The newspaper of the physics community

October 2005

interactions

Institute of Physics

Public asked to watch the sky

The Moon Watch project will use the public's observations to refine the lunar calendar.

Members of the public are being invited to take part in a mass experiment that could ultimately lead to a more accurate lunar calendar and better predictions of the date of the new crescent Moon. Called Moon Watch, the experiment is part of Einstein Year, and Her Majesty's Nautical Almanac Office (HMNAO) hopes to use the observations to refine its existing models, which provide official dates for diary publishers, religious groups and others.

The timing of the new Moon – the point at which the Sun and Moon occupy the same position in the sky – can be determined easily with astronomical calculations. Often, the first sliver of Moon is visible the day after but, if it happens to be too close to the Sun or too close to the horizon, or if the crescent is too thin, then it may not be visible until the next day or even the day after that. The actual day when it is visible can also depend on where you are in the world.

The model used by HMNAO takes all of these factors into account, but it relies on observations coming mostly from the Southern Hemisphere or the Middle East, with relatively few from more northerly latitudes. Because of this, the model may not be completely accurate for some places, such as the UK, says Steve Bell of HMNAO. "I've been doing these sightings every month for a while now, and sometimes the model says the Moon should be 'easily visible' when it's actually quite difficult to spot," he adds.

The data collected on the Moon Watch website should help to refine the model, resulting in more accurate predictions for northern Europe.

Many religions base the dates of festivals around the movements of the Moon. For example, in the Christian tradition the date of Easter is governed by the lunar calendar; the Jewish calendar is lunisolar; and the timing of the Hindu Holi festival of light is also governed by the lunar calendar. The Chinese celebrate a Moon festival; and in Islam holy days are also determined by the movements of the Moon. In most cases the timing is based on mathematical predictions of the date of the new Moon, but in Islam the new month begins only when the crescent Moon is visible in the sky.

"Since ancient times, people have developed calculations to predict when the new Moon will be visible, but it's actually a very difficult physical problem because visibility depends on so many factors," explains Usama Hasan, a senior lecturer at Middlesex University.

Russell Watkins

Observers should look for the new crescent moon just after sunset in the days following the new moon.

SPOTTING THE MOON

- Pick a day close to the new Moon (3–5 November or 2–4 December).
- Find a westerly facing spot, with a clear view of the horizon.
- Wait for the Sun to set, then look in that part of the sky. (Don't look directly at the Sun, particularly if you have binoculars or a telescope.)
- Can you see the new crescent Moon? Are you sure that it's not a cloud or a vapour trail? Make a note of what you've seen and where you've seen it.
- Go to www.crescentmoonwatch.org and enter your location, the date, the time, the weather conditions, and the position and orientation of the Moon (if you saw it).
- Come back again next month and try the same thing again.

"Many countries still rely on actual sightings, but in Britain people tend to follow the dates used by their relatives in their home country," says Hasan. "This means that you can have two or three mosques in the same area of the country that start the same festival on different dates. It's very confusing, and people are very keen to solve this problem because of the disunity they experience every year."

This confusion about dates is now closer to being resolved, thanks to Moon Watch. The project is open to anyone who wants to take part – all they need to do is look outside around the time of the new Moon, just after sunset, and see if they can spot the new crescent Moon.

This year the dates to go looking are 4–6 October, 3–5 November and 2–4 December. Results should be entered on the Moon Watch website (www.crescentmoonwatch.org) so that the data can be used to refine predictions about when the Moon is first visible to the naked eye.

At this time of year in northern latitudes the Moon is much closer to the horizon at sunset. "You've got a thicker amount of atmosphere to look through so that's going to make the Moon look a little fainter," explains Bell. Observers will have to look very carefully as the thin slice of Moon can be hard to spot, and it is all too easy to mistake a wisp of cloud or vapour trail for the Moon. "There's also a relatively narrow window to make the observation – only 30 to 40 minutes after the Sun has set. As you wait for the sky to get darker and darker, the Moon will also be getting closer and closer to the horizon. By the time it's nice and dark, the Moon will have already set."

Bell and his colleagues are particularly interested in observations from northerly latitudes, particularly those above 50°, because there may be some effects of extreme latitude on the visibility of the crescent Moon that the HMNAO model does not currently take into account.

When HMNAO approached Caitlin Watson, programme manager for Einstein Year, about the idea for Moon Watch, she seized on it. "It's an ideal mass participation activity. It's easy to get involved with as it doesn't require any special equipment. What's more, the information we're asking people to gather will make a real contribution to physics." The first results from Moon Watch will be available in December of this year, but the project will continue to follow the Moon for several years.

www.crescentmoonwatch.org

einstein year
Explore, Discover, Invent - Physics

www.einsteinyear.org

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Parent at Move Over Einstein Exhibition, p2

"We were warned that leaving our seats could be lethal."
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Albert Einstein™ HU. www.alberteinstein.net

HIGHLIGHTS

Einstein dance speeds round the country

The national tour of *Constant Speed*, Rambert Dance Company's production celebrating the centenary of Einstein's groundbreaking 1905 works, began in September in Salford. The company will be taking the production around the UK this autumn, with accompanying talks by a physicist at each venue. Rambert will also be holding workshops in schools in each city that it visits. These are principally designed to enthuse young people about dance, but the Institute is also providing printed material to support science teachers who want to explain the physics that inspired the dance.
www.rambert.org.uk

Physics on offer at shopping centres

Einstein Year's interactive exhibition, Move Over Einstein – The Next Generation is Here!, is continuing its tour around the UK. Last month it spent two weeks at the Lakeside Shopping Centre in Essex before heading across the county to the Harvey Shopping Centre in Harlow. It proved a good way of reaching people who don't normally engage with physics – one of the principal aims of Einstein Year.

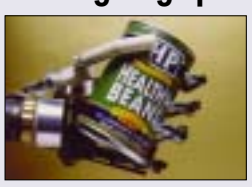
Move Over Einstein did a brisk business at Lakeside, with the exhibits crowded right up to closing time at 10.00 p.m. Many children had to be dragged away with promises that their parents would bring them back later in the week. "This is the most interested in science the kids have ever been," said one parent.

Move Over Einstein highlights some of the cutting-edge research being done by physicists, including the search for the Higgs Boson and for dark matter, and the use of quantum cryptography to develop unbreakable codes. It will also be visiting the Museum of Science and Industry in Manchester and W5 in Belfast.
www.moveovereinstein.org

The meaning of physics through poetry

On 5–6 August more than 100 people turned up at Cabot Tower in Bristol to help to create a giant physics poem for Einstein Year. Poets of all ages each wrote one word that summed up what physics means to them, launched the words off the top of the tower in tiny parachutes then wrote them in huge chalk letters around the park so that they were visible from the tower. "The activity attracted many viewers who were intrigued by the words people had chosen. It provoked many different discussions about physics and its meaning to us all," said organiser Bec Gee. She has woven the words into a poem, which can be read at www.einsteinyear.org/physicspoem.

Getting to grips with a new artificial hand



Medical physicists at the University of Southampton have developed a new ultralight artificial hand that mimics the movement of a real hand better than any other. Paul Chappell and colleagues presented their research at the Institute conference Sensors and their Applications XIII at the University of Greenwich on 6–8 September.

Most prosthetic hands are either purely cosmetic or have a very simple single-motor grip. But Chappell demonstrated a prototype that uses six sets of motors and gears that allow each of the five fingers to move independently so that the hand can grip objects in the same way as a real one. Called the Southampton Remedi-Hand, it can be connected to muscles in the arm via a small processing unit and is controlled by small contractions of the muscles that move the wrist.

