IOP | Institute of Physics
Education *Supporting Teachers*

Classroomphysics

The newsletter for affiliated schools

June 2010 Issue 13

Dr Andy Newsam – who gave the Institute of Physics Schools and Colleges Lecture for 2009, "Exploring the universe" – is on sciencelive.net.

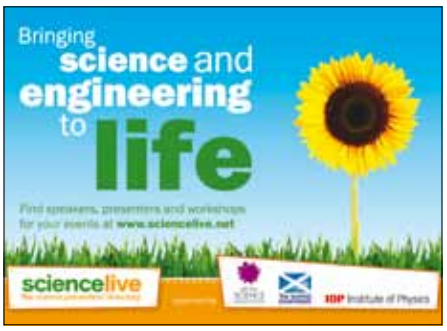
sciencelive.net comes to the rescue

How do you find speakers or workshop presenters? If you spend hours trawling the web hoping to find someone, something, anything that will meet your needs or if you just don't bother because the mere thought of the task fills you with dread, then you need www.sciencelive.net.

The *sciencelive.net* database of science presenters is designed to take the hassle out of finding people who can come into your classroom or science club and run high-quality science enhancement and enrichment activities. There are currently more than 250 presenters on the database and more than 144 of these state that they cover "physical processes". A further 88 cover "materials and their properties" and 43 specifically mention physics in the description of their presentation.

You can search the database by the name of the presenter, where they're willing to travel to, whether or not they charge a fee, age of audience, presentation type and what part of the curriculum they cover.

An added benefit of the database is that



The sciencelive.net *site is springing into action.*

teachers are strongly encouraged to leave feedback and rate the presenters so that others know what to expect before booking. While there's no substitute for phoning a potential presenter to talk through your needs, the moderated feedback provides invaluable peer recommendations that help to keep standards high.

Liselle Dixon of Ashlawn School in Rugby used *sciencelive.net* to help organise a summer science fair this year. Commenting on the experience she said: "Thirteen of the 20 workshops that we are running came from your website and I've saved many more diverse contacts for future events. Thank you for making planning these fun events a whole lot easier."

It's not just teachers who are benefitting from *sciencelive.net*. Presenters have welcomed the increase in enquiries that being on the database has generated, as well as the ability to gain feedback through the site. However, there is a note of caution for teachers. Andy Newsam from Liverpool John Moores University says: "I'm getting queries from a wider range of people than I normally do but many of them are generic scatter-shot approaches, which are not really relevant."

sciencelive.net can definitely make organising a visiting speaker, presenter or workshop much easier but make sure that you target your enquiries and don't leave booking to the last minute or you may be disappointed. Finally, make sure that you leave feedback so that everyone can benefit from your experience.

Editorial

Welcome to the last edition of *Classroom Physics* for this school year. As we go to press, a new government has just been formed and it looks like there may be significant changes on the horizon for teachers and schools. Over the last few years, the STEM agenda has meant that physics has had an increasingly visible profile in the world beyond school, reflected in the number of recent television programmes with a science focus. We hope that this attempt at understanding the significance of physics reaches into schools and classrooms all over the country. There are details about a new Future Morph poster that you can use to help students to make the links between science and future careers (p2).

The Institute's education department has been busier than ever over the last few months, as the Stimulating Physics Network (p3) rolls out across England and various other projects continue to progress – see updates on the Education Forum (p2) and *talkphysics.org* (p3). Our front-page story is a reminder that *sciencelive.net* is an easy way of looking for and contacting speakers and workshop presenters.

There are reports on our course for sixth-formers, Physics in Perspective, and the Big Bang Fair in Manchester (pp4&5), as well as news of events and projects for students, including the British Science Festival and the CERN@school project, based at a school in Canterbury.

Our teaching tips include some ideas from the Gatsby Science Enhancement Programme on using phosphorescent film in teaching the properties of the e–m spectrum (p7) and there are suggestions for modelling the Earth's magnetic field from the Earth Science Education Unit (p8).

If you are an affiliated school you will be receiving the 2009 Nobel Prize in Physics poster and ASE wall planner with this mailing. In addition, there is a shopping list of some of our resources that you might like to order from us. If you would like to do so, complete the form, scan it and e-mail it to education@iop.org or fax it to 020 7470 4991.

