of post-PhD transition points, when large numbers of people leave the university environment for careers in, say, government or industrial research. These data show that less than 0.5% of science PhD students will ever become full professors, while just 3.5% will obtain lower-ranking permanent positions as research staff at universities.

For physicists, that 3.5% figure is probably a little low. Slightly older data collected by the Institute of Physics and the US National Science Foundation suggest that the fraction of physics PhD students who obtain permanent academic jobs has historically hovered between 10 and 20%. Yet even this higher number still indicates a yawning gap between the aspirations of early-career physicists and the realities of the academic job market. Indeed, according to an August 2012 survey carried out by the American Institute of Physics (AIP), nearly half (46%) of new physics PhD students at US institutions want to work in a university. The next most popular career plan among those surveyed, attracting 18% of responses, was “unsure”.

The mass departure of PhD-level physicists from academia is not, in itself, a bad thing – either for society or for individuals. “The knowledge and skills developed [in a physics PhD] are first rate, and can be applied across many disciplines to a huge set of potential problems,” notes Steve Hsu, a physicist and vice-president for research and graduate studies at Michigan State University in the US. Jobs in finance and technology, he points out, are usually better paid and more stable than the series of temporary posts that has become the norm for postdocs and other early-career researchers (ECRs). As a result, Hsu says, he often advises PhD students who have an interest in applied research to seek careers in industry, rather than academia.

But for many, the decision to leave the ivory tower is not entirely voluntary, and some postdocs have expressed concerns about their lack of preparation for alternative careers. One person interviewed for this article noted that although most postdocs do make contingency plans, “having a plan B can be seen as lacking commitment to an academic career”, and might therefore harm their chances of obtaining that elusive permanent post. There are also indications that a career structure built on a series of short-term contracts is hurting science as a whole, by depriving it of talented people who leave for reasons that have nothing to do with aptitude or enthusiasm.

All of these factors – the shortage of permanent academic posts, the gap between expectations and reality, the anxieties about training and the fact that “success” depends on much more than talent and hard work – have prompted a groundswell of concern for ECRs. In July an article in the Washington Post about the lack of career opportunities for PhD-qualified scientists in the US attracted more than 3500 comments from readers, many of whom shared personal experiences of the tough academic job market. Meanwhile, in the UK, a consultation exercise carried out in mid-2011 by the pressure group Science is Vital received nearly 700 responses from scientists troubled about the structure of academic careers. Their answers to a questionnaire indicated widespread dissatisfaction about the prevalence of short-term contracts, the perceived or actual need to emigrate or relocate for jobs, and the impact of mobility on families and relationships (see box on p57). Some
of those who responded – including senior scientists as well as ECRs – compared academic research to a pyramid scheme that produces a tiny handful of “winners” and a huge number of “losers” in the scramble for permanent posts.

A paradoxical situation?

When the American baseball player Yogi Berra was asked why he no longer frequented a particular restaurant, he replied, “Nobody goes there anymore. It’s too crowded.” In some ways, the situation for ECRs seems to echo Berra’s words. In essence, the sheer number of junior researchers limits their long-term career prospects, but this does not seem to be stopping people from joining the queue. To put it bluntly, if career progression is so poor, why does the field remain so competitive?

One answer is that an academic career holds many significant attractions. “What I love about working an academia is the independence,” says Sarah Kendrew, an astrophysics postdoc at the Max Planck Institute for Astronomy in Heidelberg, Germany. “Not just in terms of working hours and not having to conform to some corporate image, but independence of thought. In research, we’re not just ‘allowed’ to have our own opinions – we’re actively encouraged to develop and pursue our own ideas.” In comparison with other posts she has held – including an engineering job and an internship in a scientific press office – the independence of academia is “an amazing luxury”. Others echo her views. “The best thing about being a postdoc is having the freedom to do something you are passionate about,” says Aimee McNamara, a medical-physics researcher at the University of Sydney in Australia. “Even if you are employed for a particular project, you get the freedom to pursue your own research interests as well. Not many jobs in the world offer that.”