Chappell says that the next stage is to integrate the latest sensor technology with the Remedi-Hand to create a "clever" hand: "The aim is to create a hand with the sort of functionality that a human hand has but also a sense of touch. This will let the hand 'know' how tightly to grip an object like a coffee cup without dropping it but not so tightly that it's crushed. It will also have an integrated slip-sensor that will tell the hand if something is beginning to slip out of its grip."

Einstein Year reports success

By Ayala Ochert

In the first half of 2005 more than 280 000 people in the UK and Ireland took part in Einstein Year. Overall there have been more than 430 activities, making it one of the Institute's most-successful-ever initiatives.

The two biggest activities so far have been the Eisteddfod Yr Urdd in Wales and the touring Move Over Einstein exhibition, which have each drawn around 100 000 participants. Hundreds of smaller local events have also taken place, approximately 50 of which were supported by grants from the Institute.

Among those who haven't attended these events, many will have heard about Einstein Year through the 300 or so articles that have appeared in newspapers and magazines since the start of the year and through the more than 50 television and radio broadcasts. The Einstein Year website had more than 100 000 visitors in the same period, and more than 20 000 people downloaded the *Time Twins* computer game, which had been created for the year.

"It is very gratifying to know that so many people have been participating in Einstein Year, but it's also important to find out whether we've been successful in changing perceptions of physics," said Caitlin Watson, programme manager for the year.

The Institute of Education is carrying out an independent evaluation to determine the impact of Einstein Year. It will include interviews with participants and event organisers, event questionnaires, and a longitudinal survey of 11- to 14-year-olds to discover their attitudes towards physics. The full evaluation is due to be published in spring 2006.

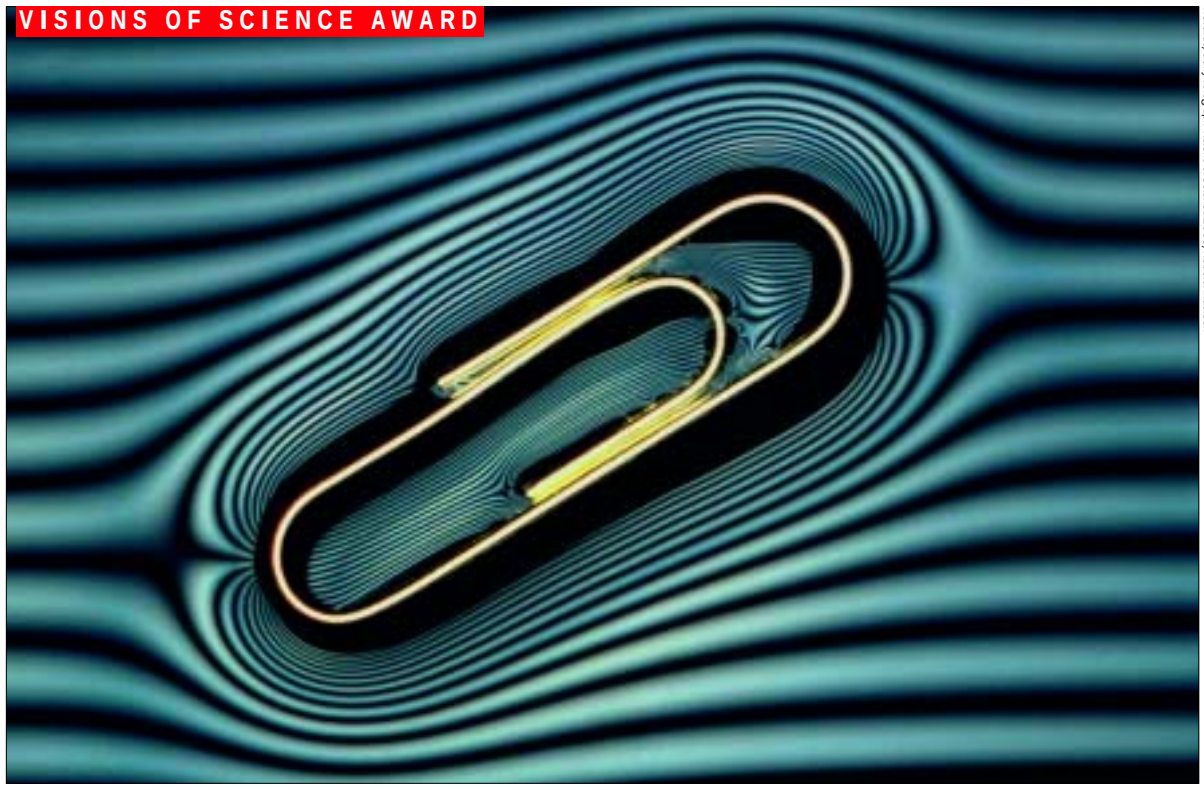
"When the results are in we'll know more about what worked and what didn't, and we'll use that to inform future physics outreach activities," commented Watson.

There has been further good news this year for the physical sciences. The latest figures show an increase of 11.4% in the number of students accepting a place at a UK university to study physics. Chemistry experienced an even bigger jump – up 17.3% in comparison with last year.

The overall increase in the number of students was 8.6%, probably because many students who would have deferred entry chose to accept a place this year rather than next, when student fees are to be introduced.

"I am very pleased to see this increase and I hope that it's a sign that students are beginning to choose courses, like physics and chemistry, that have strong career possibilities," said Peter Main, the Institute's director of science and education. "But we'll need to look closely at next year's figures to see if this is a real increase or just a blip associated with the change in funding."

VISIONS OF SCIENCE AWARD



Novartis/Daily Telegraph Visions of Science 2005/Robert Anderson

Robert Anderson's "Surface tension" is the winner of a special Einstein Year award, sponsored by the Institute of Physics, in this year's Visions of Science photographic competition. The award was given for the "most creative image showing the wonder and ingenuity of contemporary physics". Anderson took this photo using a grille in front of the light source and used the resulting diffraction pattern to convey Einstein's idea that light is bent by strong gravitational fields. See the winning images at www.visions-of-science.co.uk.

Look to the future with webcasts

Throughout October the Institute will be running a series of webcast lectures for Einstein Year, each an introduction to an exciting new area of physics or technology.

The first in the series, "The search for the Higgs", will be delivered by Tara Shears, a particle physicist at the University of Liverpool. Like all of the lectures in the series, it is aimed at people who have studied physics but doesn't require any detailed knowledge of the subject. Shears will describe the experiments that could lead to the first direct observation of the elusive Higgs particle and the challenges that face those who are involved in the search.

The second interactive webcast will be given by Neil Johnson, a professor of physics at Oxford University, whose talk "The new physics of many-people phenomena" will give an introduction to the field of complexity. "From unexpected movements in the world's currency markets through to the future threats posed by unknown viruses and even the apparent chaos of ongoing wars, such as Iraq, physicists have recently made vital contributions," says Johnson.

The webcasts should appeal to physicists who are thinking of moving into a new field, those who work in related fields and those who are simply interested in knowing more about these fascinating subjects. Other topics in the series include unmanned space missions, the physics behind computer games, and the ozone layer and climate change.

The interactive webcasts are entirely virtual and require only a computer, some headphones and an Internet connection. There will also be the opportunity to ask questions. "With this technology we're hoping to reach members who aren't able to reach our more traditional events, especially those who live overseas," says Alex Byrne, the Institute's professional standards manager.
http://careers.iop.org/events

Meeting probes the nanoscale

David Reid reports on the latest nanotechnology research that was presented in Leeds.