As ever, feedback is always appreciated. Have a good summer!

Clare Thomson, editor (tel 020 7470 4981, e-mail clare.thomson@iop.org).

Future Morph campaign promotes jobs in STEM

The Science Council has produced a new poster to promote the Future Morph careers website and to raise awareness of the job opportunities available from science- and maths-related subjects. The A1 poster features a range of people working in STEM and the reverse is designed as a blank template for students to create a version of the poster using their own images.

For more information: To request copies of the poster, contact Future Morph (e-mail futuremorph@sciencecouncil.org) or visit www.futuremorph.org.

New education forum is set to involve Institute members

The Education Forum was launched on 29 March with a lunch and an inaugural meeting.

The forum gives members and named teachers from affiliated schools an opportunity to engage with educational issues and to link with the educational activities of the Institute. We hope that members of the forum will support Institute educational activities and advise on projects and policy – for example, providing input to consultations.

Active members have the opportunity to join advisory committees for events and conferences, such as our Physics Update courses and our Teachers Award panel, and we welcome the opportunity to have more teachers involved in this important work. We anticipate that the forum will conduct much of its business online, although, in addition, there will be periodical meetings (probably annually).

The launch event attracted 43 teachers from affiliated schools and individual members, 21 of whom signed up to be active members; we ran workshops on the new GCSE specifications and on general concerns about physics at GCSE level. There was a positive, purposeful atmosphere and we had excellent feedback (which we are still collating) about the issues and the event.

For more information: If you would like to join the forum, visit www.talkphysics.org, log in or register and then look for "Education Forum" under "all groups". You can then click on "request membership" on the left-hand side. If you would like to become an active member, e-mail education@iop.org with your request.

Teachers of physics sign up to summer practicals

Professional development courses from the Getting Practical (GP) programme are taking place all over England during June and July. There is still time for teachers and their supporting staff to register their interest and take part in a course before the end of the summer term.

This training offers teachers, technicians and HLTAs the opportunity to reflect upon the way that they teach practical physics and to discover ways to improve the effectiveness of their practical lessons. Courses that have already taken place have been extremely successful and popular with teachers of physics.

Getting Practical

The GP site (www.gettingpractical.org.uk) lists the dates of courses that are currently planned and it is regularly updated as new course dates and venues become available. Take a look to see how you can get involved.

For more information: To register your interest in the programme, contact Kirstie Hampson (e-mail kirstiehampson@ase.org.uk, tel 01707 283 000).

Physics network is a real source of inspiration

Last September we announced the launch of the Stimulating Physics Network. So how has this exciting school-based support programme developed since then?

Our Physics Teacher Network has been expanded so that we now have 37 Physics Network Co-ordinators (PNCs) supporting all teachers of physics in England, as well as the co-ordinators working in the rest of the UK. This means that there are now many more free local workshops and network meetings for you to choose from. PNC workshops help teachers to develop a variety of teaching and learning approaches that engage and motivate all pupils. To find out how you can access workshops such as "Ideas for modelling in electricity for KS3", "Rocket launcher make and take" and "What happens next?", check out "Events" (p6) or your regional page on www.stimulatingphysics.org.

We have also recruited 23 teaching and learning coaches (TLCs) who are working in partnership with 276 schools by offering in-school, bespoke support focused on increasing the uptake of physics at A-level. During the course of an academic year, TLCs spend five or six days in each school developing support programmes tailored to the needs of individual schools/teachers.

The head of science from a school in Leeds said of the support that she has received: "The specific support offered by Rachel was outstanding and focused on what we really needed at the time so we could instantly improve the quality of the teaching and learning."

In addition to offering workshops focused on developing the teaching and learning of physics, TLCs can also provide one-to-one support for non-specialist teachers of physics. They also work with teachers to introduce after-school clubs, run a virtual music festival based on physics ideas (Ashfield), develop strategies for encouraging more girls to continue with physics beyond GCSE, set up e-mentoring support for pupils, integrate careers materials into schemes of work and expand the range of purposeful practical work that takes place in physics. In addition, they facilitate a visit from the "Ever Wondered Why?" Roadshow, designed to enthuse students about physics and the world around them.

David Richardson, the "Ever Wondered Why?" Roadshow presenter, enthrals some students.

