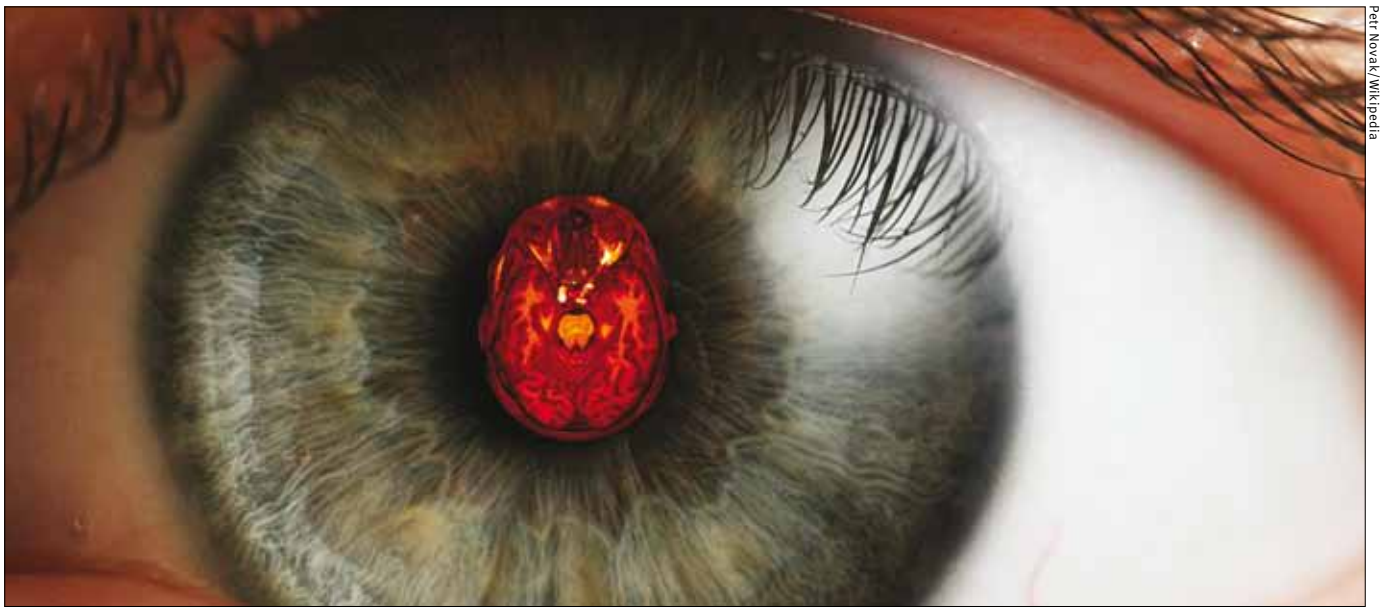
IOP | Institute of Physics
Education *Supporting Teachers*

Classroomphysics

The newsletter for affiliated schools

December 2010 Issue 15



Petr Novak/Wikipedia

From X-rays to antimatter: the science of seeing inside your body

The 2011 Institute of Physics Schools and Colleges Lecture Tour will show how physicists build machines that do what our eyes cannot – see inside the human body

2011 marks the centenary of Marie Curie winning her second Nobel prize for the discovery of the elements radium and polonium, as well as the centenary of Rutherford's model of the atom. It is therefore fitting that the 2011 Schools and Colleges Lecture Tour should cover one of the many fields in which Marie Curie's research on radioactivity has been applied – medical physics.

Over the past 100 years physicists have developed increasingly sophisticated techniques to see inside the body, allowing doctors to better diagnose and treat illness and disease. Starting with the discovery of X-rays and including the advent of the CT (computerized tomography) scanner, the application of radioactive molecules in nuclear imaging and the use of super-strong magnetic fields in magnetic resonance imaging (MRI), Dr Michael Wilson will uncover the science behind the techniques and introduce the physicists who pioneered their development.

The show will involve hands-on demonstrations, 3D animations, and some amazing audio-visual media. The free lecture lasts an hour and is suitable for ages 14 and over. It will be touring all over Great Britain throughout 2011. Although the lecture is free of charge, places must be pre-booked with the relevant venue.