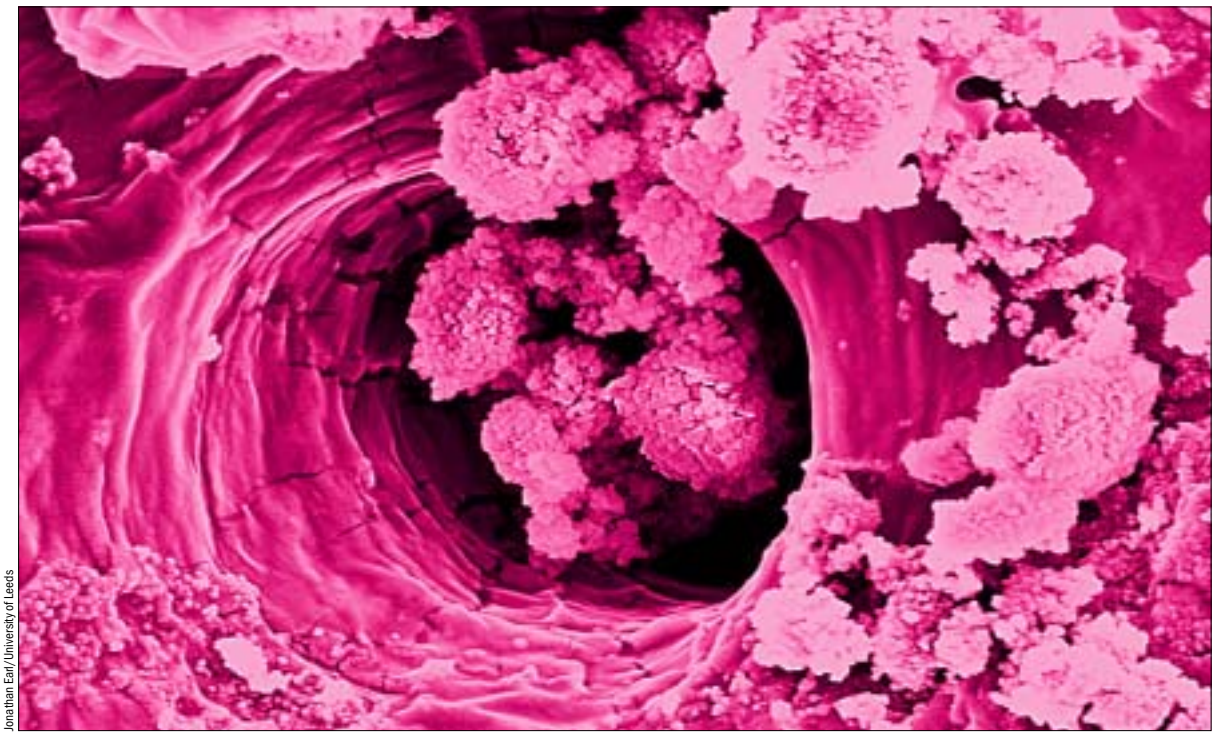
The latest research in imaging, analysis and fabrication at the nanoscale was presented in Leeds last month at EMAG-NANO 2005, the first collaborative conference between the Institute's Electron Microscopy and Analysis Group and its Nanoscale Physics and Technology Group.

The conference, which attracted more than 150 physicists from the US, Japan, the Middle East and Europe, showcased images from state-of-the-art scanning tunnelling electron microscopes. With these machines it is now possible to "see" the surfaces of single atoms in nanoparticles.

Flemming Besenbacher of the University of Aarhus, Denmark, described how this is useful in determining what makes materials chemically reactive and in understanding how catalysts work. He said that this new ability could help in the design of catalysts that are better at solving real-life problems, such as the recycling of toxic materials and the more efficient use of fossil fuels.

In his plenary lecture, Colin Humphreys of the University of Cambridge explored further how developments in electron microscopy are revolutionising nanotechnology research. In future we can expect to see the three-dimensional imaging of complex structures and the more accurate preparation of nano-objects, he said.

Nanotechnology applications are cropping up in many unexpected areas. Jonathan Earl and colleagues from the University of Leeds presented their work on nanospheres for filling the tiny holes that can cause sensitive teeth.



Jonathan Earl/University of Leeds

Scanning electron micrograph of nanospheres filling one of the tiny holes that cause sensitive teeth.

When the dentine of the tooth is exposed it can cause pain because it is made up of thousands of tiny fluid-filled channels that radiate outwards from the nerve endings at the centre of the tooth. Heat, some chemicals and physical contact can cause the fluid in these channels to move in or out, triggering the nerve endings and causing sharp pain. By blocking the channels the flow can be reduced and the pain stopped or significantly reduced. Currently this is done with special toothpastes and fluorine mouthwashes that encourage the re-mineralisation of the dentine coating.

Earl presented preliminary results showing that the most successful particle shape for filling these channels is a "nanosphere". He and his colleagues are trying to synthesise nanospheres of hydroxyapatite – a ceramic material used by dentists.

"We have found that these tiny spheres are really good at filling the channels in teeth, filling them quite evenly and going inside the holes to a good depth," said Earl. The next stage will be to work out how to synthesise nanospheres of hydroxyapatite, or a combination of hydroxyapatite and fluorine, to fill the holes and encourage remineralisation.

Zhong Lin Wang of the Georgia Institute of Technology revealed the incredible diversity – and beauty – of nanostructures that can now be created. He has been able to make zinc-oxide nanostructures in the shape of belts, ropes, rings, springs and, most recently, helices.

The proceedings of EMAG-NANO 2005 will be published in the *Journal of Physics Conference Series*.

Pugwash founder dies, aged 96

Josef Rotblat, the Nobel prize-winning physicist and peace campaigner who organised the influential Pugwash Conferences on Science and World Affairs, has died at the age of 96.

Rotblat, who was made an honorary fellow of the Institute in 2001, was born in Poland and came to England in 1939 to work on nuclear fission at Liverpool University just before the outbreak of the Second World War. He later worked on the Manhattan Project in Los Alamos to develop the atomic bomb. But, on realising that there was no possibility of the Nazis developing their own bomb, he left and became a lifelong campaigner for nuclear disarmament.

After the war, he worked on medical applications of nuclear physics and was awarded the CBE in 1965. In 1995 he was elected a fellow of the Royal Society, and in the same year he received the Nobel Peace Prize jointly with the Pugwash Conferences.

London wins bid to host students

By Samuel Henry

More than 300 students from around the world arrived in Coimbra, Portugal, on 11 August for 2005's International Conference of Physics Students (ICPS). The conference gave students the opportunity to present a lecture on their work or a field of interest to an international audience, and to make or renew contacts with other young researchers.

While most participants were from Europe, including more than 20 delegates from the UK, there was also a healthy number from China, Pakistan, Mexico and several African countries.

A highlight of the conference for the UK delegation came at the end, when they succeeded in winning their bid to host the conference at University College London in 2007. They faced tough competition, with rival bids from Nigeria, Greece and Poland.

"It was nerve-wracking," said Laura Pickard, a student at Bristol University who presented the bid. "I think I know how the Olympic lot felt not so long ago. We concentrated on the diversity of London and having a well organised and enthusiastic team to run things, and it seemed to work."

Participants gave their own lecture or presented a poster. These ranged from accounts of research by third-year PhD students to undergraduates talking about a topic of interest to them. "It's a great chance for students to practise giving a lecture in a chilled-out environment," said Adrian Stannard, a postgraduate student working at the National Physical Laboratory.

The conference also included guest lectures from some academic physicists. José Fernando Ferreira Mendes from the University of Aveiro in Portugal gave a talk on complex networks, which led to a lively discussion about the social networks of students created by the ICPS. Fernando Nogueira from Coimbra spoke about nanotechnology, while Simon Goodwin of Cardiff University discussed the chances of making contact with intelligent extraterrestrial life.

