

# NEWSLETTER

March 2008

## Magic reveals some of its secrets



Clockwise from top left: setting up and using the water rocket; the Sorting Hat says: "Hufflepuff"; explaining anatomy with a bony friend.

On 9 December the branch held its annual event, this year entitled Harry Potter and the Order of the Physicist. This is our biggest outreach event of the year. It is aimed at all ages but has a particular objective to stimulate an interest in science among school students.

The afternoon started with a lecture by Roger Highfield (author and science editor of *the Telegraph*) entitled the "Science of magic". Attendance was good and people seemed to enjoy it.

The quidditch-playing wind-up wizards were a big hit. They were constructed from a cotton-reel wheel and an elastic band for power, cunningly

hidden behind a cardboard silhouette. Hoops and a pitch were then set up for the quidditch games.

In the main hall the demonstrations included the old stalwart "spinning chair and bicycle wheel/bags of sugar", which was as popular as ever; a voice-changing microphone with Dementor effects and what sounded like a Dalek; a water rocket (outside, not in, or there would have been holes in the ceiling); and a bona fide sorting hat, which seemed to put a lot of people into Hufflepuff House.

The planetarium got more visitors than last year. Everyone who went seemed to enjoy

it, including some of the demonstrators, who had got into the spirit of the event with various academic robes, hats and broomsticks.

The table of Institute of Physics freebies "sold" well, with raids from teachers for their schools. The *Marvin & Milo* packs of "Do try this at home" experiment cards disappeared rapidly, as did the fuzzy Institute "bugs". I managed to bag one, but lost it to a little girl who needed it more than I did.

"Call my bluff" featured panellists Roger Highfield, Elizabeth Crilly, Paul Nicholas and Megan Morys.

The demonstrations included

optical illusions (a lit candle on a desk versus an unlit candle in a bell jar – mirrors made it seem that both candles were lit); impulses (support a broomstick by two needles in its end with the needles resting on wineglasses, then when you hit the broomstick, what breaks?); and sound waves (an acoustic spotlight that uses ultrasound to get a narrow beam and a beat frequency to make it audible). This year the audience didn't win, but neither did the panellists – it was a 3–3 draw.

It was a most successful afternoon, with more than 400 people attending.

**Rebecca Clark**

# Centre opening reunites pioneers

The participants at a landmark Cambridge conference, which reshaped our understanding of the nature of the universe, reunited on 19 December for the opening of the university's Centre for Theoretical Cosmology (CTC).

Prof. Stephen Hawking, who organised the original Very Early Universe (VEU) workshop, was joined by colleagues from the 1982 event for the launch of the centre, where it is hoped that future scientists will build on the foundations that he laid. They will use the facility to develop our understanding of the creation of the universe.

The opening was part of a four-day symposium of leading theoreticians who celebrated the 25th anniversary of that first VEU workshop and discussed the future of the field. The 1982 meeting marked the development of a new theory that preceded the modern idea of the Big Bang, known as the inflationary universe model. The model worked out how tiny vibrations of fields in the vacuum could be amplified on a much larger scale, to form galaxies and stars.

The new CTC features a unique statue of Prof. Hawking by artist the late Ian Walters. The sculptor was renowned for his full-body work depicting



*The new CTC will be instrumental in supporting further exploration of theories about the universe.*

Nelson Mandela, which stands in Parliament Square. The Hawking sculpture was his last public work before he died of cancer last year.

The vice-chancellor of the University of Cambridge, Prof. Alison Richard, was joined by distinguished guests for the opening of the facility at the Centre for Mathematical Sciences on Wilberforce Road.

At the opening, Prof. Hawking and the director of the centre, Prof. Neil Turok, outlined their plans to put the CTC at the centre of development and testing of theories relating to the universe.

Prof. Turok, chair of mathematical physics at the University of Cambridge, recently won a prestigious international award, the

Technology, Entertainment, Design prize, both for his work in the field of theoretical cosmology and for his efforts as an education activist.

Part of the Department of Applied Mathematics and Theoretical Physics, the centre will enable the university to continue its work in theoretical physics and cosmology.