Dr Wilson has always been fascinated by the physical world and enjoys the challenge of making scientific ideas accessible to any audience. After completing his first degree in natural sciences at Cambridge, he taught physics and mathematics for two years at Shrewsbury School before moving into a medical-physics career. After teaching at the University of Birmingham for five years, he is now a consultant clinical scientist in the nuclear medicine department of the University Hospital Birmingham NHS Trust. He continues to teach at the University of Birmingham, as well as being involved in a range of other teaching roles.

Dr Michael Wilson.

For more information: visit www.iop.org/schoolslecture from January 2011 to find out about venues and bookings.

Editorial

Welcome to the second edition of *Classroom Physics* for this academic year. It contains news of resources and events for January and beyond. Read the article on making the most of your affiliation next to this editorial (p2) and help us to ensure that we can provide the best support for you.

Our 2011 Schools and Colleges Lecture explores what physics does for us in the field of medicine – in particular, medical imaging (p1). We hope that young people will find this a particularly engaging application of physics. In parallel with this we are reviewing our medical-physics teaching resources and an updated version will be available later next year.

We also have information about two new resources mailed separately to affiliated schools. These are short films and other resources to help the teaching of astronomy and space (p5) and a set of posters – "See the world differently" (p3). These have taken quite a time to develop; we hope that you will find them as engaging and useful as we intend.

Another important development that may take a while to demonstrate its usefulness is the National STEM e-library (p5). This is the place to go to find resources from a whole range of different sources, including material that is no longer in print. It is well worth visiting to see if there are hidden treasures that you might like to use.

Featured opportunities for students include SciCast Physics, which has secured further funding (p2), as well as The Big Bang Fair (p4). For older students there is information about Headstart (p2), the Physics Olympiad and Challenge competitions (p4).

For teachers, there is news of a successful Welsh teachers meeting in October (p4) and the free CPD courses offered by Getting Practical (p3).

Our teaching tips are linked to teaching astronomy and space, via our new DVD and *talkphysics* SPT materials, and aim to give you a flavour of the rich resources that are available.

We look forward to seeing as many of you as possible at the ASE Annual Conference in Reading in January; visit us on marquee stand C2. As always, comments or suggestions are welcome.

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

Making the most of affiliation

Our affiliation scheme for schools and colleges is reaching out to more schools and colleges than ever before. At the time of writing, there are 1677 members of the scheme from all over the UK and Ireland. We hope that *Classroom Physics*, *Physics World* and *Physics Education* are useful additions to your physics resources, providing both information and inspiration.

The IOP website at www.iop.org was given a revamp in the summer and we hope that you find it easier to access information and resources than before. If you haven't been there yet, you can go directly to the education pages by going to www.iop.org/education. Click on "I am a teacher" to find out about all of the support that we offer teachers and schools, including resources and CPD opportunities. If you would like further resources – either posters, careers material or anything else – you can e-mail us at education@iop.org at any time.

When you receive your renewal subscription request, we also ask you to update the details that we hold for your school and the named person (usually the teacher in charge of physics or head of physics). We want our database to be as accurate as possible, so we are grateful to you taking the time to complete this form. Currently, we do not have e-mail addresses for a significant number of teachers. We would like to be able to contact you electronically from time to time and so it is helpful if you can provide this information.

It is also important to make sure your e-mail address is current to get electronic updates on Institute offers. For example, you should have received an e-mail about 16–19 membership, which includes an example of an e-alert sent out to young members. These e-alerts will be sent out regularly to affiliated schools to highlight the latest content and offers for 16–19 members.

For more information: To discuss any aspects of affiliation, contact our coordinator for affiliated schools, Daniel Josman (e-mail daniel.josman@iop.org, tel 020 7470 4832).

SciCast Physics is on!

After months of uncertainty, core funding has been secured for the 2011 Planet SciCast competition – meaning that the Institute-sponsored SciCast Physics category is now open for submissions.

Planet SciCast invites budding movie-makers to produce short and entertaining films that explore science, and the SciCast Physics category focuses on films that explain a principle of physics in less that two-and-a-half minutes. Previous entries have used rap (*The Geiger Müller Groove*), Lego (*Gravity, Mass and Weight*) and even wigs (*The Last Straw*) to grab the attention of the judges. Take a look at the films on the website for inspiration and to spark your students' creativity as well as for hints and tips on the technicalities of film-making.