The week-long meeting included an excursion to Lisbon and to the beach at Figueira da Foz, where the students held a Physics on the Beach festival, demonstrating science to local school children.

They were helped by EuroPhysics-Fun, a group from Denmark that demonstrated the physics of air pressure by shooting tennis balls high above the beach, as well as other experiments that involved magnets, liquid nitrogen and a sound system.

Although they spoke no Portuguese, and the audience understood little English, they still managed to convey the message that physics is fun. The group also set up an experiment to transmit an audio signal, through a chain of 257 people holding hands, by exploiting the potential difference between the ends of the chain, thereby achieving a new unofficial world record.

The conference was organised by the International Association of Physics Students, which is run by students, for students. Its next meeting, ICPS 2006, will be held in Brasov, Romania.

IN BRIEF

● **A Lab in a Lorry**, one of the three mobile physics laboratories that have been successfully touring the UK since May, is now in South Africa and is due to arrive in Durban a week before the three-day World Conference on Physics and Sustainable Development, which begins on 31 October.

Starting in Cape Town, the lorry will take its interactive experiments to local schools before embarking on the 2000 mile journey to Durban, visiting schools en route.

This is the first time that one of the lorries has toured outside the UK or Ireland, and the organisers hope that there will be more tours in the developing world.

● **Finding a job is the top concern** of the Institute's student members, according to a survey carried out this summer on behalf of Nexus. Of the 272 members who responded to the survey, 70% identified this issue as very disturbing or worrying, while 68% were equally concerned about choosing a career and 55% had similar worries about tuition fees.

Other issues deemed very disturbing or worrying were personal or non-academic matters (44%), quality of lectures (43%), practicals and experiments (40%), finding a PhD place (39%) and safety at university (25% of females, 11% of males).

NEWSMAKERS

Theoretical physics graduate **Aoibhíonn Ní Shúilleabháin** was crowned the Rose of Tralee at the annual festival of the same name held in Tralee, Ireland, in August. She graduated this year with first-class honours, won prizes in mathematical modelling and last year won a student placement at CERN. She plans to do postgraduate studies in biophysics.

Lionel Wilson, head of the Planetary Science Research Group at Lancaster University, has received the 2005 G K Gilbert Award from the Geological Society of America. The award recognises outstanding career achievement in planetary geoscience.

John Mallard has been awarded the Medal of the European Federation of Organisations of Medical Physics for his "outstanding and internationally recognised contributions to medical imaging". He also received the Gold Medal of the Royal College of Radiologists.

Robert Lambert of Heriot-Watt University was judged the Best Physics Student in the 2005 SET Student of the Year awards for his work towards a quantum-dot based single-photon source.

Institute of Physics awards 2006

DIRAC

Michael Gillan
University College London

The Dirac medal and prize, for outstanding contributions to theoretical physics, has been awarded to Michael Gillan for his contributions to the development of atomic-scale computer simulations, which have greatly extended their power and effectiveness across an immense range of applications.

Mike Gillan is one of the world's leading computational physicists. In the 1980s, while at Keele University, he developed a technique for calculating the rate of thermally activated barrier-crossing, incorporating quantum tunnelling.

Based on Feynman's path-integral formulation of quantum mechanics, Gillan's technique yields a simple and general expression for the transition rate, which is correct in both the quantum and classical regimes. Although he invented the technique in the context of hydrogen diffusion in metals, Gillan's methods are now used in many fields, including proton transfer in chemistry and biology.

Following the invention by Car and Parrinello of first-principles molecular dynamics, Gillan was the first to realise that their approach could be generalised by using alternative methods to search for the ground state.

His pioneering paper on this subject in 1996 contributed greatly to today's highly efficient codes. His work in this area – in particular his development of the CONQUEST code – made him one of the world leaders in "linear scaling" density functional theory, in which the computational effort scales linearly with the size of the system.

Building on Car's work, he showed how first-principles simulation combined with thermodynamic integration could be used to study phase diagrams and chemical equilibria.

Through a series of brilliant applications of these techniques to solid and liquid iron alloys, Gillan and his collaborators placed much-improved constraints on the temperature and chemical composition of the Earth's core – parameters that are of great importance for understanding the dynamics of the Earth.

GLAZEBROOK

Andrew Taylor
CCLRC Rutherford Appleton Laboratory

The Glazebrook medal and prize, for outstanding contributions to the organisation, use or application of physics in an industrial, commercial or educational environment, has been awarded to Andrew Taylor for his contributions to neutron scattering physics, for his leadership as director of the ISIS facility at the Rutherford Appleton Laboratory, and for his realisation of the second target station at ISIS.

Andrew Taylor has made outstanding contributions to physics since becoming director of the ISIS facility at the Rutherford Appleton Laboratory – the world's most powerful pulsed neutron source – in 1993.

He has inspired and led initiatives to develop new neutron-scattering instruments through partnerships with UK universities, and he has developed and expanded international collaborations, resulting in multi-million-pound investments in ISIS from other countries. These achievements have turned ISIS into an acknowledged world-class research centre in condensed matter science.

Taylor played the leading role in the realisation of a second target station at ISIS – the TS2 project – from its inception and planning through to securing its funding. His perseverance and determination were essential in driving the project forward, and he successfully convinced the heads of research councils, government ministers and officials, and the wider scientific community of the strategic importance of TS2 for UK science. Construction of this £140 m project began in 2004. The design features of TS2's innovative instrument suite will open up neutron-scattering research in new areas of soft condensed matter, the physics of advanced materials and nanoscience.

Taylor's strong personal engagement and his passion for neutron scattering, coupled with his vision for the future direction of ISIS and the Rutherford Appleton Laboratory, have been key drivers in motivating all ISIS staff to maintain the facility at the forefront of neutron-scattering science.

GUTHRIE

Marshall Stoneham
University College London

The Guthrie medal and prize, for contributions to physics by a physicist of international reputation, has been awarded to Marshall Stoneham for his wide-ranging theoretical work on defects in solids, in particular his seminal work on the consequences of defects for the electronic properties of materials.

Marshall Stoneham has pioneered the application of modern solid-state theory to problems of real industrial interest and, in the process, has added immeasurably to our fundamental knowledge of materials science.

His work covers an immense range. On the applied side it includes corrosion, radioactive waste, ceramics, diffusion, the reliability of non-destructive inspection, passivation and radiation-damage processes. On the basic research side it has encompassed work on polarons, muons and muonium, quantum diffusion and tunnelling, as well as electronic coherence in quantum dots and quantum computing.

Stoneham pioneered studies of colour centres in ionic solids, and he has made many contributions to the dynamics of defect processes and the role of excited states.

In covalent crystals, such as diamond and silicon, his work was key to understanding intrinsic defects and their motion, and to resolving controversies concerning hydrogen, which is an important impurity. His accurate predictions of defect vibrations and absolute classical diffusion rates were among the first. With Peter Flynn he proposed the quantum theory of diffusion for light impurities.

His work on oxides has been important to nuclear safety and radioactive-waste handling. By recognising the central role of image interactions, Stoneham also clarified a wide range of metal–oxide interface problems.

Marshall Stoneham has been an inspiration to a generation of physicists – both theoreticians and experimentalists – who are interested in the application of solid-state and condensed-matter physics and who wish to understand their subject at the most profound level.

BRAGG

Derek Raine
University of Leicester

The Bragg medal and prize, for significant contributions to physics education, has been awarded to Derek Raine for his innovative work on the teaching of physics in universities, in particular for pioneering the use of problem-based learning in physics in the UK.