**Jeannette Fine**, editor

## Physics Skills Day will be focusing on energy

The Cavendish Laboratory's 9th Physics Skills Day will be held on 21 June. The event is designed specifically for newly qualified physics teachers and for those teaching physics who do not have a background in the subject, with the aim of providing support and continuing professional development for people teaching 11–16-year-olds (Key Stage 3 and Key Stage 4). Science technicians are also welcome to attend.

The theme of this year's Skills Day is energy. The event will include discussion sessions and information about key discoveries that were made in Cambridge and cutting-edge

developments in this field.

The discussion sessions will provide a comprehensive overview of issues in the teaching and learning of concepts in energy, practical approaches to resolving these issues and information about resources available to support teaching. The sessions will include conceptions and misconceptions – issues in the teaching and learning of concepts in energy; information on the energy content in the National Curriculum along with information on web-based resources; and a practical opportunity to participate in and develop engaging activities to promote the understanding of

concepts in energy.

There will also be a presentation during the day that will include information about the Cavendish Laboratory's cutting-edge energy research. There will be ample opportunity to discuss your own experiences of teaching and learning about energy and to raise any questions that you may have about teaching, learning and research in this field.

The day will start with coffee at 9.30 a.m. and end with an opportunity for open discussion at 4.00 p.m. Lunch and refreshments will be provided.

The meeting is subsidised by the Cavendish Laboratory and the Institute of Physics, so it

has been possible to limit the fee to £20 per participant. To book a place, send a cheque for this amount, payable to the University of Cambridge. The number of places available is limited to 25 to ensure optimum participation in the planned practical activities.

For further details, contact Dr Lisa Jardine-Wright, Educational Outreach Office, Cavendish Laboratory, Madingley Road, Cambridge CB3 0HE (tel 01223 333 318; e-mail outreach@phy.cam.ac.uk). Further information is also available at [www-outreach.phy.cam.ac.uk/phy\\_skills\\_days/](http://www-outreach.phy.cam.ac.uk/phy_skills_days/).  
**Jeannette Fine**, editor

# Course challenges pupils

Do you know some AS-level students who are interested in physics and who could benefit from a challenge? If so, the Senior Physics Challenge (SPC) might be for them.

The SPC is a summer school offered by the Department of Physics at the University of Cambridge that tries to bridge the gap between the way in which physics is very often taught in secondary schools and the way in which people are expected to learn it at university. At secondary school the emphasis is frequently on rote learning to pass exams, while at university much more emphasis is put on problem solving and experiment work.

The summer school offers intensive tuition that emphasises the development of these problem-solving and

experimental skills. Most of the time during the day will be devoted to solving physics problems, usually via lab classes, although there will be three or four lectures on general physics and research.

Students will stay at a small number of colleges. The group will eat together in the evening then have entertainment (e.g. physics estimation quizzes), and talks about university physics and admissions in the UK. The SPC will start in the afternoon on 29 June and will end after lunch on 3 July.

Attendance at the summer school is by nomination and teachers are invited to nominate one or two of their students. They should already have displayed some aptitude for physical and mathematical thinking, shown promise at

GCSE and during their AS year, and must be taking physics and mathematics forward to A2 level. Further mathematics is not necessary for the simple reason that many schools do not offer it. It should be made clear to the students that the SPC will be demanding, but also rewarding for those who have a strong interest in physics and plan to continue with it at university level. To apply and for further details, see [www-spc.phy.cam.ac.uk/](http://www-spc.phy.cam.ac.uk/).

Given the ages involved, students will be required to adhere strictly to the policies relating to children under 18 being in the university.

The SPC receives financial support from the colleges, the Cavendish Laboratory and the Ogden Trust.

**Jeannette Fine**, editor

**The deadline for your contributions to the next issue of this newsletter in May is:**

**Friday  
28  
March**

## Talk introduces LHCb experiment

The last Cambridge Physics Centre lecture of the 2007/2008 season will be on 11 March during Science Week. "Physics at the high-energy frontier – the Large Hadron Collider" will be given by Dr Valerie Gibson, a lecturer in the Department of Physics at the University of Cambridge and a fellow of Trinity College. She is the UK spokesperson for the Large Hadron Collider (LHC) experiment LHCb, which is designed to study matter-antimatter asymmetries and search for new physics. Her work is with a worldwide team investigating the differences between matter and antimatter by studying the beauty (b) quark.

