The newspaper of the physics community

September 2005

interactions

Institute of Physics

Physics students get a boost

Heather Pinnell reports on the launch of the Institute's Undergraduate Bursary Scheme.

An Institute scheme designed to attract more students into physics is being rolled out this month. The Undergraduate Bursary Scheme (UBS) will offer grants of £1000 per annum to undergraduates following accredited physics courses in the UK and Ireland, starting with those entering university in autumn 2006.

Universities that choose to take part in the scheme will be given a quota of bursaries to distribute among students about to embark on a physics course at their institution. Each university will use its own detailed criteria to allocate the funds, but the emphasis will be on encouraging applications from students who do not traditionally choose physics or from those who might be deterred from the subject for financial reasons.

In total, 300 bursaries a year will be available. The quota for each institution will depend on the number of students in the second year of its physics courses, and the distribution will be biased in favour of smaller physics departments.

Jan Chlebik

An Imperial College student at work. Women are among those targeted by the Undergraduate Bursary Scheme.

Students following a three-year bachelor's degree will receive £3000 over the duration of their course; those studying for a four-year integrated master's degree will receive £4000. There will be appropriate arrangements for those on non-standard courses. Bursaries will not be transferable between institutions, but students will not lose them if they switch between accredited courses at the same university.

These physics-based bursaries are not intended to replace standard university bursaries but, where physics departments have their own schemes for prospective students in place, they may choose not to give both to the same student.

The scheme has been welcomed by a number of university physics departments. Durham University is one of those participating and its head of physics, Richard Abram, says: "Anything that encourages people to come and study physics, particularly if they have difficult financial circumstances, is a good thing.

"I think the Institute has shown the way here by producing this bursary scheme. It's the first professional institution to do this following the introduction of top-up fees, and it's clearly to the benefit of the physics community as a whole, and certainly to the students studying physics and to university departments."

Durham University plans to concentrate on students in financial need, but also intends to use the bursaries to encourage more local students to come to the university. Abram points out that the north-east has one of the lowest participation rates for higher education in the UK.

Institute of Physics
Undergraduate Bursaries

The emphasis is on students who do not traditionally choose physics or those who might be deterred for financial reasons.

Jonathan Tennyson, head of the physics department at University College London (UCL), is also upbeat about the scheme: "It is an extremely positive response to the changes to fees and the problems physics has in recruitment of students. I am sure it will have an impact." He says that UCL is likely to target certain local disadvantaged schools and to address the under-representation of women, although arrangements have not yet been formally agreed.

Peter Main, the Institute's director of education and science, says that with the UBS the Institute is signalling its commitment to support students who are qualified to study physics, and who are thinking about doing so, but who might be put off by the top-up fee arrangements.

"The possibility of getting a bursary may be that little bit that tips the scales," says Main. "It should benefit about 10% of the cohort of undergraduates studying physics. But there will be many other university bursaries out there as well, so it's just a part of the picture."

Many students and politicians had argued for more radical measures, such as the abolition of tuition fees and the full restoration of grants, and they questioned the value of bursaries. While the Institute took no position on the issue, it wanted to ensure that the introduction of top-up fees did not turn students away from physics, says Main.

Labour MP Ian Gibson, former chair of the House of Commons Science and Technology Committee, gave the scheme a cautious welcome. In April the committee produced a report that praised the proposed scheme and recommended that the government should set up others like it, and Gibson remains supportive.

"I think it's a good initiative and I wish it well. Hopefully it will attract people into this subject area, though I have my doubts that it is the panacea that's required to bring people into physics," he said. "But at least it's a step forwards and not backwards."

The Institute's chief executive, Bob Kirby-Harris, says that the Institute has been working closely with physics departments in the UK and Ireland to roll out the scheme: "We want to stimulate demand for physics and to encourage young people to study physics who might otherwise have studied something else.

"We'll be actively publicising the scheme to post-16 students and we will maintain close connections with university admissions tutors and student advisers in schools," he says. "We see the UBS as one means to encourage greater participation in undergraduate physics."

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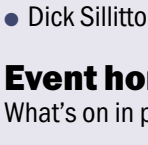

"Teaching is just like doing stand-up comedy."
Bruce Fummey, p5

"Real science is just as way out as the science fiction."
Jon Tucker, p8

HIGHLIGHTS

Guiding girls towards science

This summer Girlguiding UK launched a science resource pack for Einstein Year aimed at inspiring girls aged 10–14 to become scientists. Called *Go For It! Experiment*, the pack includes dozens of experiments that Girl Guide groups can do together and contains ideas for a half-term's worth of activities. There is a section exploring the forces of nature – such as static electricity and the Bernoulli effect – and others on what makes popcorn pop and how rocks form.

www.girlguiding.org.uk

Music of the heavens

Young people visiting the National Maritime Museum in Greenwich over the summer had the chance to create musical compositions inspired by the "sounds" of the cosmos. Musician and PhD student Jade Hamilton held the free Heavenly Music workshops as part of Einstein Year. The participants used hand-held low-frequency radios to pick up signals from sources including the Sun, stars, the aurorae, Jupiter and its moons, pulsars, the cosmic microwave background and even the natural frequencies of the Earth.

The young music-makers then used these to make stellar compositions of their own with the musical instruments supplied. The workshops also included background on the historical connections between astronomy and music, and there were musical demonstrations to help to explain the physics of sound.

Spend a penny on new batteries

Physicists in Singapore have managed to create a paper battery that generates electricity from urine. The battery could be used as a power source for cheap, disposable healthcare test-kits, say the researchers in the August issue of the Institute's *Journal of Micromechanics and Microengineering*.

The battery unit is made from a layer of paper steeped in copper chloride sandwiched between strips of magnesium and copper. The final product, which is laminated in plastic, is just 60 × 30 mm, with a thickness of just 1 mm, making it smaller than a credit card. Using 0.2 ml of urine, the authors generated a voltage of around 1.5 V and a maximum power of 1.5 mW.

Lead author Ki Bang Lee of Singapore's Institute of Bioengineering and Nanotechnology says: "We are striving to develop cheap, disposable credit-card sized biochips for disease detection. Our battery can be easily integrated into such devices, supplying electricity on contact with biofluids such as urine."

Prime Minister congratulates innovative teacher

To celebrate Einstein Year and the opening of the new National Science Learning Centre this autumn, the Institute is awarding £3000 bursaries to teachers of physics. The centre, in York, will provide professional development opportunities to science teachers around the country and is the only facility of its kind in the world. The bursaries will allow teachers to take full advantage of the centre's facilities to develop their own innovative teaching ideas.