But there are also some less pleasant factors contributing to the crowded postdoc pool. One is the economy. Many employers that traditionally offered well-paid research work outside a university environment have shed jobs in recent years, limiting alternative career options. For example, a report carried out in June by the scientific data firm Battelle found that the number of biotech jobs in the US shrank by 1.4% between 2007 and 2011, while employment in aerospace-related jobs fell by 5.9%. Both figures compare favourably with the 6.9% drop across the US private sector as a whole, yet there are signs that cuts in key industries have hit some early-career scientists hard. Indeed, the American Chemical Society found that only 38% of new chemistry PhDs who responded to its annual careers survey had found permanent non-academic jobs since graduating in 2011 – the lowest fraction for seven years. The fraction employed as postdocs, in contrast, went up slightly, rising from 45% in 2010 to 47% in 2011.

Another factor boosting the number of postdocs relative to the number of permanent jobs concerns the “pyramid” structure of scientific funding. At entry level, funding for PhD studentships, research assistantships and postdoctoral fellowships is often relatively plentiful. At more senior levels, however, funding tapers off and competition becomes much more intense. According to Athene Donald, a condensed-matter physicist at the University of Cambridge who often discusses career issues on her personal blog, the “pyramid” problem is particularly acute for biomedical researchers. “So much money has been thrown at ‘let’s cure cancer’ or whatever that there are lots of entry-level positions for students and postdocs that don’t go anywhere,” she told Physics World. “And they will never go anywhere because there aren’t enough jobs higher up.”

Advice and training

Funding for physics research is not quite as pyramidal as it is in biomedicine, chiefly because there are fewer entry-level posts available. However, physicists are not immune to other factors driving the postdoc boom. One of these is a lack of advice about possible alternative careers. A recent paper by researchers in the US examined how “adviser encouragement” affects career preferences among PhD students (H Sauermann and M Roach PLoS ONE 7 e36307). They found that while academic physicists, as a group, generally encourage their students to seek university-based employment, they tend to adopt a more neutral or discouraging stance towards non-academic work (figure 2a). This was the case even though the students themselves became slightly less interested in physics research and teaching over the course of their PhDs (figure 2b). According to a 2010 report by the UK research organization Vitae, physicists may also be at a disadvantage in their knowledge of alternative careers. The report found that only 24% of physical-science students had a permanent job directly before beginning their PhDs, compared with 57% of students in the biomedical sciences and 49% of biologists.

Donald acknowledges that senior academics are partly to blame for the shortage of advice, especially when they give the impression that students who leave academia have failed or “wasted” their scientific training. “That is a terrible message [but] it’s pretty pervasive,” she says. “I
believes that universities should also be offering more training to ECRs. “We could do more to prepare students specifically for careers outside physics by requiring them to take courses in, for example, computer science and management,” he suggests. Exposing students to the career experiences of their predecessors who left academia would help, Hsu says.

**Tending the academic dream**

There is just one problem with providing better training and advice on non-academic careers: many PhD students and ECRs are not interested, or feel they do not have the time to investigate their options. “I really don’t have a back-up plan,” says Alan Duffy, an astrophysics postdoc at the University of Melbourne, Australia. “It’s something that I often find myself briefly thinking about, but then other tasks in my day demand my attention and it’s set aside.” David Nataf, an astronomy PhD student at Ohio State University, agrees. “My PhD training was tightly focused on academic careers, but that’s what I chose,” he says. “Had I been planning to opt out, I would have asked for more teaching duties, or taken some programming and statistics courses…[but] I hope to continue in academia and specifically in research for a very long time.”