Derek Raine has been at the forefront of recent developments in the teaching of physics at university level and is one of the most innovative physics educators in the UK. His range of interests spans the development of student-centred learning environments through problem-based learning, the redesign of the physics curriculum so that students naturally develop key skills along with subject knowledge, and the use of flexibly paced learning schemes that allow individuals of different abilities to achieve their full potential.

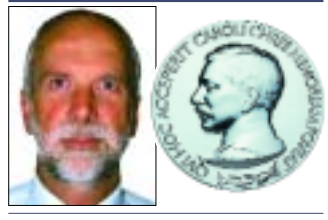
Raine is also the coordinator of, and inspiration behind, the Interdisciplinary Science (i-Science) degree at Leicester University, which applies the problem-based learning approach to integrate physics into a broader science framework and is expected to be especially attractive to students with mixed arts and science A-levels.

He has created numerous learning and teaching initiatives within his own university and has contributed to many academic reviews at other institutions. He has served on the Higher Education Academy Physical Science Advisory Committee and the Institute of Physics New Degree Working Group.

Raine has earned major collaborative grants to develop and disseminate the problem-based learning approach and to promote excellence in physics teaching in general.

In 2004 he received recognition for his contribution with the award of a National Teaching Fellowship. His tireless promotion of teaching and learning in university physics departments is an inspiration to all physics educators who strive to improve the standards of teaching while satisfying the university's demands to produce high-quality research.

CHREE



David Gubbins
University of Leeds

The Chree medal and prize, for distinguished research in environmental physics, terrestrial magnetism, atmospheric electricity and related subjects, has been awarded to David Gubbins for his contributions to our understanding of the dynamics and evolution of the Earth's core through his work in kinematic dynamo theory, thermodynamics and palaeomagnetism.

David Gubbins has had a huge impact on the field of geomagnetism – from his seminal contributions in dynamo theory and core dynamics to his geomagnetic observations, including satellite observations and the interpretation of palaeomagnetic observations, all of which have given him a unique perspective on the subject.

In the 1970s his most important contributions were on the thermal evolution of the Earth's core and kinematic dynamo theory. His work on geomagnetic field analysis in the 1980s changed the subject when he addressed the mapping of the field at the core–mantle boundary as an inverse problem, then developed modern methods of regularisation, which have become the *de facto* standard. Gubbins also realised the potential benefits of applying these techniques to data from earlier epochs. This resulted in the creation of maps of the magnetic field back to 1650 plus the application of his methods to palaeomagnetic data. This work led to a fundamental change in the understanding of the core magnetic field.

In a prescient paper in 1981, he predicted super-rotation of the Earth's inner core, evidence for which has only recently been seized upon by the seismological community.

In the 1990s, in addition to his major contributions to observational seismology, Gubbins produced a short but significant paper entitled "The distinction between geomagnetic excursions and reversals", which showed his willingness to propose speculative, yet testable, ideas. This paper may yet prove to be one of the landmarks in our understanding of geomagnetic reversals.

DUDDELL

Peter Wells
Cardiff University

The Duddell medal and prize, for outstanding contributions to the advancement of knowledge through the application of physics, has been awarded to Peter Wells for his work on the application of ultrasound to medicine.

Peter Wells has been a major force in the development of ultrasound imaging – from its early days right through to its extensive use in medicine today.

In the 1960s he worked on a treatment of Menière's disease and developed novel equipment and a variety of measurement techniques. His interest soon turned to diagnostic applications, and he was instrumental in building one of the world's first articulated-arm B-scanners. His pioneering efforts led to early devices that included a water-immersion automated ultrasonic breast scanner, a catheter-mounted endosonographic probe and an accurate time-position recording instrument for cardiological applications.

In 1969 Wells wrote a paper that demonstrated the feasibility of pulsed Doppler ultrasound, and he broke new ground with his description of the directivities of Doppler transducers. His pioneering work also includes dynamic focusing with annular array transducers, acoustic speckle and blood-flow volume rate measurement, and the quantification of Doppler blood-flow signals.

In the 1970s Wells was again at the forefront of medical ultrasound, in particular the implementation of greyscale ultrasound. Around this time there was an increasing awareness of the possibility that ultrasound scans might be hazardous, and he made key contributions that subsequently had a significant impact on national safety standards.

His recent innovative research interests include the development of ultrasonic biomedical micro-imaging techniques (confocal acoustic microscopy), telepresence ultrasound systems and continuous-wave Doppler tomography.

Wells' contribution to medical ultrasound has been wide-ranging

The Institute's awards aim to recognise and reward outstanding achievements in physics and to encourage younger members of the community towards greater success in the future. The Institute honours the following physicists, each of whom has made a remarkable contribution to their field.

and outstanding, as recognised by his fellowships of the Royal Society, the Royal Academy of Engineering and the Academy of Medical Sciences, and honorary fellowships awarded by numerous professional bodies worldwide.

KELVIN

Kathy Sykes
University of Bristol

The Kelvin medal and prize, for outstanding contributions to the public understanding of physics, has been awarded to Kathy Sykes for her contributions to public engagement with science, in particular through presenting science on television and for initiating the Cheltenham Festival of Science.

Kathy Sykes completed her PhD in physics in 1996 and, after a short period as a postdoctoral researcher, chose to develop a career engaging the public with science. Her first major role was head of science at Explore in Bristol, where she was responsible for the development of many of the exhibits. At the same time she developed a career presenting science in the media, with television programmes such as *Rough Science* and *Mind Games*.

Sykes has also pioneered the concept of science-dialogue projects. In Bristol she organised the "Science Matters" series, which went to inner-city areas and asked communities what they wanted to discuss, and then took the scientists to them. It led to events like the one called "Do drugs do your head in?", in which Rastafarians, neuroscientists, psychologists and other scientists discussed the issues, listened to and learned from one another.

In 2002 Sykes began the Cheltenham Festival of Science and was appointed to the Collier Chair in the Public Engagement with Science at Bristol University.

She is actively trying to change the culture, both within universities and in government, to make engaging with the public a real part of what scientists do. She is a member of the government's Council for Science and Technology and has written a report for the council on this subject. She chairs the Sciencewise panel and has advised Lord Sainsbury and Sir David King on issues of public engagement in science.

MOTT

Peter Weightman
University of Liverpool

The Mott medal and prize, for distinguished research in condensed-matter or materials physics, has been awarded to Peter Weightman for his work on the electronic structure of materials using a variety of laboratory and synchrotron techniques, and for his development of Auger spectroscopy and reflection anisotropy spectroscopy.

The Auger process – the principal decay mechanism of core-ionised atoms – was discovered in 1923 by Pierre Auger in cloud-chamber experiments but could not be studied directly until the development of electron spectroscopy. By combining high-resolution measurements of Auger spectra with atomic structure calculations, Peter Weightman pioneered the understanding of Auger profiles, and his techniques now find application in many fields of surface and materials science.

Weightman gave the first proof of the Cini–Sawatzky theory, which states that Auger profiles are determined by the ratio of the on-site Hubbard correlation energy, U, to the single-electron bandwidth, W, and later showed the need to extend the Hubbard Hamiltonian to include off-site interactions.

He also provided the first treatment of the molecular Auger spectrum that went beyond the independent electron approach and gave a consistent method of defining and measuring charge transfer and electron screening. This led to a new definition of electronegativity – the first use of electron spectroscopy to determine impurity activation in a semiconductor and the first observation of disorder broadening of core-level photoelectron lines by Madelung contributions.

He played a leading role in applying reflection anisotropy spectroscopy – an optical method for studying semiconductors – to new fields, and he provided its first application to metal–liquid interfaces and the first demonstrations of its sensitivity to molecular orientation on surfaces.