The first of these bursaries went to physics teacher Nick Baker (above right) of the Queen Elizabeth Community Technology Centre, who was presented with his award by Prime Minister Tony Blair. Baker plans to use the money to develop new computer-based resources to enhance his students' understanding of physics in applied science GCSE.

HEFCE to work with Institute

By Ayala Ochert

The Higher Education Funding Council for England (HEFCE) said on 28 June that it would help to protect "strategically important subjects" – including physics – by working with subject-based organisations like the Institute of Physics.

In the wake of several high-profile science department closures, last December then education secretary Charles Clarke asked HEFCE to see what could be done to protect those subjects. In its response, HEFCE said that it was an "exaggeration" to say that university science departments are in crisis – despite the fact that 30% of physics departments have closed in the last decade. It also said that "intervention [in the higher education market] should be kept to a minimum".

"We must not regard every single announcement of the closure of a department as a reason to engage in moral panic," says Sir Howard Newby, chief executive of HEFCE.

Newby argued that closures could be seen simply as part of the "natural adjustment" of universities to fluctuations in student numbers and changing priorities. "The categories we are dealing with – maths, physics, chemistry, engineering, biology – these are 19th-century disciplinary categories. Yet this is how many universities still choose to organise their science teaching today, despite the fact that fewer students are opting to study these courses," he says.

To stimulate demand for subjects that are considered vital to the national interest, HEFCE has begun working with organisations that represent those subjects. It has given £942 000 to the Royal Society of Chemistry and £2.85 m to the Royal Academy of Engineering for pilot projects in these strategic subjects. In January it agreed to give the Institute more than £40 000 to begin a consultation process aimed at identifying pilot projects to increase the number of students taking physics.

In the spring the Institute convened a series of meetings in Birmingham, Leeds and London with academics, teachers, industrialists, careers advisers and other interested parties. They came up with a range of ideas, including improved careers advice in schools, targeting schools that have low participation rates in physics, and conducting research into ways of attracting more girls into physics.

The Institute will put in a detailed formal application for funding to HEFCE by the end of the year.

• The number of students taking A-level physics declined again this year by 2% to 28 119.

POSTER COMPETITION

This poster, created by Ng Alvina Jane, aged 11, from Hong Kong, was one of the winning entries in the Physics Across the World poster competition, which was held as part of Einstein Year and World Year of Physics. Students aged 10–16 were asked to create colourful posters showing how physics and its applications make their lives better. Almost 2000 students from 34 different countries entered the competition, and the winners were chosen at the European Physical Society (EPS) meeting in Bern, Switzerland, in July. Each of them received a digital camera, donated jointly by the EPS and the Institute of Physics. The winning entries can be seen at http://www.einsteinyear.org/events/posters.

Instrument maker to help PhD students

By Ayala Ochert

Scientific instrument makers Cambridge Magnetic Refrigeration (CMR) have an innovative new scheme to support postgraduate students.

The company has promised to make an annual donation to the Institute's Low Temperature Group of 1% of the turnover from sales to the group's members. This donation will help to fund the group's existing bursary scheme, which is designed to support UK-based PhD students to attend international conferences.

CMR customers will be able to identify themselves as members of the group when they make purchases via their online store. The instrument makers are also setting up a similar scheme for the Institute's Superconductivity Group.

"We are delighted that CMR have chosen to support the groups – and their student members – in this way," says Peter Main, the Institute's director of science and education, although he stressed that the scheme does not imply any endorsement of the company's products.

The scheme is the brainchild of CMR's managing director, Kurt Haselwimmer. "Having been an academic myself, I am aware of the symbiotic relationship between scientific instrument companies and their users," he says. "We occupy that grey area between the academic and industrial communities where so much technical and cultural innovation lives."

Haselwimmer encourages other scientific instrument companies to support the academic community in similar ways. With sales of scientific equipment in the UK worth some £100–200 m per year, it might be possible to raise as much as £2 m to support UK academics, he says.

New Kung Fu site is smash hit

Ayala Ochert reports on an Einstein Year website designed to attract 11- to 16-year-olds.

How do you get teenagers interested in concepts such as conservation of energy and momentum, and Newton's laws? The answer: show them how they can be used to explain how Kung Fu works.

That's the idea behind a dynamic new multimedia website created by the Institute for Einstein Year – www.kungfuscience.org. It is just one of several innovative projects for Einstein Year that engage young people by highlighting the physics involved in activities they're interested in. Kung Fu is currently enjoying a renewed popularity, thanks to recent films like *Crouching Tiger, Hidden Dragon*.

The website follows the story of a young physicist, Michelle Cain (who works at the Institute), who has just two days to learn how to break through three planks of wood with her bare hands.

Luckily she has Kung Fu master Chris Crudelli (presenter of BBC Three's *Mind, Body and Kickass Moves*) to help her. The website includes videos of Crudelli demonstrating some Kung Fu techniques – including breaking concrete blocks – as well as the moment of truth when Cain tries to break the wooden planks.

Cain has a "lab book" where she records her thoughts and experiments, and reassures herself that she can break the boards by working out the physics behind the Kung Fu move. "Chris's advice does make sense from a physics point of view," she writes.

Crudelli shows her the three crucial aspects to the technique. First, she must pretend that the target is well below the boards. This is because beginners naturally slow down as they reach the target to avoid hurting their hand. "If I do this I could end up hurting my hand even more as I might not have enough force to break the wood," writes Cain. "All my downwards momentum would be absorbed by the wood as it bends slightly, and then directed back at my hand as the wood springs back to its original position. Ouch!"

David Bebber

Physicist Michelle Cain demonstrates how she used the principles of science to master the art of Kung Fu.

Second, she should try to move her whole body downwards as she strikes and not just her arm. "Kinetic energy is proportional to mass, so the more mass I can put into my strike, the greater my force will be," writes Cain.

Third, she must turn her hand upwards just before the point of impact. Cain concludes that this ensures the smallest surface area of the hand is used so there is more energy per unit area at impact.

The website shows Cain calculating the energy required and working out whether it is possible for her to break the wood, given her size and how fast she can move her arm. She even gets in sports scientist David James to record her, using a high-speed camera to determine her speed precisely. As the picture above makes clear, theory and practice came together perfectly in the end.