There may still be a few final places remaining on this intensive support programme. If you are interested, contact your regional external liaison officer (contact details are on your regional page at www.stimulatingphysics.org).

For more information: visit www.stimulatingphysics.org or www.iop.org/network.

Teachers take time out to get talking physics

The Institute's new community website *talkphysics.org* is up and active. It is the place to go to share ideas, get tips or simply gossip about the world of physics and physics education.

The site is structured around groups. Once you have registered, you can use the tabs on the homepage to see the most recent discussions in all open groups. In particular you might want to start with "News and comment", which functions in a similar way to our PTNC and CAPT e-mail user groups. You will get e-mail updates when there is a new post, unless you switch this function off.

To follow or contribute to a discussion, follow the link on the homepage (join the group – if you haven't already) and away you go. You can also look for older discussions using the search. When you join a group, you can use the notifications page to get e-mail updates of all new comments.

You can also set up your own groups to share your ideas with the world (in open groups) or within your department (in a closed group).

talkphysics.org
Linking teachers of physics

The site is still under development and we are interested to hear your thoughts and ideas, either directly or through the "Issues and suggestions" group.

For more information: visit www.talkphysics.org to register and get started.

New programme promotes cutting-edge science in the physics classroom

Contemporary science topics fascinate students because they are perceived as exciting and controversial, helping students to engage with cutting-edge, real-world problems. This experience is known to change attitudes and affect career choices.

As scientific developments progress so rapidly, it is important to give teachers the opportunity to remain excited and engaged with their subject. The Science Learning Centre (SLC) network has developed a suite of courses in partnership with researchers funded by Research Councils UK. The Contemporary Science programme is designed to deliver the latest knowledge, new contexts and practical activities to support teachers in delivering the curriculum in an accessible, enjoyable and stimulating way for all.

Many of these courses take place at the centres and institutions where the researchers work (e.g. "New materials and nanotechnology" at the Science Museum and Imperial College, "Astrophysics" at Mill Hill Observatory and "Measuring performance in sport" at the University of Leicester).

In addition to allowing teachers access to contemporary science directly linked to the curriculum, these events aim to broaden teachers' knowledge and confidence for the delivery of many How Science Works aspects. For example, when looking at the use of modelling in a climate change course, teachers have the opportunity to work with real data and take these activities back for their students to try. The events include opportunities for debates on ethical and social issues (e.g. the socio-economic impact of earthquakes).

Each course is designed to support Key Stage 4 science specifications but the contexts in many of the courses will be relevant to post-16 teaching as well. Thanks to Research Councils UK funding, the courses qualify for an Impact Award of £200 per day. Any teacher from a maintained school or college in the UK can apply.

Physics-related courses include "Astrophysics", "Climate change" and "New materials and nanotechnology".

Sheila Curtis, SLC London

For more information: about the Contemporary Science programme, visit www.slcs.ac.uk/cuttingedge or the Research Councils UK at www.rcuk.ac.uk/per.

Event inspires future physicists

"The quality of the lectures was superb and the students were really inspired, as was I!"

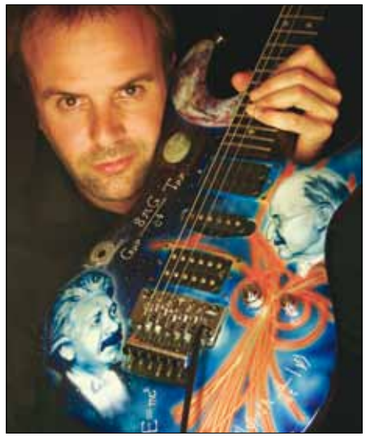
"We travelled a long way for this event but the change in attitude of my students is remarkable."

"The clear enthusiasm of the presenters was transferred to the audience who seemed spellbound most of the time."

With lectures from the likes of professors Jim Al-Khalili and David Mackay – covering diverse topics ranging from the Large Hadron Collider, computer games, sustainable energy and time machines – this year's sell-out Physics in Perspective course was an immense success. Schools from all over the UK attended and the teachers who organised this trip were as much engaged by the talks as their students. The Sunday lectures are located in the heart of University College London's campus, with the following two days based at the Royal Institution, a venue steeped in scientific history.

The dates of next year's Physics in Perspective course will be 20–22 February 2011. Look out for the advertising flyer, which will be included in the September issue of *Classroom Physics*. This is a must-attend event for all your aspiring physicists.