Weightman is the chair of the steering committee for the Fourth Generation Light Source project at Daresbury Laboratory.

RUTHERFORD

Ken Peach
CCLRC Rutherford Appleton Laboratory

The Rutherford medal and prize, for contributions to nuclear physics, elementary particle physics or nuclear technology, has been awarded to Kenneth Peach for his contributions to high-energy physics as leader of key experiments at CERN investigating CP violation and as director of particle physics at CCLRC's Rutherford Appleton Laboratory, where he has played a key role in reviving accelerator science for particle physics applications in the UK.

In the 1980s and 1990s Ken Peach had a leading role in the highly significant NA31 and NA48 experiments at CERN on "direct" CP violation in the neutral kaon system. He then had a dual role as director of particle physics at the Rutherford Appleton Laboratory (RAL), where he led a large and highly rated group of research physicists, and was responsible for the facilities that support UK particle physics at home and abroad. Peach was also responsible to PPARC for the delivery of the UK programme of particle physics. Here he was also highly successful and was held in high regard, both by the research council and by the UK physics community.

Peach has been instrumental in re-establishing high-energy accelerator research in the UK. The country was a world leader in this field but, when the national accelerators NINA and NIMROD closed, UK experts moved abroad, mostly to CERN, and for many years the subject was neglected in the UK. Since his appointment at RAL in 1998, Peach has revived interest and activity, realising that groups could work at labs throughout the world yet still be based in the UK. By careful allocation of hard-won resources to hand-picked projects, he has built up a number of areas in which the UK now has an internationally recognised world-leading role. The recent establishment of the CCLRC Accelerator Science and Technology Centre, which links the resurgent high-energy accelerator activity with established UK excellence in medical and synchrotron physics, is the culmination of this work.

PPARC has also acknowledged the importance of accelerator R&D for particle physics through the creation in 2004 of the Cockcroft and Adams Institutes for Accelerator Science. Peach is now the first director of the John Adams Institute, based at Oxford University and Royal Holloway, University of London. Peach has also established the UK as a leading partner in the neutrino factory projects, with an R&D programme that will play a vital part in establishing their viability.

BOYS

Karl Krushelnick
Imperial College London

The Boys medal and prize, for distinguished research in experimental physics and recognising physicists early in their careers, has been awarded to Karl Krushelnick for his contribution to plasma physics through his investigations into the interaction of ultra-intense lasers with matter.

Karl Krushelnick was appointed as a lecturer in the plasma physics group at Imperial College in 1997. His programme of research there has led to the observation of magnetic fields of the order of 500 MG; the generation of high-quality proton and ion beams of MeV energy from direct laser irradiation of solid targets; and relativistic electron-beam generation from a combination of plasma-wave and direct laser field acceleration, demonstrating that plasmas may be a candidate for next-generation particle accelerators. For this work he has received worldwide acclaim.

Much of Krushelnick's work has been enabled by the push to higher intensities and thus higher energy densities at the focus of state-of-the-art laser beams. This has implications not only for the nonlinear study of these interactions but also for possible applications in hot-spot ignition of inertial confinement fusion capsules – an area in which he has also been responsible for ground-breaking work. In particular, in a series of successful experiments on the Gekko laser in Japan, a gold guiding cone was successfully shown to deliver a high-intensity ignitor beam to a compressed core without the deleterious effect of laser-beam propagation instabilities.

Krushelnick's work has given a major impetus to the exciting new developments in ultra-high-power lasers now being pursued at the Rutherford Appleton laboratory, in particular the petawatt laser and the recently announced Astra petawatt upgrade.

MAXWELL

Ruth Gregory
University of Durham

The Maxwell medal and prize, which recognises outstanding contributions to theoretical physics in the last 10 years, has been awarded to Ruth Gregory for her contributions to physics at the interface of general relativity and string theory, in particular for her work on the physics of cosmic strings and black holes.

Ruth Gregory's contributions to the understanding of the very early universe – a field that requires an appreciation of fundamental particle physics, general relativity and cosmology – have been outstanding.

Together with Raymond Laflamme she showed the instability of black strings and p-branes – extended objects that are found as low-energy solutions in superstring theory and are analogues of black holes in extra-dimensional theories. This important result is contained in a widely cited paper.

More recently, with Rubakov and Sibiryakov, she showed that a class of extra-dimensional theories affects gravity at a large scale, paving the way for cosmological tests. Before this it had been thought that the only effect of such theories was at short distances.

Gregory has made seminal contributions to the physics of cosmic strings – vortex solutions of quantum field theory, similar to those seen experimentally in superfluid helium. They are found in particle physics theories and are of significance for cosmology.

She showed that the space–time around strings arising from global symmetries is non-singular. This has since been used to find alternate "brane world" models in two extra dimensions. Gregory's earliest contributions found the effective action for cosmic strings, making them amenable to computation and allowing the investigation of their gravitational properties.

PATERSON

Timothy Leighton
University of Southampton

The Paterson medal and prize, for outstanding contributions by a physicist early in their career to the application of physics and its commercial exploitation, has been awarded to Timothy Leighton for his contributions to the field of acoustics in liquids, in particular to biomedical ultrasonics, acoustical oceanography, cavitation and industrial ultrasonics.

Timothy Leighton's contribution is outstanding in both breadth and depth. He is an acknowledged world leader in four fields relating to acoustics in liquids: biomedical ultrasonics, cavitation, acoustical oceanography and industrial ultrasonics. He has delivered more than 70 pioneering advances, from devices used in hospitals to the world's first count of bubbles in the surf zone (crucial to understanding atmosphere–ocean gas flux, coastal erosion and the optimisation of military sonar).

Behind these advances lies rigorous physics: his oceanic work, for example, involved the discovery of a new ultrasonic signal and the understanding of its mechanism of generation. This was necessary before he could devise calibrations for the measurement device and incorporate it into an ocean-going rig capable of withstanding the energetic pounding of ocean waves.

Leighton's research has led to an improved ability to predict the performance of high-frequency sonars in the challenging coastal environments of modern naval warfare. He worked on the team that developed the world's first 3D sub-bottom profiler, which has been used for geophysics and marine archaeology. He has developed perhaps the only acoustic technique for measuring very dense bubble populations, like those found in the rough surf zone. He developed ultrasonic prototypes that are used in potteries around Europe for quality control; in production lines for pharmaceuticals and food; and in hospitals to monitor the treatment of kidney disease and osteoporosis.

His research has also contributed to measurement guidelines for foetal scanning, quality control in ultrasonic cleaning-bath manufacture and sonochemical reactors.

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LETTER FROM

...the careers team

When did you know what you wanted to do in life? For the lucky few who have always known, career planning has been simple. But for many it can take years of trial and error before they find something that makes them happy and fulfilled.

To help to guide our members through these difficult decisions, last year the Institute appointed a careers adviser – Vishanti Lall – who can offer one-to-one advice to those who need it. But we believe that there's much more that we can offer, and we've been looking at ways of improving our services to members who want to develop their careers.

A good starting place is our student members, who are just about to embark on physics careers. Many of our partners in industry have expressed concern about the declining interest in the physical sciences among young people, but we know there are plenty of talented young physicists out there.

Here at the Institute, we're well placed to bring the two together because we have strong links with student physics societies, university physics departments and our Business Partners Network of physics-based companies.

So on 27 October the Institute will be holding its first-ever **Science, Engineering and Technology Careers Fair** at its central London headquarters. This is aimed mainly at undergraduates in their final year of a university degree, but it will be open to all those looking for a job, including postgraduates and young physicists who may be looking for a new direction. Even if you're not looking just now, it will be an ideal opportunity to quiz people about the jobs they do and to find out where your career might take you.