While some devotees of Kung Fu have not appreciated this demystification of their art, others have praised it. As one visitor to the site wrote: "It's no longer a case of mind over matter, but more an understanding of matter with the mind."

www.kungfuscience.org

Tribute to wartime radar research

In June Sir Bernard Lovell unveiled a plaque at Malvern College to commemorate the radar research that he and others did while based there during the Second World War.

In 1942 the boys at Malvern College, a public school, were moved out and the Telecommunications Research Establishment (TRE) was moved in. Lovell headed the TRE team that developed the H2S radar system, which allowed RAF bombers to identify targets for night-time and all-weather bombing. It is said that the H2S technology gave the Allies a crucial advantage that helped them to win the war.

After the war, Lovell set up the Jodrell Bank radio telescope in Manchester, and he went on to have a distinguished career in radio astronomy.

Physicists get paid the most

By Ayala Ochert

One in five university physicists earns more than £50 000 but their numbers are declining, according to a report by the Higher Education Funding Council for England (HEFCE).

The study looked at the numbers of academics employed in England during the last eight years and how much they are paid. It found that lecturers in physics, chemistry and mathematics received the top pay, with physicists receiving the most.

The median salary for physicists on permanent contracts in 2003–4 was £41 330, well above the overall average of £35 370. The study also looked at the top earners – 21% of university physicists earned more than £50 000, compared with 12% overall.

The bad news is that there are fewer physicists than there were in 1995. Back then there were 1833 physicists with permanent jobs in academia, but in 2003 there were 1646 – a drop of 10%. During the same period the overall number of academic staff increased by 16%.

There were similar declines in the numbers of chemists and mathematicians. However, there was an increase by 19% in those classified as working in "other physical sciences", whose numbers rose from 1316 to 1562. The number of academics working in the biological sciences rose by 26% in the eight-year period.

"Physics is very top heavy in terms of departments rated 5*. Many of the departments with lower grades have closed. This means there's a high concentration of high-quality research people, many of them professors," said Peter Main, the Institute's director of education and science.

The HEFCE study, "Staff employed at HEFCE funded HEIs: trends, profiles and projections", also looked at the demographic changes since 1995. The population of university physicists actually got younger during the period – 44% were aged over 50 in 2003, compared with 52% in 1995. This contrasts with an increase in the overall proportion of academics aged over 50 in that time – up from 34% to 41%.

Despite an increase in the proportion of women employed as university physicists – from 7% to 10% – it was still the lowest of all subject areas.

IN BRIEF

● The **35th Annual General Meeting** of the Institute of Physics took place on 21 July. Members passed the following four resolutions:
– BDO Stoy Haywards LLP were reappointed as auditors *(98.7% in favour);*
– new annual membership subscription fees from 1 January 2006 were approved *(90.3% in favour);*
– amendments to the Royal Charter were approved *(94.8% in favour);*
– amendments to the Bylaws were approved *(94.0% in favour).*

● From 2006 ***Physica Scripta*** **, a leading international journal for experimental and theoretical physics**, will be published jointly by Institute of Physics Publishing and the Royal Swedish Academy of Sciences. The academy had published the journal in house but this move will enable it to promote the journal to new markets through the Institute's global publishing network. The academy will continue to manage all submissions and the peer-review process, while the Institute will carry out its publication, distribution and sales.

NEWSMAKERS

Sir David Wallace, past-president of the Institute of Physics, has been appointed director of the Isaac Newton Institute for Mathematical Sciences at the University of Cambridge, starting in October 2006.

John Womersley is to be director of particle physics at the Council for the Central Laboratory for the Research Council.

Lloyd Fletcher, information systems manager at Institute of Physics Publishing, has won a special commendation in the Working Families "Britain's Best Boss" competition for his championing of innovative family-friendly policies.

Phil Willis MP (Liberal Democrat) has been appointed chairman of the House of Commons Science and Technology Select Committee.

Muzzamil Lakhani, a partially sighted physics student at Bristol University, was named International Student of the Year 2005 in recognition of his triumph over adversity. He came to the UK from Pakistan and learned to walk with a cane and lead an independent life.

Peter Kalmus has been awarded the European Physical Society's 2005 HEPP Outreach Prize for his long-standing involvement in particle-physics outreach in schools and to adults.

Have your say in shaping the Institute's future

It has been two years since the Institute developed its first Strategic Plan, which covered the years 2004–2008. We have achieved much since then, not least the introduction of *Interactions*, as well as the succcessful launch of Einstein Year and the creation of the Undergraduate Bursary Scheme. There have also been changes to the environment in which we operate, with the government's own 10 year strategic plan for science and the recent national focus on the problem of closing university departments. So it is timely to revisit the plan and update and refocus it.

In producing this 2006–2010 Strategic Plan we are seeking to consult as widely as possible. The consultation process will culminate in a final plan, to be agreed by Council in October, that will provide the "envelope" within which the more detailed plans and budgets for next year's activities will be set. The Strategic Plan is broken down into three levels:

- the identity and mission, the vision and the values of the Institute, which guide everything that it does;
- the strategic goals of the Institute – what the Institute is trying to achieve;
- the programmes through which the Institute delivers its goals – further subdivided into strategic and enabling programmes – the what and the how. The draft form of these are given in more detail below.

If you have comments about the ideas described here, we would encourage you to raise them through the formal channels of your local branches or groups. Alternatively, send your comments to us (e-mail: **strategy.responses@iop.org**; Web: **http://members.iop.org/strategy**).

IDENTITY & MISSION

The identity and mission statement is a description of what the Institute is and what it does. Based on the Charter, it is the standard wording used when describing the Institute.
The draft statement is:

The Institute of Physics is a leading professional society that supports physicists throughout their education and career and promotes the international advancement and dissemination of physics in order to further the understanding of the physical world and its application for the benefit of society.

Or, in shorthand:

Promoting physics, supporting physicists, engaging society

VISION

The Institute's vision statement sums up the Institute's ultimate aim. Ideally it should be memorable and meaningful – for members, staff and all other stakeholders.
The draft statement is:

First for physics

VALUES

The Institute's values describe what the Institute stands for and the guiding principles for how the Institute should behave.
The draft values are:

Professional	accurate, effective, efficient, using and developing best practice
Ethical	honest, respectful, fair, accountable
Passionate	enthusiastic, committed, forward-looking
Open	to debate, to change
Inclusive	listening, working in partnership, teamwork, valuing diversity, supportive, approachable
Authoritative	expert, influential, trusted

STRATEGIC GOALS

The strategic goals sum up what the Institute is trying to achieve.
Five draft goals have been identified:

Next generation	A strong demand for physics courses at school and university in the UK and Ireland.
Members	A broad, growing and engaged membership, encompassing the whole of physics.
Physics-based sector	A healthy physics sector – in education, research and business – in the UK and Ireland.
Dissemination	A leading global communicator of physics to all audiences.
Society	A strong worldwide physics community engaging in global issues and contributing real benefits to society.