Duffy and Nataf are not alone. In an informal poll carried out on *Physics World*’s Facebook page last month, respondents were asked to pick which action would be most helpful to physics postdocs. Only 17% chose options related to training or advice on non-academic jobs. The overwhelming favourite, with 73% of the vote, was longer-term contracts – something that would help keep more physicists in academic research, rather than helping them to succeed outside it.

Rowe, however, thinks that longer-term contracts would be a major improvement even for physicists who, like him, decide to leave academia. “I can’t help but think that the annual-to-every-two-years round of writing applications and proposals to stave off your pre-determined unemployment is bad for productivity,” he says. Fewer, longer contracts for postdocs would also benefit scientific projects that have long lifetimes compared with a typical two- or three-year contract, he adds.

Intriguingly, some recent research supports the idea that longer-term contracts would be better for science. After analysing the productivity of 300 physicists, a group of complexity theorists in Italy and the US found that short-term contracts can “amplify the effects of competition and uncertainty” and thus make academic careers “more vulnerable to early termination, not necessarily due to lack of individual talent and persistence, but because of random negative production shocks” (Petersen et al. *PNAS* **109** 5213). The theorists also found evidence of a “rich get

---

*Figure adapted from figures in *Phys. Rev.* **D 84**.*
“When I started out with my PhD, the need to move around to pursue a career in science was actually appealing to me,” says Aimee McNamara, a South Africa-born medical physicist who is currently doing a postdoc at the University of Sydney in Australia. “I liked the idea of experiencing different research environments as well as different cultures, and I still believe it’s a very important thing to experience as a scientist.”

Moving from one location to another is relatively common for physicists. When Physics World asked – via an unscientific poll on the magazine’s Facebook page – what steps physicists had taken to pursue their careers, 38% of the 111 respondents said they had moved more than 500 miles at least once, while an additional 13% had moved a shorter distance. A separate poll on the most important factor for choosing a postdoctoral position found that “location” got the lowest score of all the options offered, attracting a measly three votes out of 63.

The problem is that after a while, moving around becomes more problematic. “Being on two or three-year contracts throughout our late 20s and early 30s means it’s really hard to plan a long-term future – buying a house, having children and so on,” says Sarah Kendrew, an astrophysicist who moved from London to the University of Leiden in the Netherlands before obtaining her current post at the Max Planck Institute for Astronomy in Heidelberg, Germany. “I really find that I’ve had to be flexible and readjust my goals and expectations according to where work takes me.”

Moving around can be particularly trying for early-career researchers with spouses, children or other relatives who depend on them. After obtaining his PhD from the University of Manchester in the UK, Alan Duffy – who was, at the time, single – moved to Perth, Australia, to do postdoctoral research at the International Centre for Radio Astronomy. That decision was easy, he says, but now that he has a partner, his subsequent 3000 km move to the University of Melbourne required some hard thinking. “It was too good an offer to refuse, but only because my partner was able to make it work for her career,” he says. “Some postdocs just won’t be this lucky.”

In addition to the infamous “two-body problem”, in which academic couples struggle to find two research jobs in the same location, there is also a less well-known dilemma affecting physicists who are gay. Legislation on civil partnerships and social attitudes towards homosexuality varies widely among different countries and US states, observes Elena Long, a PhD student at Kent State University in Ohio who has worked on raising awareness of gay, lesbian and transgender issues in physics. Because of this variation, she says, gay physicists may have to balance an attractive job offer with concerns about being accepted in the local community.

In some cases, the need for mobility can prompt or hasten a decision to leave academic research. “One reason why academia doesn’t appeal to me so much is the lack of real freedom to choose where you want to live,” says Barnaby Rowe, an astrophysics postdoc at University College London who plans to leave research to train as a secondary-school teacher. “There are a number of places where you can do astronomy, but they’re quite thinly spread. If a job comes up, you may not get another job offer, so you take it…That lack of flexibility is tough on family members, and research is not something that I love enough to wish to inflict that on them anymore.”