For more information: If you wish to be included on the mailing list for next year's event, contact Manchi Chung (e-mail manchi.chung@iop.org).



Presenter Mark Lewney and his electric guitar.

Scottish students scoop the Institute's prize for physics

Keith Alexander and Erik Bews, who are both aged 17, from Kirkwall Grammar School in Orkney won the prestigious Institute of Physics prize for physics at the National Science and Engineering Competition at the Big Bang Fair in Manchester this March for their research into wave-testing facilities.

The winners, who are currently doing their Advanced Higher physics, developed their project to gain an idea of the limitations of wave tanks, specifically looking at the ability of the wave-tank beach to absorb waves and its capacity to produce predictable waves under different conditions.

As winners of the Institute prize they receive £500 plus a certificate and a visit to two of the UK's world-leading research facilities, the Diamond Light Source and the ISIS neutron and muon source at the Harwell Science and Innovation Campus in Oxfordshire.

Alastair Skene, principal teacher of physics at Kirkwall Grammar School, said: "It is good to see ingenuity, hard work and interest being rewarded in science. Opportunities for success send a message to younger pupils that physics can be not only intensely interesting but also rewarding."

Co-ordinated by the British Science Association in partnership with Young Engineers and The Big Bang, the competition, open to all 11–18-year-olds, accepts research projects from all areas of science, technology, engineering and mathematics.

Keith and Erik receive their award at the ceremony in Manchester from the Institute's President, Professor Dame Jocelyn Bell Burnell.

The British Science Festival challenges and enthuses students of all ages

The British Science Festival (BSF) is Europe's largest celebration of science, engineering and technology with a wide programme of events for adults, families and school groups. In partnership with Thinktank, Birmingham's award-winning science museum, the festival visits Birmingham on 14–19 September.

The BSF is a great way of encouraging young people to enjoy studying STEM subjects through interactive workshops and entertaining and informative science shows.

It also allows students to discover for themselves how science affects all aspects of their lives, and enjoy some hands-on fun. As well as enriching curriculum activity for students, the event also provides resources and ideas for teachers to use in class.

For younger students the emphasis is on making science activities enjoyable and relevant to their lives. For example, budding footballers will learn how, by knowing about physics, they can take a perfect free kick by watching the film *Bend It Like Beckham*.

The festival gives older students the chance to immerse themselves in discussion and debate about how science is applied in our everyday lives and to consider ethical concerns surrounding different areas of science. Activities include the provision of energy in the future and the science behind particle accelerators.

You may also be interested in bringing students to one of the Award lectures. These lectures offer a rare opportunity to meet and question some of the UK's most inspiring scientists and engineers, and gain new insights into the broad range of careers that are open to those that study STEM subjects.

A visit to the BSF may well be a life-changing event for many students.

For more information: visit www.british-sciencefestival.org for more details and to download a copy of the schools programme.

CERN@school engages students in research

Would your students be interested in getting hold of a piece of detector from the Large Hadron Collider? The CERN@school project aims to allow students to do just this, as well as giving secondary schools across the country the opportunity to become involved in university-level physics research. Dr Becky Parker, from the Simon Langton Grammar School for Boys in Canterbury, is starting a pilot project involving 10 schools in Kent and she hopes to extend this to many schools across the UK.

In 2008 the Langton Satellite Team came second in the British National Space Centre/Surrey Satellite Technology Limited Space Competition to put an experiment in space. It designed a new-style cosmic-ray detector based on Medipix detector chips developed at CERN. LUCID (Langton Ultimate Cosmic ray Intensity Detector) will fly on the TechDemoSat satellite in early 2012. Along with the detector in space, Becky thought that it would be interesting to have smaller versions of LUCID – CERN@school detectors – in schools. These can be used for radioactivity experiments and also for monitoring cosmic rays, for example detecting muons. She is linking all of the schools that are involved to a server at the Langton Star Centre to map cosmic radiation and to correlate readings as the satellite passes over when it is operational.

Becky set up the Langton Star Centre when she joined the school as head of physics and she says: "We find that giving students the chance to be involved in a real research project and to collaborate with other students encourages a huge uptake in physics both at A-level and beyond to university. We are aiming to link up with other cosmic-ray projects across the world to make a much larger network. We have support from the GridPP, the UK part of the CERN Grid to give us access to the facilities of the Grid once the volume of data becomes too large for the Langton Star Centre. Your students would therefore be involved in a CERN@school collaboration linked together by the CERN Grid!"