PROGRAMMES

The Institute's programmes are what the Institute plans to do to reach its goals. They are split into strategic programmes – the what – and enabling programmes – the how.
The 10 draft strategic programmes are summarised below:

Strategic Programme	Aim
Membership	To build a larger and more engaged membership, representative of the breadth and depth of the physics community.
Education	To improve provision of physics teaching and careers advice in schools, colleges and in higher education.
Promoting physics	To modernise the "physics brand" and promote physics to all sectors of society, building interest, support and engagement.
Policy and advocacy	To exert effective influence on government policy in key areas, based on well researched, authoritative and representative Institute policy positions.
Promoting the Institute	To maximise the Institute's impact and influence, through strong and consistent brand messages.
Science and research	To engage with the academic community at university, department and individual levels, and to maintain and improve the quality of research in physics and related disciplines.
Industry and business	To engage with the business community, provide services to members within that community and improve on the knowledge-transfer and innovation performance of physics and related disciplines and on the economic contribution of physics-based enterprises.
Diversity	To promote diversity across the physics community by identifying and promoting best practice.
International	To take a leading international role – with international, European and other physical societies – in the promotion of physics.
Publishing	To be the world's leading physics publisher.

Enabling programmes support the delivery of the above strategic programmes.
The four draft enabling programmes are summarised below.

Enabling Programme	Aim
Finance and funding	To ensure the long-term financial sustainability and effectiveness of the Institute.
Governance	To ensure that the Institute conforms to best practice as a charitable organisation – at minimum operating within the Charter and meeting all legal requirements – and ensure effective consultation with its members and other stakeholders.
People and processes	To maximise performance through effective management processes and well trained, motivated and engaged people.
Systems and facilities	To maintain the Institute's facilities and systems in a cost-effective manner.

profile: Bruce Fummey

A cosmic comic is born

Ayala Ochert meets a comedian standing up for science.

Lawrence McNamara

Bruce Fummey experiments with extracting the humour from physics.

By day Bruce Fummey is a physics teacher at Larbert High School in Falkirk, but by night he is – so he claims – the "funniest guy on the Afro-Celtic comedy circuit". It might seem like a strange combination of careers but, according to Fummey, the two are not so different: "For me, teaching is just like doing stand-up comedy. I just slip in a bit of education when the kids aren't looking."

To make the point, Fummey has just created a stand-up comedy show for the Edinburgh Fringe called *The Greek, the Apple and the Time Machine*, which traces the history of physics from Aristotle, through Newton, via Maxwell and all the way to Einstein. The story he tells – of the process of unification in physics – is one you've probably already heard, but you won't have heard it told like this before (as Fummey warns, don't bring your granny). If it goes down well at the Fringe, he hopes to take the show on a national tour (and he might even clean up some of the jokes).

Growing up in Perth as a mixed-race boy from a single-parent family – his father was from Ghana and returned there shortly after Fummey was born – life was tough. But, despite some ups and downs in his school career, he held on to a love for physics and science throughout. "My teacher was a guy called Peter Murphy and he was passionate about the subject," he recalls. "That's what teaching is about – communicating a passion." For Fummey, that means making sure that his students are having fun and telling them stories that keep them engaged. "People learn when they're having fun," he explains.

He had originally planned to go into the ministry after leaving school but, after taking a physics degree at the Paisley College of Technology, followed by a series of what he calls "crappy jobs", he decided to train as a physics teacher instead. After four years of teaching he moved on to a computer training job at Scottish Amicable. "I left while I was still enjoying the party," he says. "I wasn't trying to get away from teaching; I was going towards something else."

Fummey then qualified as a financial adviser. He excelled in the exams, becoming one of a handful of people in Scotland to be elected a fellow of the Society of Financial Advisers on the strength of his exams alone. But, he admits, he was "rubbish at selling", and two years ago decided to quit the business to follow his dream of becoming a stand-up comedian. Around the same time, he heard from a former colleague that his old job at Larbert High School had become available. "They kept the job open for me for 14 years – nobody noticed I was away," he jokes.

Fummey had always known he could make people laugh. At school he was the "class clown", and he had since developed his skills at his local speakers' club. In 2001 he won the Association of Speakers' Clubs national competition with a funny, yet poignant, speech called "Confessions of an anorexic" (much of Fummey's humour references his not inconsiderable girth). But it was after a Burns Supper speech that brought the house down that he decided to try his hand at stand-up comedy. "I was on cloud nine after that speech. The buzz of people coming up to you and shaking your hand – it was wonderful. As a stand-up you're always trying to recreate that," he says. The comedy went well from the start, and soon Fummey started his own comedy club, Just Laugh, which now has shows in Dundee, Stirling and Perth.

"Teaching is about communicating a passion – and people learn when they're having fun."

He's also enjoying being back in the classroom, although he says that the environment has changed in the 14 years he's been away. "I think it's a much more difficult job now than it was before – the standard of behaviour and the pupils' attention spans have gone down. There are also lots more boxes to tick and we're constrained by targets and SATs." But Fummey says he still loves the job.

At first his return to physics teaching was meant to be a stop-gap until his stand-up and speaking career took off. But now that it has, he feels torn. "I'm trying to spin different plates – teaching and running a comedy business. Ultimately, something's going to have to give, but I don't want to give up teaching. It's a fun job."

His current stand-up show based on physics may be the way forward. "This project has got me really enthused and made me realise there's so much more stuff I want to learn about. I think I'd like to draw it all together and do 'performance physics' – entertainment that makes science accessible to people," he concludes.

www.brucefummey.co.uk

OBSERVATIONS

Imperial College physics student James Martin describes his summer in Beijing, which he spent exploring physics-based businesses in China.

Monday

I arrived at the airport yesterday with my "Institute of Physics, Beijing" sign written in Chinese. When I got to the Institute offices, I discovered that they are part of a huge science park that includes restaurants, a park and sports facilities. My contact, Prof. Mingfang Lu, first took me to meet representatives of the Chinese Physical Society. The society apparently kept physics alive in China during the Japanese occupation in the Second World War. It has since expanded from 50 members to 40,000 and is still growing.