For more information: This year's deadline for entries is 27 April 2011. For further details about the competition, visit www.planet-scicast.org.uk.

Physics students can get a 'headstart'

EDT Headstart offers five-day residential courses for year-12/S5 pupils to sample degree-level study and student life before completing UCAS application forms. With a broad portfolio of courses in all STEM disciplines, we are, for the first time in 2011, offering a new physics Headstart course at the University of Leicester.

The aim of the Headstart physics course is to introduce students to the vital role of physics in contemporary society from the purest fundamental research to current cutting-edge technology. Physics has links with space science, the biosciences, the environment and even with the financial world, all of which address problems at the interface between society and technology.

During this course students will work on problems to gain experience of research methods and will experience:

- lectures from leading researchers;
- workshops;
- hands-on, practical, problem-based learning;
- team work and group presentations;
- careers information.

To enjoy the full university experience, participants will stay in the university's halls of residence with talks and social activities in the evening.

For more information: and to apply online, visit www.headstartcourses.org.uk or call 01707 871 505.

Physicists see the world differently

A brand-new series of three hi-tech, interactive posters from the Institute of Physics is now available, to illustrate the wonder and awe that physics can inspire by allowing people to see the world differently.

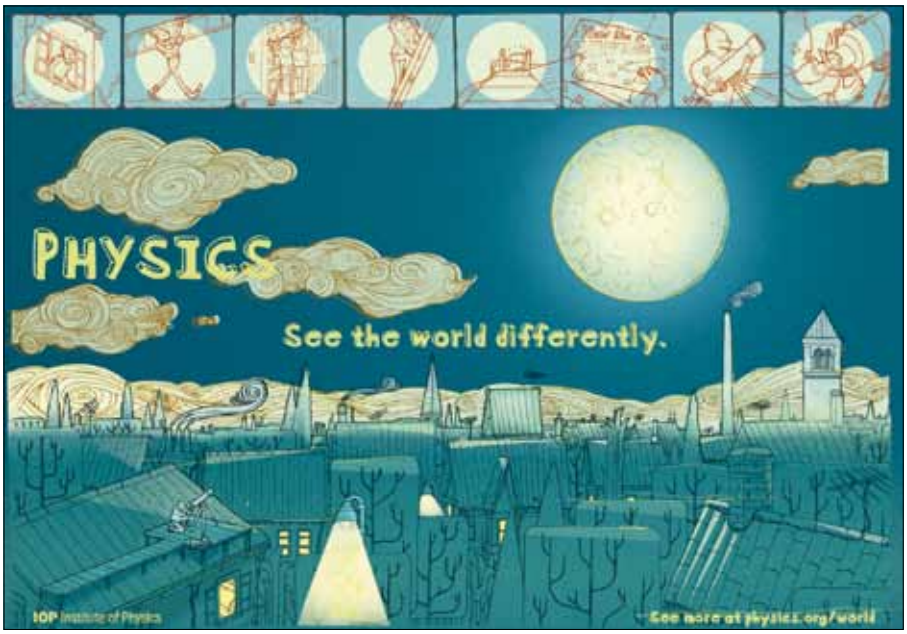
The aim of the posters is to get across the idea that physics expands our horizons and deepens both our understanding and our wonder of the natural world. It gives us access to new ways of experiencing the world. In a sentence, it allows us to *see the world differently*. The posters convey these ideas through:

- The illustrations – which are attractive, intriguing, deep and revelatory.
- The ink technology – which reveals new pictures when the conditions change. The posters transform in the dark, under UV light or when they are heated up.

Each poster illustrates and emphasises at least one aspect of seeing the world differently. These include:

1. In a literal sense: physics has provided us with views and images that we couldn't get with our naked eye. For example, images from microscopes and telescopes; images from space or from inside the body; and processed images from seismographs, cardiographs and infrared cameras.

2. In a metaphorical sense: physics encourages and engenders an approach of looking at the world differently; it opens our eyes and lets us take a different view of the way the world works.



3. By modelling: physicists represent and interpret the physical world using predictive models – from fields and force arrows through ray optics to mathematical representations of the weather and sub-atomic particles, there is an invisible, modelled realm that allows them to see the world differently.

We are hugely indebted to the talent, patience and generosity of the illustrator Joe Alterio in developing these three posters. You can see more of his work at www.joealterio.com.