Entry is free and there will be a wide variety of professional careers showcased at the fair, from the more traditional R&D jobs to ones in finance, health, scientific publishing, teaching and consultancy. There will also be a postgraduate careers adviser who will be talking about what it's like to do a PhD.

We have an impressive array of exhibitors on the look-out for new talent, including Accenture, AWE, BP, Dstl, ExxonMobil, MBDA, NHS Careers, QinetiQ and Sharp Laboratories of Europe.

The fair also features a drop-in CV clinic, so you can make sure that you're putting your best foot forward. And, in case you needed another reason to come along, there's also the chance to win one of three Sharp 15 inch LCD televisions. We hope to see you there.

Clair Collins is the main organiser of the careers fair. For more information, go to **http://careers.iop.org/careers_fair**.

Lost and found

Over the summer the Institute introduced new credit-card style membership cards, which have had some unexpected benefits. In the last few weeks we have received two separate phone calls from members of the public who had come across lost wallets containing the cards. From the details given we were able to identify the members, contact them and put them in touch with the person who had found their wallet.

This story has two morals. First, ensure you keep your membership card with you at all times. Second, give the membership department your up-to-date details by visiting http://members.iop.org and logging in to change your record.

Lisa Cornwell
Membership department, Institute of Physics

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

FALLACIOUS PHYSICS COMPETITION

Three wrongs that make a right

Back in June, *Interactions* launched Fallacious Physics – a competition for Einstein Year – and asked readers to send in examples of the "best of the worst physics" in movies, on television, in adverts or anywhere else they crop up.

The results are now in. First prize goes to Alex McDowell of South Ruislip, Middlesex, who spotted some bad physics in a recent episode of ITV's *Bad Girls*. In the drama about a women's prison, an inmate stabs one of the warders with a "knife" carved out of ice. To keep the weapon cool as she lay in wait, the prisoner had wrapped it in foil and stored it in a cold toilet cistern. As our winner points out, the physics is flawed on two fronts – water has a high specific heat so it would have melted the ice quite quickly, and using foil would have been counterproductive because it's a good thermal conductor.

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The two runners-up are Mahmud Fikri of Omareya, Kuwait, and Stanley Melinek of Borehamwood, Hertfordshire. Mahmud sent in the first few pages of Tintin's *The Shooting Star*, in which Hergé's hero thinks he has spotted a gigantic spider in space but is reassured by an astronomer that it's just a spider sitting on the telescope's lens (pictured left). As Mahmud points out, if there really had been a spider on the lens it would simply have made the image of the star fainter. Moreover, as the focus is set on the star, the image of the spider wouldn't appear.

Stanley chose to highlight an error in William Golding's *Lord of the Flies*. The character Piggy is described as "myopic", but Golding also says that Piggy uses his glasses to light fires. Stanley points out that a myopic person would have glasses with divergent lenses, but only a convergent lens would be useful in focusing sunlight to start a fire.

notices

NEW BUSINESS PARTNER

Withers & Rogers LLP.

NEW MEMBERS

Akhlaq Aslam, Keith Barrett, Jose Brandao-Neto, Joao Cabral, Robert Dacey, James Dutson, Timothy Gilfedder, Stephen Graham, Paul Green, Sasha Heriot, Paul Hulse, Marc Labiche, Maria Lada, Davy Machin, Robert Maier, Tetyana Mykhaylyk, Heather Pegrum, Eoin Phillips, Marc Schmidt, Mark Scrancher, James Sharp, James Stanley, Peter Stiffell, Cheuk-wai Tai, Nicholas Tsangarides.

IN MEMORIAM

Richard Bingham, Paul Booth, Gordon Camfield, Bertie Davies, David Dollimore, George Isaak, J M McAlister, Matthew Newnham, Terence Quinn, Alastair Rae, Tiesheng Rong, L P De Valence.

ANNOUNCEMENTS

- **The Arthur C Clarke Foundation** and the National Science Learning Centres are inviting entries for a student competition to create a five-minute presentation on the future of satellite technology. Entrants must be aged 14 to 18 and live in the UK. The first prize is a trip to NASA's Kennedy Space Center. The closing date is 15 December 2005. Visit www.clarkefoundation.org for further information.
- **The Public Sector Research Exploitation Fund** was set up by the Office of Science and Technology to help public sector researchers to turn their ideas into commercially marketable products. It has now been boosted by £25 m. The deadline for applications for funding in the current round is 4 November. Visit www.ost.gov.uk for application forms.
- **A new book**, *60 Years a-Growing: a History of the Canadian Association of Physicists*, has been published to mark the association's anniversary this year. Written by Jasper McKee, it costs C$15/$12.50 plus shipping. To order, visit www.cap.ca.
- **Physics on Course 2006**. The latest issue of the Institute's popular guide to higher education for prospective physics students is now available. Distributed to schools and colleges in the UK and Ireland, it is also available free to members. Contact Leila Solomon at the Institute (e-mail leila.solomon@iop.org).

WANTED

- **Nominations for the Institute's Young Professional Physicist of the Year Award 2006** We are looking for young physicists in industry, academia or elsewhere who have improved the public perception of physics, organised events promoting physics in their local area or worked in schools to help children and young people to understand physics. E-mail: sarah.connolly@iop.org. The deadline for nominations is 30 October.
- **Physicists for art project**. Artist Zev Robinson and computer programmer Adrian Marshall are seeking physicists who are willing to be interviewed for an art project that juxtaposes images, sound and text. For further information, e-mail: info@artafterscience.com.

MEMBER OFFER

- **Online subscriptions prize draw**

David J King from Bo'ness, West Lothian, is August's prize-draw winner. He will receive a 512 MB data stick. For your chance to win a data stick, pay your 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**).

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

• Practically Astronomical!
Royal Observatory Edinburgh, Islay, UK
7–8 October
Dan Hillier 0131 668 8406

• Motion in the Mall
The Chequers Centre, Maidstone, UK
8 October
Chantelle Jay 01732 843833

• Relatively Simple: $E = mc^2$ 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

Reflective, Emissive, Transmissive and Transflective Colour
UKDN, Bletchley Park, Milton Keynes, UK
11 October
www.ukdisplay.net

Signal Processing Solutions for Homeland Security
IEE, London, UK
11 October
www.iee.org/Events/SPSforHS.cfm

Future Access to Neutron Facilities – Town Meeting
CCLRC, The Royal Society, London, UK
11 October
www.cclrc.ac.uk

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

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

Commercialising Research for Nanofabrication
IOP Industry & Business, London, UK
13 October
http://industry.iop.org

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

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 Scientifique de Cargèse, Corsica, France
17–29 October
www.ccr.jussieu.fr/lptmc

When the Lights Go Out: Power to the People
CCLRC Daresbury Laboratory, Warrington, UK
18 October
liviop@amarks.co.uk

Chance Encounter with a Black Hole
The Royal Institution, London, UK
18 October
www.rigb.org

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

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 381580

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

Geometry and the Universe: a Symposium on General Relativity
Stony Brook University, New York, USA
20–21 October
http://insti.physics.sunysb.edu/itp

Cooling the Tube
Railway Engineers Forum, IEE, London, UK
21 October
www.iee.org/events/coolingthetube.cfm

2005 IEEE Nuclear Science Symposium (NSS) and Medical Imaging Conference (MIC)
Wyndham El Conquistador Resort, Puerto Rico
23–29 October
www.nss-mic.org/2005/nss2005.html

Workshop on Single Photon: Sources, Detectors, Applications and Measurement Methods
Teddington, Middlesex, UK
24–26 October
www.spw2005.npl.co.uk