I'm here because earlier this year the Royal Academy of Engineers and the Institute of Physics jointly awarded me their Engineering Leadership Award. I'm using the prize money to find out how business – and physics – operate in the world's fastest growing economy.

I don't have to travel far to visit my first Chinese business – Tri-Cycle, a magnetic material manufacturer, is in the same science park. It produces components for all kinds of devices, from hard-disk drives to industrial batteries, and it is a spin-off from some research funded by the Chinese Academy of Sciences. This science park seems to be full of companies like it.

Tuesday

I visited Tsinghua University and was shown round some of their condensed matter and quantum physics experiments. The Chinese research budget is increasing every year and Tsinghua seems to be getting an increasing proportion. They also seem to take academic work very seriously here – during the exam period, traffic is diverted and roadworks are paused so that students can work in silence!

My next stop was the National Natural Science Foundation of China, which distributes roughly 30% of the country's basic science research funding. Prof. Zu Guang'an showed me round their new facilities, including an impressive glass-walled Sino-German conference centre. After lunch I visited Daheng Laser, which uses lasers to print designs on packaging and to cut out intricate shapes. The company seems to be doing very well locally, but the manager explained the importance of international trade to a business like this and how it has created China's recent explosion in prosperity.

Wednesday

The day started with a visit to Suzhou Xingheng Power Supply Company, which (as the name suggests) produces power-supply packs, mostly for use in movie cameras. Their innovative design provides constant power with self-regulation, which means that if there is a faulty core or component, it is automatically switched off.

The owners treated me to a fantastic lunch at a local restaurant, followed by tea at a local tea house. There were more than 1500 different types of tea on offer, although I tasted just 15.

My final visit was a formal tour of the Institute of Physics offices, followed by dinner with the vice deputy director, Prof. Mu Sun, who told me about the Institute's publishing operation, which supports China's huge and growing scientific community.

Thursday

Before leaving to go home, I have a couple of days sightseeing – taking in Tiananmen Square, the Forbidden Palace and the Great Wall. It is a really eye-opening trip. I had read about China's growing economy, but now I've seen for myself what's behind it. In this hard-working, competitive and creative atmosphere, progress seems inevitable and will probably accelerate as the infrastructure improves. Sitting on top of the Great Wall (1200 steps up!), reflecting on my visit, I realise what a vibrant past and promising future this country has.

For details of the Engineering Leadership Award, visit http://www.raeng.co.uk/education/undergrad. To contribute to **OBSERVATIONS**, e-mail your idea to interactions@iop.org.

Institute of Physics

interactions

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LETTER FROM

...the chief executive

Four years ago this month, when I was a pro vice-chancellor at the University of Namibia, I was involved in organising an international conference looking at how universities engage with their communities to promote sustainable development. It took place in Oshakati, a small outlying town in the north of the country, where the university had recently established its second campus.

University staff met academics from other southern African countries and members of the local community to consider case-studies of university–community projects and to produce an action plan for how universities should work with neighbourhood "stakeholders" in developing their regions. Out of it came a range of successful programmes, including science foundation courses, small business training, careers guidance and placement, and distance-learning science degrees.

Looking back, I'm struck by the parallels between the work I was doing then and the Institute's preparations for the World Conference on Physics and Sustainable Development (www.wcpsd.org), to be held in Durban, South Africa, in October. The world community of physicists will be working together to examine case-studies and to develop an action plan for how physics can contribute to four key areas: economic development, energy and the environment, education and health.

The conference is particularly fitting for this International Year of Physics, and its subject matter couldn't be more pressing, as the science academies of the G8 nations made clear this summer. Before the summit in Gleneagles they produced a statement emphasising the fundamental importance of science, technology and innovation in resolving the problems facing Africa and other developing regions.

The Institute is making a major contribution to the Durban conference. Sir John Enderby, our president, is a member of the International Advisory Committee; Peter Melville, the Institute's international director, is chairing the Economic Development Committee; and, as chief executive, I'm involved in the education programme. A brand-new Lab in a Lorry will also be there, after touring South Africa, and we're taking along some physics education resources to explore how the lorries might be modified for use in the developing world.

I firmly believe that physics has an important role to play in improving the quality of life of people in developing countries. I hope you agree, and I welcome any ideas from members that our delegation can take to Durban.

Bob Kirby-Harris is the Institute's chief executive.

Licence to heal

Jim Al-Khalili is a great science communicator, and I broadly share his take on *What the Bleep Do We Know!?* ("Antimatters", July). There is indeed a lot of quasi-scientific claptrap out there that could do with having a few buckets of the cold water of hard science poured over it. But, as one who practises some of the dark arts of New Ageism, I wonder to what extent his ferocious attack is based on knowledge resulting from any scientific studies he has conducted into the subject, as opposed to personal, non-scientific prejudice.

Dr Al-Khalili may be reassured to know that a number of the practices that he regards as so dangerous have governing bodies that train and license practitioners. My own discipline of spiritual healing involves more than two years of training and a code of conduct that ensures that we work alongside conventional medicine, not instead of it. As a result, the NHS approves several alternative therapies for referral.

Having a sceptical mind and a scientific education, I resent being told that I am gullible and/or influenced by the placebo effect. There is more to it than that – a view shared by the 3000 scientists and medics who form the Scientific and Medical Network. They seem to have an open mind about what Dr Al-Khalili describes as "New Age mumbo-jumbo".

Sure, there are plenty of flaky types out there who give us a bad name, but much of what he so despises is fascinating, potentially beneficial and worthy of further study.

Michael Bland
London W5

Correction

Rambert Dance Company will not be performing *Constant Speed* at Sadler's Wells in London on 16–19 November as we stated in July. For full details of Rambert's national tour, tel: 020 8630 0600.

Write to interactions@iop.org or the address above. Letters may be edited for length.

OBITUARY

Richard Sillitto (1923–2005)

Richard Sillitto, a pioneer in optics, died on 19 April. Born in Lockerbie, Dumfreeshire, he studied physics at Edinburgh University before being posted to the Admiralty Signals Establishment in 1943 to work on covert infrared signalling equipment and optical techniques for detecting targets in noisy radar displays. His future wife, Winifred McMillan, worked there as an engineer.