For more information: For students, visit www.physics.org/world. For teachers, visit www.talkphysics.org/world. To obtain copies of these posters, contact the Institute's education department (e-mail education@iop.org). Affiliated schools will receive these posters in a separate mailing.

Make your practical work more effective

Getting Practical is now offering **free CPD** courses for science teachers across England. By exploring the current manner in which you teach practical science, this course can help to identify ways to make your teaching more effective. To find out more about how the programme can help you and your department, read our case-studies that are now available on the *Getting Practical* website. Up-to-date details of courses available in your area can also be found on the website at www.gettingpractical.org.uk.

The project is also supporting and promoting two booklets that are essential reference material for the prep-room:

The Language of Measurement – Terminology used in school science investigations
A joint project of the Nuffield Foundation and Association for Science Education

This resource is designed to help teachers to become confident about the special terminology associated with practical

investigations, when it should be used, and what specific terms mean. The aim of the booklet is to enable teachers, publishers, awarding bodies and others to achieve a common understanding of important terms that arise from practical work in secondary science, consistent with the terminology used by professional scientists.

The booklet is in three parts:

- an introduction giving a rationale for the approach taken;
- a glossary of key terms;
- investigations illustrating the use of the terms in context (examples from school biology, chemistry and physics).

Analysing Practical Science Activities – To Assess and Improve their Effectiveness
Robin Millar

This booklet provides teachers with the tools to analyse practical activities to clarify the objectives, highlight the main features and evaluate effectiveness.

The resource contains:

- a discussion of the effectiveness of practical teaching;
- ways to analyse practical activities;
- checklists for analysing and evaluating a single practical activity, and for analysing and comparing up to 10 practical activities.

For more information: To register your interest in the Getting Practical programme, contact Kirstie Hampson (e-mail kirstiehampson@ase.org.uk, tel 01707 283 000). To purchase the booklets, visit the Association for Science Education website at www.ase.org.uk and select "Bookshop".

International Physics Olympiad UK team celebrates success

The UK team with their Croatian guide in the Central Square, Zagreb. Left to right: (standing) Gareth Wilkes, Sergei Patiakin, Matthew Donora, (sitting) David Kell and Andrew Hyer.

In the 2010 International Physics Olympiad (IPO) in Zagreb, Croatia, we had five finalists who represented the UK and each returned home with a medal. There were more than 90 countries participating and our finalists achieved a gold medal, a silver medal and three bronze medals.

IPO 2011 will be held in Bangkok, in July.

The 2011 British Physics Olympiad

The British Physics Olympiad (BPO) attracts entries from more than 1000 talented young physicists each year. The competition has a dual purpose: to challenge and reward the best physicists in British schools and to select the UK team for the IPO. Most entrants are in year 13 (A2, Advanced Highers or equivalent level) but younger students are welcome to participate.

Any school that has not participated before or has not entered students for the BPO in the last two years may enter up to two candidates for Paper 2 free of charge, with entry fees kindly sponsored by the Ogden Trust.

Physics Challenge: Friday 11 March 2011 (enter by Friday 4 March 2011)
This is a fun challenge for GCSE, Standard Grade or equivalent-level students. The paper has a refreshing mathematical style and includes multiple-choice and short-answer sections.

AS Competition: Friday 18 March 2011 (enter by Friday 11 March 2011)
The AS Competition is designed to stretch lateral-thinking skills and encourage students to apply fundamental principles to novel situations. A single one-hour paper, it is marked in school and designed to favour all examination boards equally.

BPO Experimental Project: (enter by Friday 17 December 2011)
A project brief is provided detailing an experiment suitable for GCSE or sixth-form students. Teachers set the task, choose the best in their school for each age group and send it for national judging.

For more information: Past papers and more information regarding entry to all of the competitions can be found at www.bpho.org.uk. All papers can be requested in electronic format.

Welsh Physics Teachers Conference 2010, Brecon

Teachers being wowed by the demonstration of standing waves using Rubens' tube.

On Wednesday 6 October more than 100 delegates attended the 9th Welsh Physics Teachers Conference hosted by Christ College, Brecon. The day was a full programme of lectures, presentations and workshops for teachers and technicians.

While the teachers attended workshops given by representatives of the four main examination bodies, the technicians were busy making "toys" in a workshop given by Lee White and Frank Lane, both technicians at Holywell schools.