As director of the Langton Star Centre, Becky plays a key role in enhancing astronomy and science education for the students and as a result, one in every 200 students studying physics at university has come from the Simon Langton School.

Physics students study data collected from a CERN@school cosmic-ray (LUCID) detector.

For more information: contact Becky Parker, e-mail bparker@thelangton.kent.sch.uk or visit www.thelangtonstarcentre.org.

Grounds for Learning conference demonstrates the fun of outdoor physics

The Institute of Physics in Scotland ran its engaging outdoor physics workshop at the 2010 National Networking Event for Grounds for Learning. Grounds for Learning, part of the UK charity, Learning through Landscapes, helps Scottish schools and early-years settings make the most of their outdoor spaces for play and learning.

The conference aimed to show how school grounds can deliver a Curriculum for Excellence and enhance the educational experience that we provide for young people in Scotland. There was an excellent mix of hands-on workshops exploring innovative, effective and achievable outdoor learning approaches and thought-provoking presentations to inspire and challenge. Teachers and outdoor educators also had access to practical examples of how to deliver high-quality experiences in outdoor spaces and on marketplace stands, as well as time for networking with each other.

The outdoor physics workshop involved an active run through some physics activities that can be used out of doors and in schools. These include "Sunshine, shadows and stone circles", "Sundials", "Rockets" and "Survival in the outdoors using physics". Resources linking the activities to the Curriculum for Excellence experiences and outcomes for the sciences are available. Gregor Steele from the Scottish Schools Equipment Research Council was a huge help in running the "Solar cooker" workshop. Thanks also go to Bob Kibble for providing the materials for the "Sunshine, shadows and stone-circles" workshop and to Tom Clark for providing the rockets.

The delegates left the conference inspired with practical ideas that they could take back and try out, without the need for school-grounds development or expensive resources.

Alison McLure, Institute of Physics national officer in Scotland

Pupils get all fired up during the rocket workshop held at the Grounds for Learning national event.

For more information: To download the "Physics beyond the school gate" resources, visit www.iop.org/education (click on "Projects" then select "Online resources" to find them).

Events

EVENTS FOR TEACHERS

North Wales Teachers Conference
Bangor University
8 June
This free conference is open to everyone who teaches physics, including non-specialists. Speakers will include Dame Jocelyn Bell Burnell and there will be a variety of engaging workshops, including John Nunn demonstrating the VPLab and Andy Newsam from the Astrophysics Research Institute LJMU.
Details and booking: contact Andrea Fesmer (e-mail andrea.fesmer@talk21.com).

Stirling Physics Meeting
University of Stirling
9 June
This day of lectures and workshops will include an exhibition.
Details: contact Claire Garland (e-mail claire.garland@iop.org).

Rugby Physics Meeting
Rugby School, Rugby, Warwickshire
10 June
For all teachers in schools and colleges, this will be a day of information, stimulation and communication. It will include an exhibition and workshops.
Details: contact Manchi Chung (e-mail manchi.chung@iop.org).

North East Physics Teachers Conference
Ogden Centre for Fundamental Physics, Durham University
23 June, 9.30 a.m.
This will be a free day of talks, workshops and displays for teachers, organised by the Institute in conjunction with Durham University and the Science Learning Centre.
Details and booking: visit www.sciencelearningcentres.org.uk/northeast or tel 0191 370 6200.

Merseyside Physics Teacher Network Annual Conference: Physics Can Be Easy!
Chadwick Laboratory, University of Liverpool
24 June
This will be a full day of talks, workshops and discussions for all science teachers and trainee teachers, even those who are not physics specialists. It is aimed primarily (but not exclusively) at KS3 and KS4. There will be amazing ideas to inspire you and materials to take back to the classroom.
Details and booking: contact Lucas Hayhurst (e-mail lht@blueyonder.co.uk).

Manchester Teachers Conference
Manchester Metropolitan University, Oxford Road, Manchester
24 June
This conference aims to share the vision and enthusiasm for teaching physics and science and it is directed at teachers working at KS4. There will be free entry for secondary-education delegates and exhibitors.
Details and booking: contact Dr Vladimir Vishnyakov (e-mail v.vishnyakov@mmu.ac.uk).