In 1946 Edinburgh University invited Sillitto to research the Kapitza effect, but the proposed experiments were beyond the existing technology. He later worked on the new Cockcroft–Wilson high-voltage machine, and in 1983 he became head of the new applied optics research group, doing pioneering work on microdisplays.

Sillitto became a fellow of the Institute in 1960 and was a fellow of the Royal Society of Edinburgh and of the Optical Society of America. He served on the *Progress in Optics* editorial advisory board and on the Edinburgh University senate. He also gave lectures and radio broadcasts on popular science topics and chaired the Scottish branch of the Institute in the 1970s.

Students remember his excellent lecture preparation, inspirational teaching, quiet manner and dry sense of humour. Former student Howie Firth says: "Of all the skills that we need to draw upon in life and in science, clarity of thought is up there at the very top, and Dick Sillitto's teaching simply glowed with it."

Remembered by his son, **Hillary Sillitto**.

notices

NEW BUSINESS PARTNER

Tessella Support Services.

NEW MEMBERS

Andrea Adlam, Syed Ahmed, Atif Aziz, Pavel Belov, David Chambers, Ajmol Choudhury, Ian Coulson, Neil Curson, David Djajaputra, Marko Dragosavac, Timothy Durrant, Jake Duthie, Angela Dyson, Martin Farnan, Christopher Field, Alan Fielding, Andrew Forrest, Steven Geer, John Getty, Emma Griffiths, Toto Gronlund, Robin Grosset, Christopher Harvey, Abdilrida Hasaani, Thorsten Hauler, Abbas Haydari, Alister Henderson, Graeme Hilton, Jonathan Hird, Steven Holmes, Philip Holtom, Stuart Humber, Alan Hydes, Antonis Kalemis, Sajid Khokhar, Kathryn Long, Kathiresan Manickam, Andrew Maroney, Keith Norfolk, Robert Nowak, Sunday Ogunyale, Owusu-Korkor Osei, Barry O'Shea, Vitalis Ozebo, Nilkanth Patel, Nicola Percy, Jayshen Ramanah, David Rodriguez-Martin, Leon Rogers, Bradley Russell, John Sharkey, Peter Torok, Matthew Tosh, Vladimir Vishnyakov, David Walters, Claire Watson, John Webster, Thorsten Wengler, Jason Whittle, Vanessa Willott, Andrew Wood, Mohammed Yaseen.

NEW FELLOWS

Ernest Cady, Gareth Edwards, John Fernie, Amit Goyal, Christopher Hill, Robert Lamb, Glenn McDowell, Christopher Marchese, Katepalli Sreenivasan, Dimitri Vvedensky, Ali Yousif.

IN MEMORIAM

Edward Butcher, Alistair Campbell, B Crowther, David Gillings, Peter James, John Jennings, A Langridge, John Meek, D Morantz, Roger Pook, John Porter, Peter Trier, David Warner.

ANNOUNCEMENTS

- Nexus invites student members to attend one of three **Einstein Year dinners** – in London, Manchester or Edinburgh – on 15 October 2005. These black-tie dinners will be followed by music and dancing. Tickets are £15–20. For information and to reserve your seat, visit http://nexus.iop.org.
- Applications are invited for the Institute's **Best Practice in Professional Development Awards**, which recognise companies that are committed to training and developing physicists. There are two awards: one for enterprises with less than 250 staff and one for large organisations. The deadline for applications is 1 November 2005. For more details, visit http://careers.iop.org/Pdev/Award.html.

MEMBER OFFER

- **Online subscriptions prize draw**

Stephen McMahon from Warrington is June's prize-draw winner and Christopher Sinclair from London is July's winner. They will each receive a 512 MB data stick. For your chance to win a data stick, pay your membership subscription online at http://members.iop.org when you receive your subscription notice.

Visit **whatson.iop.org** for the Institute's full online calendar for the physics community or **www.einsteinyear.org** for Einstein Year public outreach events (indicated in **blue**).

SEPTEMBER 05

● Fun Physics Roadshow!
University of Manchester, Manchester Museum, UK
1 September – 30 December
Barbara Grundy 0161 275 4926

● Jaro de Einstein
Scottish Esperanto Association, Scottish Churches House, Dunblane, UK
1 September – 30 December
www.skotlando.org

Diffractive Optics 2005
Institute of Applied Optics and Warsaw University, Warsaw, Poland
3–7 September
www.do2005.org

Fundamental Problems of Mesoscopic Physics: Entanglement and Coherence in Nanoelectronics
ESF Research Conferences, Acquafredda di Maratea, Italy
3–8 September
www.esf.org/conferences/pc05188

CONFERENCE

Novel Applications of Surface Modification
Chester College, UK
18–21 September
Topics include biomaterial surfaces, engineering at the nanoscale and surface engineering. Organised by the Institute's Applied Physics and Technology Division. Student bursaries available.
http://conferences.iop.org/APTD

Neutrons in Biology
Institut Laue Langevin, Grenoble, France
4–7 September
www.ill.fr/neutbio2005

Mathematics for Biomedical Engineering: Summer School
University of Warwick, Coventry, UK
4–9 September
www.warwick.ac.uk/go/ssimbe

2005 CERN School of Computing
CSC, Saint Malo, France
4–17 September
www.cern.ch/CSC

● From Kelvin to Einstein
University of Glasgow, UK
5 September
Matthew Trainer 0141 330 6437

E*PCOS 05: 2005 European Symposium on Phase Change and Ovonic Science
*E*PCOS Committee, Cambridge, UK*
5–6 September
www.epcos.org

CFN Summer School 2005 on Nano-Biology
DFG-Center for Functional Nanostructures, Bad Herrenalb, Germany
5–8 September
www.cfn.uni-karlsruhe.de/summerschool05

An Engineer in Court
IMechE, London, UK
6 September
www.imeche.org.uk/conferencesandevents/court

UK Polymer Showcase
Polymer IRC, Wakefield, UK
6–7 September
www.polymerirc.org

Sensors and their Applications XIII
University of Greenwich at Medway, Chatham, UK
6–8 September
http://conferences.iop.org/Sensors

International Conference on Surfaces, Coatings and Nanostructured Materials
Centre for Mechanical Technology and Automation, Aveiro, Portugal
7–9 September
www.mec.ua.pt/ICSCNM

IEE Pulsed Power Symposium 2005
IEE, Basingstoke, UK
8 September
www.iee.org/oncomms/pn/powerca/PulsedPower.cfm