Dr Ben Evans and Prof. Ken Morgan from Swansea University wowed the audience with a presentation about the supersonic car (the Bloodhound) and how teachers could become involved with the project (www.bloodhoundssc.com).

Lunch provided an opportunity to meet exhibitors and talk informally to the different workshop providers. The afternoon constituted a variety of workshops including "The Faulkes Telescope project", "Make your own modulated laser receiver", "The Datamouse project", "Lights camera images", "Dragsters – make and take", "Waves on custard" and "Dancing flames".

Next year's event will be held at the same venue on Wednesday 5 October 2011. To register interest, e-mail conferences@iop.org with "Welsh Physics Teachers Conference 2011" in the subject line. Having registered your interest you will receive an e-mail containing the online link to registration once registration becomes available.

The Big Bang: UK Young Scientists' and Engineers' Fair wants you!

A competition finalist at the 2010 fair.

Make sure to join in the fun at The Big Bang: UK Young Scientists' and Engineers' Fair on 10–12 March 2011. Next year's venue, the ICC London ExCeL, will play host to a whole host of interactive exhibits, workshops, simulators and shows, to inspire young people about the science, technology, engineering and mathematics (STEM) all around them.

The Big Bang hosts the finals of the prestigious National Science and Engineering Competition and also kicks off National Science and Engineering Week 2011. Competition finalists, drawn from the regional fairs and individual entries, will have their own exhibition stand among big household names, to showcase their hard work to journalists, prospective employers and universities – as well as the school groups and VIPs attending the fair. As well as receiving great prizes, winners of the senior individual categories are crowned the UK Young Scientist of the Year or the UK Young Engineer of the Year at the award-winners' ceremony.

Regional fairs will take place across the country as part of the build-up to The Big Bang 2012 and they will provide an excellent opportunity to stimulate interest in STEM among your students, to reward their hard work and creativity, and to gain recognition for your school.

For more information: Registration for The Big Bang 2011 is now open. Make sure that you don't miss out by registering now at www.thebigbangfair.co.uk. To find out how you can get involved in your regional fair, visit www.thebigbangfair.co.uk/map and click on your area.

Expand your horizons with the Institute's new 'Teaching Astronomy and Space' DVD

This brand-new resource has been put together with the aim of helping in the teaching of astronomy and space to 11–16-year-olds. If you are a teacher in an affiliated school you will have received a copy of this DVD in October, otherwise you can obtain a copy by e-mailing the address below.

The resources are built around a series of five Teachers TV programmes which are available to watch at www.teachers.tv. The programmes were produced with generous funding from the Science and Technology Facilities Council, on behalf of the Institute of Physics and Teachers TV. Within the programmes there are sections to use with students, where astronomers talk about their work in an inspiring and engaging way, as well as guidance and advice on setting up and managing practical activities with students. The activities are supported by full teaching notes. Page 8 of this newsletter includes the teaching notes that go with the classroom activities on the seasons, as a taster of the kinds of things that are on the DVD.

In addition to the programme clips, there is a selection of the additional teaching resources available from the National Schools Observatory. These include a gravity simulator, which shows what it is like to drop a ball on any of the planets, and a simple electric orrery, which shows the relative positions of the planets as they move around the Sun. This can be set to see their relative positions today, but also in the past and future. LTImage software, which allows you to do image processing and analysis, is also included, along with some engaging activities that use the software.

The final part of the DVD is an extensive list of web links and free software that are available to further support the teaching of this topic. These may be particularly useful if you run a GCSE astronomy course in your school.

Glasshead

The Gran Telescopio Canarias sits 2267 m above sea level on the island of La Palma.

For more information: visit www.iop.org/education and select "resources for the classroom". E-mail education@iop.org to request a copy of the DVD.

STEM Centre aims to be the place to find resources for the STEM subjects

The National STEM Centre is co-located with the National Science Learning Centre on the University of York campus. The centre offers a range of support for teachers and lecturers, including at its heart the largest accessible collection of teaching and learning resources in the UK for STEM subjects for students aged 5–19. These resources span multimedia, print, practical teaching materials and research publications – both contemporary and "archive".