South West Physics Teachers Conference
St Luke's Campus, University of Exeter
25 June
This will be a free day of talks, workshops and displays, organised by teachers for teachers.
Details and booking: visit www.tinyurl.com/PhysicsExeter or contact Alison Alexander (e-mail alisonalexander@aol.com).

Liverpool Physics Teachers Conference
Chadwick Laboratory, University of Liverpool
1 July
This annual conference is for specialist teachers of physics and it is aimed at GCSE and A-level. Organised jointly by the University of Liverpool and the Institute's Merseyside Branch, there will be free entry for all participants. There will be new ideas and activities to try. For information about last year's conference, visit www.liv.ac.uk/~iop/PTC/index.html.
Details: contact Steve Barrett (e-mail s.d.barrett@liv.ac.uk).

Physics Update
University of Sheffield
9–11 July
This three-day residential course will feature an exciting programme of lectures and workshops.
Details and booking: visit www.iop.org/update or contact Manchi Chung (e-mail manchi.chung@iop.org).

Physics Subject-Knowledge Booster Course
Charterhouse, Surrey
12–16 and 19–23 July
The course (now in its fifth year) is free (except for travel and cover) to state school NQTs and it aims to boost subject knowledge and confidence in teaching KS3 and KS4 physics. Places are awarded on an evidence-of-needs basis.
Details: contact Steve Hearn (e-mail steve.hearm@iop.org).

East Midlands Network Day
Leicester Grammar School, London Road, Great Glen, Leicester LE8 9FL
18 September, 10.30 a.m. – 3.00 p.m.
This will include a lecture on the Large Hadron Collider, given by Prof. W J Stirling, as well as a choice of workshops.
Fee: £10 (including buffet lunch).
Details: contact Neal Gupta (e-mail nealgupta@talktalk.net) or Helen Pollard (e-mail h.pollard@sep.org.uk).

Scottish Autumn Tour
25 September – full-day event, Edinburgh
27 September, Dundee
28 September, Glasgow
29 September, Dumfries
30 September, Inverness
2 October – full-day event, Aberdeen
The Institute's Physics Teacher Network, working with ASE Scotland, has arranged a week of CPD events at the end of September, spread widely across Scotland. John Wayne and Andy Spoone from PASCO in the US have agreed to run a series of workshops for physics teachers.
At the events there will be also other workshops, exhibitions and opportunities for science teachers to share ideas and network. The two Saturday events are full ASE day conferences, including workshops from the Institute's PNCs.
Details: contact Stuart Farmer (e-mail stuart.farmer@yahoo.co.uk).

Welsh Physics Teachers Conference
Christ College, Brecon
6 October
Programme will include workshops/talks.
Details and registration: contact Cerian Angharad (e-mail cerian@angharad.fslife.co.uk).

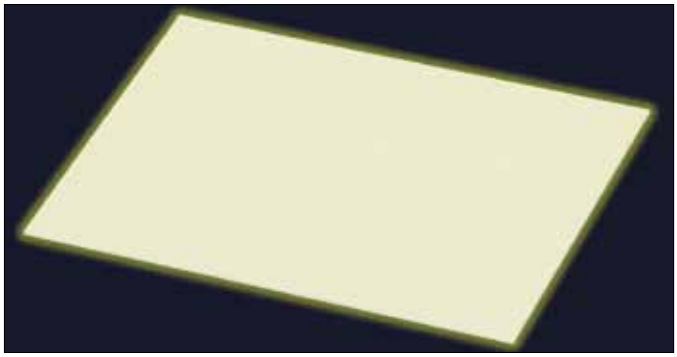
EVENTS FOR STUDENTS

Institute of Physics 2010 Schools and Colleges Lecture: Powering the Future – the Physics of Fusion
This free lecture for 14–16-year-olds, given by Dr Melanie Windridge, continues its tour.
Details and booking: visit www.iop.org/education and click on "Events" or contact Clare Mills (e-mail clare.mills@iop.org).

Residential Summer School for AS Students Studying Physics and Maths
University of Birmingham
14–15 July
More information about/reports on previous events can be found at www.ph.bham.ac.uk/schools under "Forthcoming events" on the left-hand side of the page.
Cost: £80 (inclusive of accommodation and all meals with a limited number of bursaries available for students with financial constraints).