Our understanding of the universe is about to change. The LHC at CERN near Geneva will be the world's most powerful accelerator when it is switched on later this year. Two beams of subatomic particles called hadrons (protons or lead ions) will travel in opposite directions round the circular accelerator, gaining energy with every lap. Physicists will use the LHC to recreate the conditions that existed just



*CERN's LHC promises to shed light on the origin of the universe.*

after the Big Bang by colliding the two beams head-on at very high energy. They will analyse the particles created in the collisions using special detectors in a number of experiments that are dedicated to the LHC.

The LHC is designed to answer fundamental questions about the elementary components of matter, the forces that bind them and the evolution of the universe. There are many theories about what will result from these collisions, but what's for sure

is that a brave new world of physics will emerge from the new accelerator as knowledge in particle physics goes on to describe some of the workings of the universe.

The lecture will take place at the Cavendish Laboratory, Madingley Road, Cambridge, starting at 6.00 p.m. in the Pippard Lecture Theatre. There is no need to call about this lecture – just come along.

The lectures are supported by the Cavendish Laboratory and the Institute of Physics.  
**Jeannette Fine**, editor

**E-mail your material to:**

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## Cambridge preps science festival

This year, Cambridge's science festival will take place on 10–20 March with a theme of "the world of science". It will offer more than 100 free events for all ages on all subjects, from astronomy to zoology.

The very popular Science on Saturday will be held on 15 March, when more than 40 departments, museums and community partners will open free of charge across the city. This will include Cambridge Hands-On Science (CHaOS) between 10.00 a.m. and 4.00 p.m. at the Cavendish Laboratory, featuring experiments ranging from the electrolysis of water, via a giant human hand, to the mechanics of how bridges work.

On Sunday, from 2.00 p.m. to 5.00 p.m., the Cavendish Laboratory will hold the Physics Department Open Day, with a range of hands-on experiments (this one will also be CHaOS-ic) and a lecture at 2.00 p.m., entitled "In synchrony: why things hang together".

Spontaneous synchronisation is at the heart of many natural phenomena. Your heartbeat is maintained by cells contracting in a synchronous wave; some cicada species avoid predators by timing their emergence to repeat in a cycle of prime-number years. Unplanned synchrony can lead to wobbly bridges or epileptic seizures.

Quantum synchronisation is responsible for lasers and superconductors, and it is the accepted theory (the Higgs mechanism) for the existence of mass in the universe. This lecture with demonstrations will explore some of the range of synchronisation phenomena, from the quantum to the classical worlds.

The hands-on experiments will include some from Lab in a Lorry, making dragster racing cars and a wobbly bridge to walk on. We will also have the ever-popular planetarium, so, if you want to see the stars, be sure to book your place early.

Directions to the Cavendish Lab can be found at [www.phy.cam.ac.uk/directions.php](http://www.phy.cam.ac.uk/directions.php).

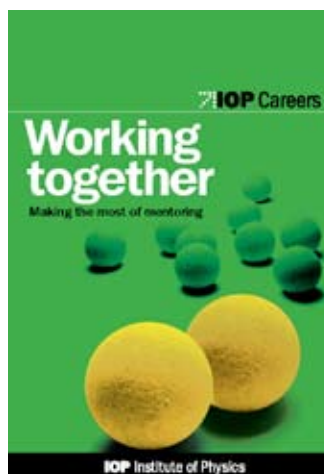
**Jeannette Fine**, editor

# IOP offers advice about mentoring

What is mentoring? This is when an individual offers to provide support and guidance to someone who is less experienced in a particular area to help them with their career or professional development. It can be useful for people who wish to develop their career or new skills, or who are returning to work after a break.