Since July 2010, selected resource collections have been available online through the National STEM Centre's eLibrary (www.nationalstemcentre.org.uk/elibrary). The resources are fully searchable, and search results may be filtered by age range, publication year, key stage, type of resource or publisher. Browsing for the Institute of Physics currently uncovers four collections, which are freely available through the eLibrary as part of the Institute's commitment to disseminating support for physics teachers as widely as possible.

For example, some of you will be familiar with the Institute's interactive flash game, "SimEnergy" (http://stem.org.uk/rx77), which supports the teaching of energy for ages 11–14, or perhaps the "Einstein Flip" (http://stem.org.uk/rxb7) resource from Science upd8, which uses the context of extreme BMX bike stunts to introduce concepts of forces. In addition to resources for subject teaching, you will also find materials from a number of providers to support the embedding of careers awareness across the STEM curriculum, and links to professional development courses including those from the Stimulating Physics Network.

The library and resource centre in the National Science Learning Centre.

Alongside contemporary resources the National STEM Centre is also building a sustainable archive of resource materials drawn from the 1960s onwards. It is hoped that these inspirational resources, including the original SATIS materials from the Association for Science Education (http://stem.org.uk/cx9n), may provide a treasure chest of ideas for schemes of work, to inform curriculum development and to support the implementation of STEM across a school or college. To foster colleagues' work with the resource collections an online community area is available for individuals, school and college networks to develop their own collaborative projects.

The physical library is open throughout the year to teachers and STEM partner organisations, with on-site accommodation available for visitors.

For more information: visit www.nationalstemcentre.org.uk.

Events

EVENTS FOR TEACHERS

ASE Annual Conference
University of Reading
6–8 January 2011
Teachers will be able to meet the Institute's education department staff and enjoy three days of varied workshops and lectures as well as a major exhibition of resources and apparatus. Highlights include the John Lewis Lecture, given by David Mackay, and workshops run by the IOP Teacher Network.
Details: visit www.ase.org.uk

Physics For Non-specialists
Science Learning Centre, London
9 February and continues on 10 March, 13 May and 6 July 2011
This is a four-day course but individual days can be booked if preferred. Impact Awards of £200 per day are available to eligible participants for the first two days only. Course fee is £430 (or £130 for days booked separately).
Booking: visit www.slcs.ac.uk (course ref: LNC10068)

Triple Science Next Steps: Physics
Science Learning Centre London
15 February 2011
This new course is suitable for those who have been teaching Triple Science for a number of years and who now require more detailed or advanced training in the Triple Science subjects. Course fee is £130 but Impact Awards of £200 per day are available to eligible participants.
Booking: visit www.slcs.ac.uk (course ref: LNC10099)

ESA KS3 & 4 Science INSET Courses
National Space Centre, Leicester
17 February (Applied Science), 3 March (Biology), 10 March (Chemistry) and 5 April (Physics)
The Space Academy project has been selected by ESERO-UK to deliver outstanding teacher CPD events for the Midlands, South and East of England. These intensive CPD events will be delivered by practising teachers and will share a large range of inspiring, curriculum-focused hands-on activities, teaching ideas and a memory stick with resources that can be taken back and immediately implemented in the classroom.
Details: contact Dr Sarah Hill (e-mail sarahh@spacecentre.co.uk)

Meteorology Workshop
Ripley St Thomas CE High School, Lancaster
17 February 2011, 4.30–6.30 p.m.
This is a twilight session to enable teachers to meet and share ideas, as well as to increase their subject knowledge. The workshop will be run by Dr Francisca Wheeler, IOP Physics Network coordinator.
Booking: visit: www.stimulatingphysics.org/regions-northwest.htm. To register your interest in future events, contact Christine Mayson (e-mail christine.mayson@iop.org)

The Scottish Science Education Conference 'Science Without Limits'
Crieff Hydro Hotel, Crieff, Perthshire
4–5 March 2011
Enrich your teaching and learning with "Science without limits" – bright ideas for the future. The conference will include keynote presentations, hands-on workshops and enticing manufacturer displays.
Jointly organised by the ASE and SSERC.
Details: visit www.asescotland.org.uk/ and www.sserc.org.uk/