For more information on mobility in physics careers, listen to our podcast “Going where the beam is good” on physicsworld.com
2013
TEACHER TRAINING
SCHOLARSHIPS

www.iop.org/scholarships

TRAIN TO TEACH • £20,000 SCHOLARSHIPS AVAILABLE • 100 TO AWARD FOR 2013

PhD Programme

Ultrafast Imaging & Structural Dynamics

Interdisciplinary research | Renowned research institutions | Excellent research conditions | Advanced courses and soft skills training | Language: English | No tuition fees | Funding available.

We seek highly motivated graduates with an MSc or equivalent in Physics, Chemistry, or Biochemistry.

Apply by 31 Jan 2013 www.imprs-ufast.de

PhD studentships in Quantum, Light & Matter physics

The Quantum, Light & Matter group in Southampton's Physics and Astronomy department conducts world-class research in the fields of quantum, atomic and semiconductor physics, photonics, magnetism and nanomaterials.

We offer PhD projects in:
- atom chips & molecular interferometry
- biophotonics & bionanotechnology
- green photonics & energy conversion
- magnetism & superconductivity
- laser physics & devices
- nanomaterials & liquid crystals
- plasmonics & nanophotonics
- spintronics
- terahertz sources & devices
- theoretical quantum optoelectronics

Fully-funded studentships for UK and EU students include a tax-free bursary of £13,590 pa and tuition fees. For application details and more information:
www.qfm.soton.ac.uk/join.php +44 (0)23 8059 2068 fpas-phdapply@soton.ac.uk

Find all the best graduate jobs, studentships and courses here in Physics World and online at brightrecruits.com
TTP Group plc

DEVELOP disruptive technologies

www.ttpgroup.com
never stop using your head

Graduate and Post Graduate Careers | From £21,850 · Near Reading, Berkshire

A never-ending journey. That’s how we’d sum up a career with AWE. A journey where you can constantly explore fresh territory, research deeper into your chosen field and develop new skills.

As the nation’s largest high-tech research, development and production facility, with sole responsibility for maintaining the warheads for UK’s nuclear deterrent and supporting national nuclear security, what we do is unique. Our standards are uncompromising. And the quality of our graduate training is every bit as impressive. Not only will you gain unrivalled practical experience; you’ll also benefit from continuous professional development including support to gain professional qualifications.

If you’re always asking questions and determined to discover just how much you’re capable of, we can’t think of a better place to start. To find out more and apply, visit our website:

www.awe.co.uk

• Assembly
• Assurance
• Business Support
• Chemical Technology
• Decommissioning
• Engineering Projects
• Engineering Sciences
• High Performance Computing
• Hydrodynamics
• IT – Corporate
• Manufacturing
• Materials Science Research
• National Nuclear Security
• Physics (all disciplines)
• Radiation Science
• Site Utilities
• Systems Engineering

AWE promotes diversity in employment. We welcome applications from women and men, regardless of disability, sexual orientation, racial or ethnic origin, or age. Applications from women and ethnic minorities are particularly encouraged. Successful candidates will be selected solely on their ability to carry out the duties of the post. Because of the nature of work associated with these posts, they are subject to special nationality rules and are open only to British citizens. All selected candidates will be required to undergo security clearance.

Are you a graduate, passionate about science, technology and engineering?

At e2v we help search the cosmos for Earth-like planets, we treat the most serious of illnesses and we keep millions of travellers safe as they fly around the world….and much, much more!

Our graduates are given the opportunity to work on ground-breaking projects like the Kepler space mission and the Curiosity rover for Mars and follow a tailored development programme to give them the best start in their career.

Successful candidates must hold, or be due to obtain in 2013, a minimum 2.2 classification in an engineering or science related degree.

If you have the above qualifications, intellect and passion, please apply at www.e2v.com

+44(0)1245 493493
www.e2v.com

Image courtesy of NASA
Your opportunity to work for Element Six in the world's largest and most sophisticated synthetic diamond R&D facility

**Element Six** is a global leader in the design, development and production of synthetic diamond supermaterials. Element Six delivers extreme application performance through innovative synthetic diamond solutions. In pursuit of this goal, we are building the world's largest and most sophisticated synthetic diamond research and development facility.