The Institute has launched a mentoring resource that allows members to match themselves with other members who wish to be mentored or to act as mentors. This can be found at [www.iop.org/activity/careers/Mentoring/](http://www.iop.org/activity/careers/Mentoring/). In addition, a workshop on mentoring at the Crowne Plaza, Cambridge, on 13 March at 6.30 p.m. offers the chance to discuss what mentoring is, learning styles, mentoring styles, mentoring skills, the mentoring relationship and the benefits of mentoring. Registration for both the workshop and the mentoring service is online. When you have registered, you will be able to search for an appropriate match, depending on your needs and experience.

The Institute has produced a booklet entitled *Working*



The IOP's booklet on mentoring, which is available for download.

*Together* to provide more information about mentoring and to help participants to get the most from their mentoring relationship. For a PDF version of the guide, see [www.iop.org/activity/careers/Mentoring/](http://www.iop.org/activity/careers/Mentoring/). To request a hard copy, e-mail [mentoring@iop.org](mailto:mentoring@iop.org).

The Institute also offers short mentoring workshops to groups of members and business affiliates. E-mail [mentoring@iop.org](mailto:mentoring@iop.org) for more details.

**Jeannette Fine**, editor

## Wrap up and join the West Norfolk Astronomy Society every fortnight

The West Norfolk Astronomy Society is now meeting for observing sessions at Tottenhill Village Hall on the second and fourth Mondays of the month. Meetings are usually accompanied by refreshments and a short talk.

The dress code for these meetings is winter woollies. For further details, contact John Clark (tel 01553 679 37).



*Mars before, during and after its closest approach to Earth in December. The north pole was visible before the Earth overtook Mars. The south pole is now visible. Photograph by John Clark, using an 8 inch telescope and a webcam.*

## Institute offers members a one-to-one careers session

The IOP mobile careers sessions are proving popular with East Anglians. That held in Cambridge on 13 February was already fully booked by the

end of January. These provide members with a one-to-one session with an IOP careers adviser. They are also available at the Institute's headquarters

## Apply for public engagement grants by May

The next closing date for grants of up to £1000 under the IOP Public Engagement Grant Scheme 2008 is 2 May 2008. For more information, visit [www.iop.org/activity/outreach](http://www.iop.org/activity/outreach).

## Outreach group entices students

This year, educational outreach at the Cavendish Laboratory is offering "Opposites attract" for its two schools workshops. The one in April is fully booked but there are places available on the second on 9 December.

The workshops, which run from 1.00 p.m. to 4.00 p.m., are aimed at Key Stage 4 students (ages 14–16). They offer a conceptual grounding in the subjects of electricity and magnetism, but also go beyond the National Curriculum and provide an opportunity for inspiration through experimentation.

The afternoon will include an introductory lecture, a hands-on practical session and a lecture on electricity and magnetism in cutting-edge biophysics.

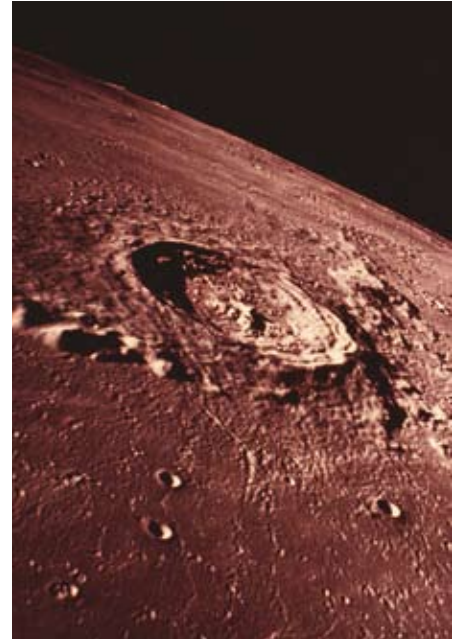
Only 60 places are available, with a maximum group size of 15 students per school. Places will be allocated on a first come, first served basis. Book by 31 October at [www-outreach.phy.cam.ac.uk/workshop/Dec2008/booking.php](http://www-outreach.phy.cam.ac.uk/workshop/Dec2008/booking.php).