Lights, Camera, Images Workshop
Ripley St Thomas CE High School, Lancaster
10 March 2011, 4.30–6.30 p.m.
A twilight session to enable teachers to meet and share ideas, as well as to increase their subject knowledge. The workshop will be run by Frances Green, IOP Physics Network coordinator.
Booking: visit: www.stimulatingphysics.org/regions-northwest.htm. To register your interest in future events, contact Christine Mayson (e-mail christine.mayson@iop.org)

Practical SHAP
University of York
31 March – 1 April 2011
The course is intended for both teachers and technicians, and it will include practical activities from both the AS and A2 years of SHAP.
Details: visit the SHAP website at www.york.ac.uk/org/seg/salters/physics/index.html or contact Joanna MacDonald (e-mail joanna.macdonald@york.ac.uk)

Spring Physics Update
University of York
15–17 April 2011
This three-day residential course will feature an exciting programme of lectures and workshops, including a visit to the brand-new National STEM Resource Centre and a practical medical-physics workshop on "Seeing inside the body" given by Dr Michael Drinnan.
Details and booking: visit www.iop.org/update or contact Manchi Chung (e-mail manchi.chung@iop.org)

Space Academy Teacher Conference
National Space Centre, Leicester
16–18 April 2011
This three-day residential conference will be filled with lectures from space scientists and interactive workshops for physics, chemistry, biology and applied science. Further workshops include using Earth-observation science to teach KS4 science and using "Antarctica expedition" in the classroom.
Details: visit www.ukspaceacademy.org or contact Dr Sarah Hill (e-mail sarahh@spacecentre.co.uk)

Summer Physics Update
H H Wills Physics Laboratory (Department of Physics), University of Bristol
8–10 July 2011
This three-day residential course for teachers of physics will feature an exciting programme of lectures and workshops, including Dr Neil Downie's hands-on sessions "Vacuum bazookas and vortex transistors" and an evening wine-tasting session on "The science of taste and flavour" with Prof. Peter Barham.
Details and booking: visit www.iop.org/update or contact Manchi Chung (e-mail manchi.chung@iop.org)

EVENTS FOR STUDENTS

IOP 2011 Schools and Colleges Lecture: From X-rays to Antimatter: the Science of Seeing Inside Your Body
This free lecture for 14–16-year-olds, given by Dr Michael Wilson, starts its UK tour.
Details and booking: visit www.iop.org/schoolslecture or contact Clare Mills (e-mail clare.mills@iop.org)

Physics in Perspective
University College London and the Royal Institution
20–22 February 2011
This is a three-day course for sixth-formers and college students, with the purpose of bringing to participants some of the excitement, relevance and fun of physics. It consists of a series of six lectures or lecture–demonstrations. Free time is scheduled in to allow participants an opportunity to explore other aspects of London. Discounted accommodation is available through Minerva Travel.
Details: contact Manchi Chung (e-mail manchi.chung@iop.org)

National Particle Physics Masterclasses
This is a popular series of one-day events for sixth-form students and their teachers, run by practising particle-physics researchers at various UK institutes (March to May 2011).
Details and booking: visit http://www.particlephysics.ac.uk/teach.html and make sure that you book early

Earth in space misconceptions

One of our Physics Network coordinators posted this on *talkphysics.org* little while ago. It ties in with the resources on the *Teaching Astronomy and Space* DVD as well as the Supporting Physics Teaching (SPT) resource *Earth in Space*. The ensuing conversation is also included below.

Carol: "I was working with a group of non-specialists science teachers today. We were looking at *Earth in Space*. Before the session I asked them to pose three questions to year-7 pupils and, if they wanted, to adults that they knew. The questions were:

1. What causes day and night?
2. Of the Earth, Sun and Moon, which is the largest?
3. Why is it hotter in the summer?

They were quite surprised by the discussions that ensued. They were able to identify a number of misconceptions – and not only in the pupils. We then looked at ways that we could tackle some of the misconceptions.

For the third question, there was an experiment in the SPT *Earth in Space*, which was very helpful. This involved looking at the voltage generated when the angle of a solar panel was altered. It provided a very clear indication that as the angle increased, so did the energy collected by the panel. The teachers were then able to link this with the angle of the Earth in summer and winter.

Another misconception that arose was in answer to the question, "Why do we only see one side of the moon?" This website provides a nice animation to help illustrate the reason: http://www.scittscience.co.uk/2008/05/why-cant-we-see-the-dark-side-of-the-moon/."