This £200m investment at the Harwell Science Park near Oxford in the UK will be responsible for developing innovative products for application within a diverse range of industries, including precision machining, oil and gas exploration, optics and electronics. We are recruiting for the following roles:

**R&D Project Managers – Salary range £45,000-£60,000**

The successful jobholder will manage a project or a portfolio of projects involving the integration of existing and new aspects of Materials Science and Technology and will develop new products and improved production capabilities.

Ideal candidates will demonstrate strong leadership qualities, being capable of motivating and challenging colleagues in a constructive manner with due regard to the creative process. The ability to manage reports, lead teams engage colleagues across the business is essential, as is the ability to work responsibly, safely and to deadlines and budgets. A technical background in materials science, technical ceramics or cemented carbides is preferred, ideally in the fields of powder processing sintering and synthesis of structures/phases; in addition to the associated analytical methods and behaviour characterisation. These roles are ideally suited to candidates with specialist Masters or PhD research qualifications in addition to relevant industry experience. Experience in project management, team leadership and IP development is highly desirable.

**R&D Scientists – Salary range £30,000-£36,000**

With responsibility for undertaking fundamental and applied research involving the integration of existing and new aspects of Materials Science and Technology, the successful candidate will develop and deliver new diamond and CBN products and improved production capabilities to meet business requirements.

Ideal candidates should be able to work within a multidisciplinary team and to present concepts to a wide range of stakeholders. Motivated, enthusiastic and ambitious candidates who possess strong technical capabilities and a pragmatic, hands-on approach should apply. A technical background in materials science, technical ceramics or cemented carbides is preferred, ideally in the fields of powder processing sintering and synthesis of structures/phases; in addition to the associated analytical methods and behaviour characterisation. These roles are ideally suited to candidates with specialist post-graduate research qualifications (Masters or PhD) and/or materials engineers, inorganic chemists or applied physicists with relevant industrial experience.

These roles will be based at Harwell in Oxford - however, some international travel will be required.

For more information on these exciting opportunities, and on Element Six, please visit our website: www.eb.com

If you feel you have the abilities and drive to fulfil one of these positions, please send your CV and covering letter, stating your current salary to Marva Harper-Smith, HR Business Partner – Innovations, email: marva.harpersmith@e6.com

---

**Imperial College London**

Postgraduate Courses in Physics

[http://www3.imperial.ac.uk/physics](http://www3.imperial.ac.uk/physics)

Are you looking to deepen your knowledge of physics? Come and see the range of Masters courses in physics taught in the Department of Physics, Imperial College London, one of the world's leading scientific universities in the heart of London.

**MSc in Physics**

The focus of the MSc is to provide a varied syllabus, with a choice of advanced courses and a major project within an active research group.

**MSc in Quantum Fields and Fundamental Forces**

This course covers all aspects of traditional particle physics, from quantum field theory and string theory to cosmology and quantum gravity.

**MSc in Optics and Photonics**

This MSc prepares graduates for a career in industry or research in lasers, biomedical imaging, displays, and other key research areas and commodity important technologies. The MSc in Photonics is available as a first year of a 2-year MPhil programme.

**MSc in Microelectronics**

The MSc explores the response of materials to high pressures generated by extreme shocks, which is crucial in many fundamental areas of physics and engineering.

**MRes in Nanoscience and Materials**

This MRes explores the marriage of nanoscience with materials science, including nanotechnology, where novel technologies in computing, healthcare and the environment are being developed.

---

**PhD studentships**

**Fusion Energy: Materials and Plasma Scientists**

The Universities of Durham, Liverpool, Manchester, Oxford and York, with Culham Centre for Fusion Energy, the Central Laser Facility and AWE have formed the Fusion Doctoral Training Network with EPSRC support.