**Jeannette Fine**, editor

## Committee needs a new treasurer

David Andrews has resigned as treasurer. Chairman Bill Proud will be acting as treasurer, and vice-chair Paul Millar will act as chair. Applicants to replace David are most welcome.

# Lectures jump, spark and crash through physics



The topics of three recent Cambridge Physics Centre lectures were skydiving, Michael Faraday and the physics and chemistry of impacts.

On 4 December Jules Hoult of Uppingham School gave a talk entitled “The physics of skydiving”. He began with an explanation of the process and posed some questions.

Modern skydiving involves going to about 13 000 feet in a plane, jumping out and falling, deploying a parachute at about 2500 ft, and then flying down to a safe and controlled landing.

Why 13 000 ft and 2500 ft?

Well, 13 000 ft gives a reasonable time in the air without running into problems with the thin atmosphere (for both plane and skydiver) and extreme cold. At 2500 ft, assuming an average weight of about 700 N, it’s “12 s to ‘splat’”, and this gives the skydiver time to deploy their reserve parachute if the first one doesn’t open correctly.

Why and how does a skydiver fall? Why is fairly obvious. However, since gravity is a constant and air resistance isn’t, a terminal speed is reached, which skydivers consider fun. They learn to stabilise themselves by arching their bodies, and they can tilt to turn, etc. They can do various things while falling, including just enjoy the view; pull faces at one another; and a number of “funky things in formation”.

Attendees also received a potted history of the parachute, including the reason, however paradoxical, that they all have holes in them. This is so that the air is neatly displaced through the top and not out of the sides, which prevents much air sickness. Nowadays, rectangular parachutes are used because they are far easier to steer than round ones and consequently give softer landings. Gliding just above the ground, however, was not recommended as this tends to lead to broken – or at least severely bruised – legs.

Hoult also went over the calculations showing how fast his terminal velocity was and how long he’d be falling. At the end there was an opportunity to ask questions. After the inevitable “What if both parachutes don’t open?” (to which the reply was “In your last four seconds, pray.”), more interesting queries appeared, such as: “What’s the stupidest thing you’ve ever done while skydiving?” In fact, it was skydiving with a watermelon, which exploded somewhere over Texas. The squash he tried the next day worked rather better (it fell at the same speed as the skydiver so he could watch it all the way to

the ground). Hoult also told of events where people skydived in or with anything at all, including convertible cars.

It was an interesting lecture, well attended and with good jokes interspersed.

On 17 January a lecture entitled “Unifying light, electricity and magnetism: the life and work of Michael Faraday” was given by Prof. Frank James, professor of the history of science and head of collections and heritage at the Royal Institution.

Faraday was at the forefront of British science during his lifetime and is particularly remembered for his discoveries about electricity, which he made in the basement laboratories of the Royal Institution in London. His discoveries had few practical applications in his lifetime because the potential for the large-scale use of electricity was only realised later in the 19th century. However, his work laid the basis for modern electrical engineering.

Faraday was also the supreme scientific communicator of his time. He used the lecture theatre of the Royal Institution to popularise science and engineering, and he played a role in founding the Christmas

lectures for young people, which continue today. In his lecture, Prof. James demonstrated some of Faraday’s experiments.

Dr Emma Taylor, lecturer in the Department of Physics and Astronomy, and the Centre for Earth Planetary Space and Astronomical Research at the Open University, gave a talk on 19 February called “A shocking solar system”.

Impacts may have played important roles in the development of life, both creating and destroying habitats and materials. They are also one of the major influences on solar-system bodies, along with volcanism and plate tectonics. Owing to the high energies involved, interesting physics and chemistry can occur. Understanding those events – working out the “When did it happen?”, “How much effect did it have?” and “What happened as a result?” – can be done with laboratory equipment and computer codes, but it can be rather challenging. This talk gave an overview of the big questions that impact scientists are trying to answer, and how they are investigating them via experiments, simulations and other approaches.

**Rebecca Clark**

# Spring events programme

For anyone interested in learning more about physics, here are some lectures that are taking place in the Cambridge.