High Density Plasma Sputtering Process Plant for Deposition of Thin Films
UK Displays Network, Hook, UK
8 September
www.ukdisplay.net

● Winchester Open Weekend
Various venues in Winchester, UK
10–11 September
01962 840 500

Bose–Einstein Condensation: EuroConference on Ultracold Gases and their Applications
ESF Research Conferences, Sant Feliu de Guixols, Spain
10–15 September
www.esf.org/conferences/pc05095

ICOLAD
City University, London, UK
12–14 September
http://conferences.iop.org/ICOLAD

Optical Engineering I
Sira, Chislehurst, UK
12–14 September
www.sira.co.uk/courses

SIMS XV: Secondary Ion Mass Spectrometry
Manchester, UK
12–16 September
www.meeting.co.uk/confercare/simsxv

ICIS05: International Conference on Ion Sources
GANIL, Caen, France
12–16 September
www.ganil.fr/ICIS05

A Gentle Introduction to Biological Modelling
IOP Computational Physics Group, London, UK
15 September
http://conferences.iop.org/GIM

Optical Engineering II
Sira, Chislehurst, UK
15–16 September
www.sira.co.uk/courses

RIVA 5: 5th Iberian Vacuum Meeting and Applications
SOPORVAC and ASEVA, Guimarães, Portugal
18–21 September
www.soporvac.org

Faraday Discussion 132: Surface Enhanced Raman Spectroscopy
Royal Society of Chemistry, London, UK
19–21 September
www.rsc.org/conferences

Bionanotechnology 2005
Royal Society of Chemistry, University of Sussex, UK
19–21 September
www.rsc.org/BioNano

NUSOD-05: Numerical Simulation of Optoelectronic Devices
Berlin, Germany
19–22 September
www.nusod.org

Wind Farm Noise
Institute of Acoustics, Edinburgh, UK
20 September
www.ioa.org.uk

Introduction to Military Thermal Imaging
Sira, Chislehurst, UK
20–22 September
www.sira.co.uk/courses

Optical Fibre Measurement Conference
National Physical Laboratory, Teddington, UK
21 September
www.npl.co.uk

SETT: The Scottish Learning Festival
Learning and Teaching Scotland/Emap Education, Glasgow, UK
21–22 September
www.ltscotland.org.uk/sett

XII Nuclear Physics Workshop
UMCS Lublin and IReS Strasbourg, Kazimierz Dolny, Poland
21–25 September
http://kft.umcs.lublin.pl/wfj

Spintronics and Nanomagnetism
IOP Semiconductor Physics and Magnetism Groups, London, UK
23 September
http://conferences.iop.org/SPI

ECOC 2005: 31st European Conference on Optical Communications
IEE, Glasgow, UK
25–29 September
www.ecoc.co.uk

TUTORIAL

Tutorial Day on Physical Acoustics
76 Portland Place, London, UK
22 September
Focusing on multiple scattering, surface acoustic waves and sensors, and medical/diagnostic applications.
Organised by the Institute's Physical Acoustics Group.
http://conferences.iop.org/TDP

SPINTRONICS'05: Spin-Dependent Transport through Nanostructures
European Spintronics RTN, Poznan, Poland
25–30 September
www.ifmpan.poznan.pl/spintronics05

OSC-05: Organic Semiconductor Conference
Cintelliq Limited, Cambridge, UK
26 September
www.cintelliq.com/conference.htm

USW Network Workshop at Euroson 2005
Ultra Standing Wave Network, Geneva, Switzerland
27 September
www.euroson2005.org/usw_network.htm

World Nano-Economic Congress
Cientifica, Singapore
27–28 September
www.cientifica.com

TUSLIP Day of Physics
University of St Andrews, UK
28 September
www.st-andrews.ac.uk/~bds2/tuslip

LECTURE

When the Lights Go Out: Power to the People
CCLRC Daresbury Laboratory, Warrington, UK
18 October
Presentation by Prof. Maxwell Irvine of the University of Manchester on meeting the UK demand for energy, followed by a discussion.
Organised by the Institute's Merseyside and Manchester branches and the IEE Cheshire and Manchester branches.
Contact Ann Marks at **liviop@amarks.co.uk**.

Modern Optical Testing
Sira, Chislehurst, UK
28–29 September
www.sira.co.uk/courses

11th Annual Cambridge Technology Management Symposium 2005
Institute for Manufacturing, Cambridge, UK
28–29 September
www.ifm.eng.cam.ac.uk/ctm/symposium

Tribology Course: Friction, Wear and Lubrication
Institute for Manufacturing, Cambridge, UK
28–30 September
www.ifm.eng.cam.ac.uk/events

OCTOBER 05

Imagery Analysis in Security, Defence and Police
Sira, Bromley, UK
5–6 October
www.sira.co.uk/courses

Wolfram Technology Conference 2005
Wolfram Research, Champaign, Illinois, USA
6–8 October
www.wolfram.com/techconf2005

● Motion in the Mall
The Chequers Centre, Maidstone, UK
8 October
Chantelle Jay 01732 843 833

● Relatively Simple: E=mc² and all that
Manchester Royal Infirmary, UK
10 October
Heather Williams 0161 276 4783

Introduction to Electronic Imaging
Sira, Chislehurst, UK
10–12 October
www.sira.co.uk/courses

HIEHIC-2005: High and Intermediate Energy Heavy Ion Collisions
NATO, Tashkent, Uzbekistan
10–15 October
www.hiehic05.uzsci.net

Humidity Masterclass
Society of Environmental Engineers/National Physical Laboratory, Teddington, UK
12 October
www.npl.co.uk/tman/index.html

MR Safety Update
Institute of Physics and Engineering in Medicine, London, UK
13 October
www.ipem.ac.uk

Digital Image Enhancement & Restoration
Sira, Chislehurst, UK
13–14 October
www.sira.co.uk/courses

● Einstein in the Library
Hartlepool Central Library, UK
14–15 October
Ruth Wiltsher 01429 404191

CONFERENCE

Energy: the Big Issues
76 Portland Place, London, UK
25 October
Speakers include James Smith, chairman of Shell UK, and Chris Llewellyn-Smith of UKAEA.
Organised by the Institute's Energy Management Group.
http://conferences.iop.org/EBI

The Future of Nuclear Energy in Europe
EU Conferences, Brussels, Belgium
17–18 October
www.euconferences.com

Temperature and Humidity Training Course
National Physical Laboratory, Teddington, UK
17–20 October
www.npl.co.uk/training

NATO-ASI: Physics and Computer Science
Institut d'Etudes Scienifique de Cargèse, Corsica, France
17–29 October
www.ccr.jussieu.fr/lptmc/CargesePhysInfo/CargeseMain.htm

What Noise Annoys?
Institute of Acoustics, Oxford, UK
18–19 October
www.ioa.org.uk

einstein year
Explore, Discover, Invent · Physics

For full details of Einstein Year events (indicated in **blue**) and in particular of what's happening near you, visit the website at **www.einsteinyear.org/events**.