With ITER under construction and the recent commission of NF in the US, fusion energy is entering an exciting new era. We work with world-leading facilities, including JET, MAST and the Central Laser Facility, while our Low Temperature Plasma research is linked with major international companies in areas such as semiconductor processing.

Our PhD programme offers:
- Fully-funded 3 and 4-year research studentships
- A training programme in fusion energy, covering materials and plasma science
- Exciting research projects, linked to world-leading fusion facilities
- Materials and plasma research projects for fusion energy
- Plasma projects in high energy density physics and laboratory astrophysics
- Opportunities for international collaboration and travel

For more information on the projects and application procedure visit [www.york.ac.uk/physics/fusion.dtn](http://www.york.ac.uk/physics/fusion.dtn) or come and see us at our open day at Culham by registering at [www.culhamphd.org.uk](http://www.culhamphd.org.uk)

The University of York

---

Physics World October 2012

---

61
Imperial College London

The Centre for Doctoral Training on Theory and Simulation of Materials (TSM-CDT) at Imperial College London is the UK’s centre of excellence for research in theory and simulation, inspired by the challenges of today and the future.

FULLY-FUNDED 4-YEAR PhD STUDENTSHIPS

What we offer:
- Comprehensive training in advanced theory
- Freedom to design your own research project
- Internationally-leading academic supervisors
- Network of 40+ research students
- 80+ collaborative research groups in 7 departments
- Full funding (fees + stipend) for eligible students
- World-class partners in academia and industry

What you bring:
- Strong aptitude for theory and mathematics
- Passion for cutting-edge research in areas including:
  - Theoretical condensed matter physics
  - Statistical physics
  - Electronic structure theory
  - Metamaterials and plasmonics
  - Continuum field theory

Applicants should have or expect to obtain a first class degree in physics, engineering, chemistry, materials or applied mathematics. Apply now for entry in October 2013. For further details visit www.tsmcdt.org

 EPSRC
Engineering and Physical Sciences Research Council

NOTTINGHAM TRENT UNIVERSITY

School of Science and Technology
Physics and Astronomy courses

Are you fascinated by the world around you?

At Nottingham Trent University we offer BSc (Hons) and Masters degree courses in subjects ranging from the large scale of cosmology to the small scale of the quantum world:

- Physics
- Physics with Astrophysics
- Physics with Forensic Applications
- Physics with Nuclear Technology
- Forensic Science (Physical)
- Medical and Materials Imaging

Whatever your interest, Nottingham Trent University will help you develop the skills you need to succeed in your chosen career.

For further information, please contact us:
Tel: +44(0)115 848 4200
Email: sci.enquiries@ntu.ac.uk

www.ntu.ac.uk/sat

Graduate coursework opportunities
Research School of Physics & Engineering (RSPE)

RSPE is one of the world’s premier centres for physics research. It is home to Australia’s world-class heavy-ion accelerator and plasma fusion research facility and a concentration of research in photonics and non-linear optics. We offer a range of unique graduate coursework opportunities based on our research strengths:

- Master of Energy Change
- Master of Nuclear Science
- Master of Photonics

Information & applications: pec@physics.anu.edu.au
W physics.anu.edu.au/education/graduate_coursework.php

Australian National University
TOSHIBA RESEARCH EUROPE LIMITED
CAMBRIDGE RESEARCH LABORATORY

Quantum Cryptography Systems

Applications are invited for two posts in the Quantum Cryptography team at Toshiba Research Europe in Cambridge.

The first role concerns R&D of next-generation quantum cryptography networks and will be conducted in collaboration with the Toshiba R&D Center in Tokyo. Candidates should have practical working experience and demonstrated achievement in optics, electronics and/or programming in C/C++.

The second role concerns experimental verification of quantum cryptographic systems towards industrial standardization, in collaboration with the European Telecommunications Standards Institute. Prior experience of fibre optical systems and/or working with standardisation bodies would be an advantage.