## Monday 3 March

### Nanoelectronics and quantum computing

Dr David Williams, head of the Hitachi Cambridge Laboratory, Wolfson Lecture Theatre, Churchill College. Put on by the Cambridge Society for the Application of Research.

## Wednesday 12 March

### Carbon footprinting: industry, people, the universe and everything

Prof. Adisa Azapagic, Manchester University. Lecture Theatre 0, Engineering Department, Trumpington Street. Part of the sustainable development annual lecture series.

## Tuesday 18 March

### The thinking machine: can a machine think?

The next University of Cambridge Research Services Division Horizon Seminar will be at Emmanuel College, Cambridge. For more information, visit [www.rsd.cam.ac.uk/events/horizon/fifthseries/tm.html](http://www.rsd.cam.ac.uk/events/horizon/fifthseries/tm.html).

## Wednesday 19 March

### Millennium mathematics project: convincing yourself, convincing others

Charlie Gilderdale, MMP. University of Cambridge, MR2, Mathematical Sciences, Centre for Mathematical Sciences.

## Wednesday 26 March

### Clinical applications of FRET and FLIM

Prof. Boris Vojnovic, Gray Cancer Institute, University of Oxford. Cancer Research UK, Cambridge Research Institute. Part of the first Theodor Förster international lecture series.

## Wednesday 23 April

### Visualization of signalling across the plasma membrane in living cells using genetic encoded fluorescent sensors and multimode microscopy

Prof. Theodorus Gadella, University of Amsterdam. Biochemistry Lecture Theatre, Sanger Building. Part of the first Theodor Förster international lecture series.

## Wednesday 23 April

### Sustainable development at the Eden Project

Tim Smit, Eden Project. Lecture Theatre 0, Engineering Department, Trumpington Street. Part of the sustainable development annual lecture series.

## Thursday 24 April

### Ocean acidification: the other CO<sub>2</sub> problem

Prof. Nick Owens, director, British Antarctic Survey. Buckingham House Lecture Theatre, New Hall, Huntingdon Road. Part of the Environment on the Edge lecture series. Admission is free, all are welcome. To register, e-mail [director@unep-wcmc.org](mailto:director@unep-wcmc.org).

## Monday 28 April

### www.Antibodies Direct.com

Dr Jonathan Milner, Abcam plc. Wolfson Lecture Theatre, Churchill College. Put on by Cambridge Society for the Application of Research.

## Wednesday 30 April

### Climate change and ecosystem services: science, economics and ethics

Prof. Robert Watson, chief scientific advisor, DEFRA and director of strategic development. Tyndall Centre, Lecture Theatre 0, Engineering Department, Trumpington Street.

Part of the sustainable development annual lecture series.

## Thursday 1 May

### International environmental governance

Prof. Bob Watson, chief scientific adviser, DEFRA, in the Buckingham House, and director of strategic development at the Tyndall Centre.

Lecture Theatre 0, New Hall, Huntingdon Road.

Part of the Environment on the Edge lecture series. Admission is free, all are welcome. To register, e-mail [director@unep-wcmc.org](mailto:director@unep-wcmc.org).

## Wednesday 7 May

### Milton 400th anniversary lectures: Milton: poetry vs. prose

Sharon Achinstein. Room 3, Mill Lane Lecture Rooms, 8 Mill Lane, Cambridge.

## Thursday 8 May

### Fluorescence correlation spectroscopy

Prof. Petra Schwille, Technical University of Dresden, Germany. Cancer Research UK Cambridge Research Institute. Part of the first Theodor Förster international lecture series.

## Monday 12 May

### I was nowhere near there at the time, Guv – honest

Prof. Sir Bob Hepple, chair of the Nuffield Council on Bioethics, former master of Clare College. Wolfson Lecture Theatre, Churchill College. Put on by the Society for the Application of Research.

If you want more information, visit <http://talks.cam.ac.uk/show/index/5462>.

I don't know what the 12 May talk has to do with science, but I'm sure all will be revealed.

# Got an idea for a branch event? If so, e-mail:

# jeannette.fine@finerandd.com

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