Glow-in-the-dark film and radiation

Phosphorescent or "glow-in-the dark" film is a low-cost resource that can be used in a variety of interesting experiments. Phosphorescent materials radiate visible light after they have absorbed energy from incident radiation. Until relatively recently, they were based on zinc sulphide – after being activated by shining light on them, they only continue to glow for a period of some minutes. The new materials are based on strontium aluminate and they continue to radiate light for many hours. The intensity of the light given off means that it is possible to experiment with them without the need for a darkened room.



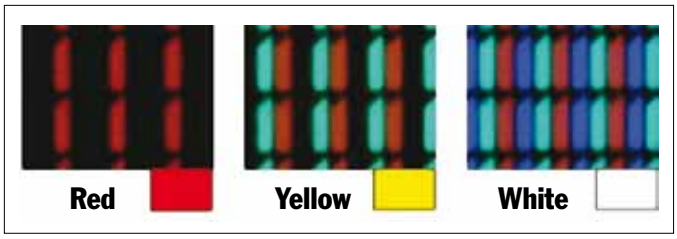
After being exposed to light, glow-in-the-dark film will continue to glow for many hours in a darkened room.

Glow-in-the-dark film is particularly sensitive to radiation in the ultraviolet region. A convenient UV source is a UV LED with its legs held by finger and thumb either side of a 3V lithium button cell (you need to use a UV LED that can operate at this voltage). Shining the UV LED and a torch onto two separate pieces of film shows clearly the difference between UV radiation and visible light. Although the UV LED appears dimmer than the torch to look at, after they are removed the glow-in-the-dark film exposed to UV radiation glows much brighter.

A convenient source of UV radiation is a UV LED and a button cell.

It is also possible to look at how sensitive the film is to different frequencies of visible light by using a matched set of red, green and blue LEDs that are of similar brightness (an "LED colour-mixing set" with specially selected LEDs is available – see below). These can be also be used with the button cells. When shone onto glow-in-the-dark film, it is clear that the blue LED has an effect but the red and green LEDs do not. Like UV radiation, the light from the blue LED has photons of sufficient energy to excite the molecules in the phosphorescent film. Then, over time, the molecules change back to their original lower-energy state and they emit lower-energy photons (this appears as green light). The photons emitted from the green and red LEDs are not of high enough energy to do this.

Another source of red, green and blue light is a computer monitor or TV screen. It can be surprising to students that all of the colours that can be perceived on a screen are produced simply by varying the intensities of tiny red, green and blue "subpixels", so it is worth looking at a screen under high magnification so that they can see this.



The colours on an LCD monitor are created from red, green and blue "subpixels".

Using a wordprocessor, some red, green and blue text on a black background can be created to display on a computer screen, and then some glow-in-the-dark film placed over the text. After holding it there for about half a minute, it can be removed and see that the only word visible on it (as a mirror image) is "BLUE".

Testing to see what colours on a screen activate the glow-in-the-dark film.

Students could be asked to make a prediction if the film is placed over cyan, magenta and yellow text on the screen, before the experiment is repeated. They should find that the cyan and magenta text (both containing blue) have an effect, but the yellow text (being made from only red and green) does not.

Predicting which colours will activate the glow-in-the-dark film.

Richard Boohan, Gatsby Science Enhancement Programme

For more information: visit the SEP website (www.sep.org.uk) where you can find related activities in the booklet "Fibres and fabrics". The "Waves and radiation sample pack", glow-in-the-dark film, UV LEDs and the LED colour-mixing set are available for purchase from Middlesex University Teaching Resources (www.mutr.co.uk).

Magnetic Earth: modelling the magnetic field of the planet

www.earthlearningidea.com
Earth Learning Idea
Innovative, Earth-related teaching ideas

Context
This modelling activity is a useful prelude to an understanding of the magnetic field of the Earth. It can assist in students' understanding of the magnetic evidence for the movement of continents and for sea-floor spreading (when remnant magnetisation is preserved in rocks), and hence a major part of plate-tectonic theory.