Candidates for either post should hold a degree or PhD in Physics, Electronic Engineering, Computer Science, or a related discipline. Prior knowledge of quantum cryptography is not necessary.

Early applications are encouraged. Applicants should state clearly the role for which they are applying and send a covering letter, CV and contact details of three referees to:

Dr A J Shields, Assistant Managing Director
Toshiba Research Europe Ltd., Cambridge Research Laboratory
208 Science Park, Milton Road, Cambridge CB4 0GZ, UK.
URL: www.quantum.toshiba.co.uk
E-mail: qcjobs@crl.toshiba.co.uk

TOSHIBA
Leading Innovation

Graduate Scientific Software Developer

£23,000-£26,000 BSc/MSc; £26,000-£29,000 PhD

Tessella delivers software engineering and consulting services to leading scientific and engineering organisations across the globe.

We recruit high achievers from leading universities who are passionate about combining their IT expertise with their science and engineering backgrounds to solve real-world problems.

You will enjoy a varied and challenging role, working closely with our clients to understand the business issues they face and helping to design and develop innovative software solutions, being involved in all stages of the software development lifecycle. Projects can range from client based consultancy or IT development to office based client support activities.

We currently have opportunities in Abingdon and Stevenage to work on a range of projects in life sciences, energy and other sectors.

You should have:

- BSc (min. 2:1), MSc or PhD in a science, mathematics or engineering discipline
- Programming experience in at least one of our core languages: Java, C#, C++, C, VB, .NET or Python

Visit www.tessella.com for details
Scottish Universities Physics Alliance
Postgraduate Opportunities

Up to 15 fully funded Prize PhD Studentships and over 100 other funded PhD places in Physics in Scotland.

The Scottish Universities Physics Alliance (SUPA) opens a single door into all Physics PhDs in Scotland. When you apply for a SUPA Prize PhD Studentship, you will also be considered for all other funded places available in Physics departments in Scotland.

Major themes pursued by researchers in SUPA are:

- Astronomy and Space Physics
- Condensed Matter and Material Physics
- Energy
- Nuclear and Plasma Physics
- Particle Physics
- Photonics
- Physics and Life Sciences

Applications should be made at http://apply.supa.ac.uk by 31st January 2013

All Physics PhD students in Scotland are considered SUPA Graduate School students and are eligible to attend all educational and training activities.
The International Max Planck Research School for Quantum Dynamics in Physics, Chemistry and Biology (IMPRS-QD) is a graduate school offering a doctoral degree program in these disciplines.

The IMPRS-QD is a joint initiative of the Max Planck Institute for Nuclear Physics (MPIK), the Heidelberg University, the German Cancer Research Center (DKFZ), the Max Planck Institute for Medical Research (all in Heidelberg) and the Heavy Ion Research Center (GSI) in Darmstadt.

Applications of students from all countries are welcome. To be eligible for PhD studies at the Heidelberg University, applicants should have an excellent Master of Science degree (or equivalent).

International applicants whose mother tongue is not English or German have to provide a proof of English proficiency.

Interested students are asked to apply via web form at: http://www.mpi-hd.mpg.de/imprs-qd/appladmiss.html.

The application deadline is 1 December 2012.

---

Do you want to study for a doctorate whilst gaining invaluable commercial experience?

The EngD is a 4-year fully funded PhD-level doctorate with an emphasis on research and development in a commercial environment.

Research projects are offered in four themes:

- **Signal and Image Processing**
- **Optics and Photonics**
- **Microsystems with Photonics**
- **Digital Tools with Optics**

Successful candidates will normally work closely with their chosen sponsoring company, with support from an Academic and Industrial Supervisor. Funds are also available to support company employees who wish to study for an EngD whilst remaining in employment.

**Funding**

Fees plus a stipend of at least £20,090 (2011/12) are provided for eligible students.