• 'Make It' Rockets
INTECH, Winchester, UK
24–26 October
www.intech-uk.com

Energy: the Big Issues
IOP Energy Management Group, London, UK
25 October
http://conferences.iop.org/ebi

• Hands-on Activities
INTECH, Winchester, UK
25–28 October
www.intech-uk.com

• The Science of Halloween
INTECH, Winchester, UK
25–28 October
www.intech-uk.com

Good Practice in Reducing Noise
Institute of Acoustics, Oxford, UK
26 October
www.ioa.org.uk

RadiotecC
Gerotron Communication GmbH, Berlin, Germany
26–27 October
www.gerotron.com

Optical Science in the Fast Lane
The Royal Society, London, UK
27 October
www.royalsoc.ac.uk/events

• RSE Roadshow
The Royal Society of Edinburgh, Stranraer Academy, Dumfries and Galloway, UK
27–28 October
Harinee Selvadurai 0131 240 5000

International Symposium on Therapeutic Ultrasound
Boston, Massachusetts, USA
27–29 October
www.istu2005.org

SPO 2005: Optics of High Technology Material Science
Taras Shevchenko National University, Kyiv, Ukraine
27–30 October
infospo@univ.kiev.ua

World Conference on Physics and Sustainable Development
International Union of Pure and Applied Physics, Durban, South Africa
31 October – 2 November
www.wcpsd.org

NOVEMBER 05

3rd International Seminar on Medical Applications of Signal Processing
IEE, London, UK
3–4 November
www.iee.org/Events/MASP2005.cfm

• An Afternoon with Albert Einstein
Buckfast Abbey, Devon, UK
5 November
www.buckfast.org.uk

Quantum Cryptography
IOP in Scotland, Royal Society of Edinburgh, UK
8 November
www.phy.hw.ac.uk/~phydtr/iop

Postgraduate Training Workshop: Preparation & Patterning of Magnetic Materials
IOP Magnetism Group, London, UK
8 November
http://conferences.iop.org/PGW

Low Temperature Techniques Course
IOP Low Temperature Group, Aston Business School, Birmingham, UK
9 November
http://conferences.iop.org/LTO5

Medical Thermography and Thermometry
IPEM/NPL, Teddington, Middlesex, UK
9 November
www.npl.co.uk/tman

IEE Seminar on Safety Assurance
IEE, London, UK
10–11 November
www.iee.org/Events/safetyassurance.cfm

ONE-DAY MEETING

Phase Transitions in Polymeric Systems
76 Portland Place, London, UK
17 November
A meeting to combine physicists from academia and industry.
http://conferences.iop.org/PHT

Experimental Techniques in Semiconductor Research
IOP Semiconductor Physics Group, Nottingham, UK
11 November
http://conferences.iop.org/TSR

Human Factors Engineering Symposium: People and Systems – Who Are We Designing For?
IEE, London, UK
16–17 November
http://conferences.iee.org/pas2005

• Enjoying the Heavens Without Spending the Earth
Bristol Astronomical Society, Bristol Grammar School, UK
18 November
www.bristolastrosoc.org.uk

• You Don't Have to be a Genius
Birkenhead Park, Cheshire, UK
18 November – 3 December
Mary Green 0151 653 9602

Successful SMEs
IOP Industry & Business, London, UK
21 November
http://industry.iop.org

Scientists generate an electrifying performance

Thunderbolts and lightning make for a very frightening display of physics on the stage, reports *Michelle Cain*.

When science communication duo Simon Singh and Richard Wiseman entitled their recent sell-out performance *Theatre of Science*, it wasn't because they couldn't think of a more imaginative name for a science show in a theatre. They were trying to evoke the old Victorian idea of "theatre", complete with the kind of dangerous experiment that 100 years ago would have been performed on some poor, unsuspecting puppy.

No animals (or humans) were harmed in this show, but there was plenty of old-fashioned drama and suspense, mixed in with some scientific oddities, stand-up comedy and some very dangerous physics.

Magician Richard Wiseman (who, by day, is a professor of psychology at the University of Hertfordshire) had the daunting task of warming up the audience, who were already overheating in the 85-seat box of stagnant air that was London's Soho Theatre.

A few magic tricks later, we were introduced to the man who "puts the fizz into physics, the mystery into chemistry and the…athematics into mathematics" – Simon Singh, better known for his best-selling popular science books. Singh used some unusual examples to convey the essence of the scientific method. He began with *Teletubbies*, moved on to Britney Spears and Led Zeppelin, and rounded off his explanation with Shakespeare. If you're wondering what any of these have to do with science, you'll have to see Singh in action, but essentially he demonstrates how our brains are apt to invent patterns in anything and everything. The scientific method, says Singh, is the only way to avoid falling into this trap and to sort the real patterns from the imagined ones.

The science was broken up by an atmospheric theramin duet by Sarah Angliss and Steven Wolf, and an effortless performance by contortionist Delia du Sol, who appeared to stretch the limits of space–time by squeezing her entire body into a cube less than a metre across.

Wiseman then played some mind games with the audience, testing their perception and concentration. Even though I'd seen some of these illusions before, I still think they're brilliant – I love the way they contradict your common sense but still have simple scientific explanations.

Matt Writtle/EMPICS

"There was plenty of old-fashioned drama and suspense, mixed in with some scientific oddities, stand-up comedy and some very dangerous physics."

Judging by the number of people who seemed to be familiar with the tricks, I would guess that about half of the audience had some kind of science background. It's a bit of a shame that there were so many in that camp, as this kind of showmanship would be a highly entertaining way of bringing science to a wider audience, and it would have been great if the show had gone on tour.

There was a pretty good reason why that didn't happen – there aren't many theatres that would host a show that passes a million volts across the stage, just two metres from the audience. Luckily, the Soho Theatre did allow it (the £12 m worth of insurance no doubt helped), which meant that a thousand or so people had the once-in-a-lifetime experience of seeing and smelling one million volts up very, very close.

This was my favourite part of the show and made for a nail-biting finale. While Singh and Wiseman cordoned off the "strike-zone" (which was about 20 cm from the front row), we were warned that leaving our seats during the demonstration could be lethal. On this thrilling and alarming note, Wiseman boomed: "Welcome, the coils of death!" to accompanying eerie theramin music and flashing red lights.

The two Tesla coils (as they are more commonly known) were about shoulder height and were impressive enough even before they were switched on. There would be one million volts passed across the two coils, Wiseman told us, which would create a 50 000 °C plasma in the nearby air. Electrons were about to be ripped from their nuclei, and would emit light when they rejoined them – in other words, lightning would be created before our very eyes.

After this dramatic build-up, the coils were switched on and there was a loud crackling noise as the superheating of the air created sonic booms. The beautiful mauve fingers of lightning, constantly moving, would have been truly mesmerising if the crackling hadn't been so loud. An unusual smell also wafted through the audience, which Wiseman told us was nitric acid. Lightning creates ozone, which reacts with nitrogen in the air to produce nitric acid, and the smell added to the whole other-worldly experience.

"Bring forth the coffin of terror!" Wiseman said next, as a thin chicken-wire sarcophagus was wheeled in. The audience voted for Singh to be "zapped", so he squeezed into the Faraday cage and awaited his fate in silence. Even though I understood how the cage works (it's effectively a 3D lightning conductor), I would have been scared to get inside. The rest of the audience clearly felt the same way, and everyone concentrated tensely on the stage. Singh's final words as he emerged unscathed from the cage summed up the performance perfectly: "Thank God for the laws of physics!"

Michelle Cain is the Institute of Physics communications officer. There were just nine performances of the 2005 *Theatre of Science*. For more information about the show and future performances, visit www.simonsingh.com.

particles