Optical Alignment Techniques
Sira, Chislehurst, UK
18–19 October
www.sira.co.uk/courses

● The Calculating Mr One
Theatre Royal Winchester, UK
19 October
www.theatre-royal-winchester.co.uk

● How Solar Electricity Works
Energy House 21, Warrington, UK
20 October
Bryan Lipscombe 01244 381 580

Sensor Applications for Micro-Systems Technology
Sira, Chislehurst, UK
20 October
www.sira.co.uk/courses

The hitchhiker's guide to Douglas Adams' universe

Heather Pinnell surveys some scientific spin-offs from the ever-popular *Hitchhiker's Guide to the Galaxy* series.

Suddenly this summer the *Hitchhiker's Guide to the Galaxy* was everywhere – the long-awaited film of the book was released in the UK in April, an extended version of the radio series was playing twice weekly on Radio 4 until June and the original television series was broadcast again on BBC Two. As the *Guide*'s author, Douglas Adams, accurately observed, the universe is a very big place but not, it seems, big enough for Earthlings to avoid encounters with Arthur Dent, Zaphod Beeblebrox, Marvin the Paranoid Android and the rest of the characters who inhabit his bizarre world.

Not that fans of the *Guide* and its sequels would want to avoid them, of course. The books have an enduring popular appeal, not least for their political and social satire – Adams targets everything from unctuous talk-show hosts and mega-rich purveyors of instant solutions to "life, the universe and everything", to more overblown examples of the science-fiction form. But behind all of this lay Adams' best joke – many of the absurd and fantastical events weaved into the books are actually based on small nuggets of scientific truth, albeit taken to an extreme and extrapolated to produce ludicrous results.

This kernel of scientific and philosophical ideas has opened up two more opportunities for devotees to the *Guide* to explore the mind of its creator. In May the Hitchhiker's Guide to the Galaxy Exhibition opened at the Science Museum in London. That same month, Macmillan also published *The Science of the Hitchhiker's Guide to the Galaxy* by Michael Hanlon, science editor of the *Daily Mail*.

The exhibition – with its interactive displays and life-sized models based on the film – is primarily aimed at families and children, with small bits of real science slipped in alongside the exhibits through short explanatory panels. "It's part of our strategy to win new audiences, to get people involved and excited about science, which they may think is a bit boring. Exhibitions like The Hitchhiker's Guide to the Galaxy help us shatter those

Science Museum

preconceptions," explains Jon Tucker, head of the Science Museum. "Once people are here we get them interested in and hooked on other parts of the museum."

The exhibition also aims to show that "real science is just as way out as the science fiction", says Tucker. Some aspects of modern science, such as experiments in teleportation, are "so way out that they could have been made up by a science fiction writer", he adds.

This conviction is also the impetus behind Hanlon's book, although it is clearly aimed at a more mature readership. In the space of 185 pages he surveys the evidence for extraterrestrial life and parallel universes, whether time travel or artificial consciousness will ever be possible, and current thinking on the Big Bang and the ultimate fate of the universe.

Hanlon has a witty and entertaining style that should hold the interest of readers with no scientific background, for whom it should prove a good introduction to some current ideas in physics. Many physicists would also enjoy the ride through some of the latest thinking in cosmology, although someone working at the cutting edge of string theory, say, would find little to chew on.

"Many of the absurd and fantastical events weaved into the books are actually based on small nuggets of scientific truth."

Along the way Hanlon makes several detours, many of which are interesting in themselves – including first-hand accounts from hoaxers who set up some of the most famous UFO "sightings" and the history of the chess-playing computer Deep Blue – though their connection with Adams' book is somewhat incidental. It also seems to be rather stretching a point to say that Adams "managed not only to predict the future but also to create it" as his fictional Babel fish (which feeds off the brainwaves of its host to translate any language instantly) merely inspired the title of a real-life computer programme.

Some of the funniest episodes in the books arise from the operations of the Improbability Drive on the spaceship *Heart of Gold*. This quantum-mechanical machine not only rescues the hero at the exact moment when the Earth is destroyed but it also produces bowls of petunias and sperm whales in the vacuum of space.

Hanlon's chapter on this begins promisingly enough: "All the atoms in the car you are driving may suddenly relocate themselves one metre to the left, or you may wake up on Jupiter, or inside the stomach of a whale. Surprisingly enough, thanks to the rules of probability (and the oddities of quantum physics), all of these fantastically unlikely things are not actually banned." Here was a golden opportunity to expand on quantum mechanics for the uninitiated. Unfortunately, Hanlon passes up this chance to instead produce an irrelevant polemic on the public's inability to understand relative risk.

That said, overall the book is a good read and written in the humorous spirit of the author, who imagined a handy guide to everything with the words "Don't panic" in large, friendly letters on its cover. In a stupendously large universe, where time is relative and hostile aliens may have spotted us already, Hanlon is an equally friendly guide.

Heather Pinnell is assistant editor of *Interactions*. The Hitchhiker's Guide to the Galaxy Exhibition is at the Science Museum in London until 27 November.

particles

Environmental Physics Essay Competition

The Institute's Environmental Physics Group is running an essay competition to recognise excellence in communicating the significance, value and rewarding nature of engaging with environmental physics. Entries can cover any aspect of environmental physics, including (but not limited to) atmosphere and climate, hydrology, plant physics, waste, energy and the built environment. Essays should be written in an accessible way and should be no more than 2000 words. The competition is open to all, but entries from students are particularly welcome.

First prize

- a £500 prize will be awarded to the winning author
- the winning entry will also be considered for publication in *Physics World*

Entries must be original and will be judged on writing quality and content. Essays can be purely scientific in content or can adopt a policy-related or other perspective. Entries and enquiries should be e-mailed to **env.essay@physics.org**. Further details can be found at **http://groups.iop.org/EP**.

Closing date: 31 December 2005