**Entry Qualifications**

Minimum entrance requirement is a 2:1 Bachelors or Masters degree in a relevant physical science or engineering topic.

**Further Details**

For more details including a list of current projects and eligibility criteria visit www.engd.hw.ac.uk or contact Prof Derryck Reid (e: engd@hw.ac.uk; t: 0131 451 3792).
The Okinawa Institute of Science and Technology Graduate University is located on a beautiful subtropical island in the far south of Japan. Our program is based on a firm foundation in the basic sciences and our non-departmental structure encourages interactions across traditional disciplinary boundaries. We are searching internationally for students who will flourish in an atmosphere of encouragement for discovery and innovation. The OIST PhD program is flexible, individualised, and well-resourced, offering top-notch facilities and close supervision in a supportive community environment. All students receive an internationally competitive support package.

Current areas of research focus of interest to physicists include

- experimental and theoretical condensed matter physics
- quantum theory and applications in computing and optics
- nanomaterials and photovoltaic materials
- structural ultramicroscopy and tomography
- mathematical and physical biology
- information in biological systems
- imaging and instrumentation
- catalysis and protein engineering
- marine biophysics and oceanography

Visit www.oist.jp or write to study@oist.jp for information on how to apply.
In radiotherapy MAASTRO is one of the leaders in physics, biological and translational research, both nationally in the Netherlands and internationally. Research successes in the lab or physics are translated to the clinic and are often applied here in clinical trials for the first time worldwide. This enables MAASTRO to improve the concept of individualized radiotherapy. Decision support systems developed by the research department of Knowledge Engineering help physicians to choose the best treatment for each individual patient.

Physics research is performed on a wide range of topics in radiotherapy. Many of the topics are related to improving patient imaging by conducting research into PET-CT imaging, ultrasound imaging, novel CT imaging and small animal pre-clinical imaging. Other topics include brachytherapy dose calculations and particle beam radiotherapy. The research facilities include clinical linear accelerators, treatment planning systems, a small animal radiotherapy system, CT and PET-CT scanners, ultrasound imaging equipment, various devices for measuring radiation dose, simulation software for dose calculations and imaging, and an electronic brachytherapy source.

Several times a year MAASTRO has new positions for PhDs and Postdocs. At this moment MAASTRO has an open position for a PhD-student in multi-modality imaging combined with precision radiotherapy for small animals and a Postdoc position in Modeling of Dose Distributions and Biological Outcome in Particle Therapy. Examples of other vacancies that have been recently posted are:

- Postdoc position in Modeling of Dose Distributions and Biological Outcome in Particle Therapy.
- PhD student in Dose Guided Radiation Therapy with time-resolved 4D portal imaging.
- (Bio) medical engineer or Medical Doctor with an interest for clinical research in molecular imaging of tumor hypoxia.
- (Bio) medical engineer, Physics, Artificial Intelligence, Machine Learning, Computer Science, or equivalent, with an interest for advanced imaging and image analysis.
- Postdoc on Medical Technology Assessment for a project on the cost-effectiveness of Particle therapy.
- PhD student in preclinical research focused on the relation between mitochondrial DNA, Cancer & Radiation sensitivity.

If you are interested in a research position at MAASTRO, please feel free to send an open application to personeelszaken@maastro.nl or fill in an application form on our website www.maastro.nl -> werken bij maastro -> open application.
GRADUATES!
Plan your next move with brightrecruits.com

Looking for employment?
Find your perfect job on brightrecruits.com. With more than 17 specialisms in physics and engineering to choose from, we have something for everyone.

Interested in further studies?
We have loads of international postgraduate opportunities just waiting for your application.

Need some advice?
Our Careers insight section offers top tips on everything from writing a CV to succeeding in psychometric tests. Plus there are some great case studies to help you to decide on your future career.

Register online with brightrecruits.com today
www.brightrecruits.com/register