The Earth has a magnetic field that is essentially bipolar, that is, it behaves as if there is a bar magnet inside, with the south pole of the magnet near to the geographic North pole of the Earth. The field is probably caused by movements within the liquid iron-rich part of the outer core of the Earth. The Earth's magnetic field reverses at irregular intervals. The reasons for this are not fully understood but magnetic evidence of such reversals preserved in rocks of the ocean floor as remnant magnetisation have enabled us to formulate the hypothesis of sea-floor spreading.

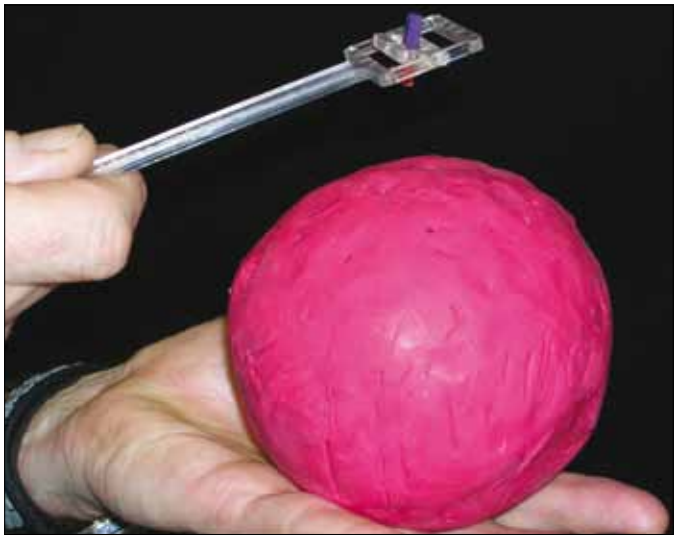
Procedure
Use a compass to show students that the Earth has a magnetic field, which causes the magnetised needle in the compass to align itself north-south. The end of the compass needle that points towards the North pole of the Earth is called the north-seeking pole (N) of the magnet (compass needle). Use the Magnaprobe™ (or a sewing needle that you have magnetised) to demonstrate that the Earth's magnetic field is also three-dimensional. In the UK the tiny magnet in the Magnaprobe will settle at an angle of more than 60 degrees from the horizontal.

Show students the large sphere of Plasticine® (which has a bar magnet hidden inside it) and state that it represents the Earth. Ask a volunteer to move the Magnaprobe around near the sphere and see if the student can locate the two magnetic poles, remembering that the north-seeking (N) pole of the compass or Magnaprobe will point towards the geographic North pole of the Earth.

Using the Magnaprobe, locate and mark the magnetic equator, (i.e. the line where the magnetised needle lies parallel to the surface of the sphere). Move the Magnaprobe from pole to pole along a line of longitude and mark the angle of dip of the tiny bar magnet at various points along this line, using some used matchsticks.

Explain that these angles may be "frozen" into ancient rocks, especially rocks like lavas of igneous origin. Such ancient magnetisation may be measured and can show the latitude at which the rocks were formed. This provides vital evidence for the plate-tectonic movement of continents over time.

Follow-up activity
- Use the internet to find a map of the Earth's magnetic field and show that it is more complex than a simple dipole field.
- Use maps of the changing value and distribution of the Earth's magnetic field to show that it must be caused by something moving within the Earth and is clearly not the result of a bar magnet in the Earth's interior!


Peter Kennett

Measuring magnetisation: a Magnaprobe™ is held over and hovers above the south pole of a bar magnet, which is hidden inside a sphere of Plasticine®. (This represents the magnetic North pole of the Earth).

iStockphoto/Onur Döngel

The north-seeking (N) pole of the compass is painted red.

Resource list
- A strong bar magnet, (e.g. 7 cm long), previously hidden centrally in a sphere of Plasticine approximately 12 cm diameter.
- A Magnaprobe (a tiny magnet suspended in gimbals in a plastic frame) or a sewing needle, magnetised by stroking it in one direction with the north end of a bar magnet, and suspended on a piece of cotton thread.
- Some used matchsticks.

Source
This teaching resource is based on an idea by Peter Kennett of the Earthlearningidea team and it is incorporated into the workshop titled "The Earth and plate tectonics", Earth Science Education Unit (www.earthscienceeducation.com).

For more information: visit www.cochranes.co.uk/show_category.asp?id=50 for the supply of the Magnaprobe. For more Earth-science teaching ideas and resources, visit www.earthlearningidea.com.