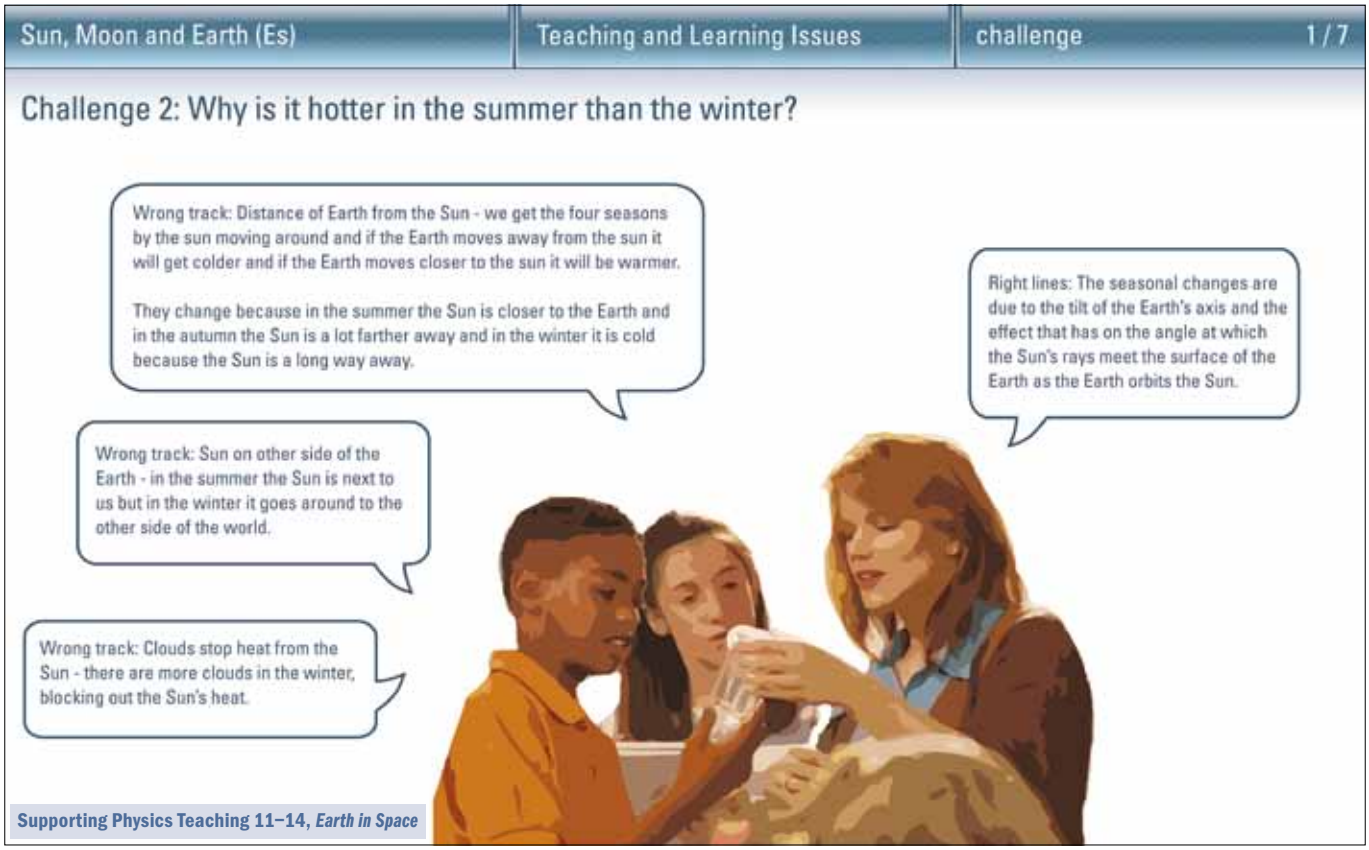
talkphysics.org
Linking teachers of physics

John: "There's another good one, after the solar panel angle has got them thinking about how the Sun's actual position in the sky determines the season. Talk about the evening star, make sure that they all know what it is that they're looking at (Venus) and then explain that the reason it's always near the Sun is because in that direction is the centre of the solar system. Somehow this lifts the whole thing out of the textbook and makes it all come alive. Dava Sobel's book *The Planets* does a lot of this stuff very well."

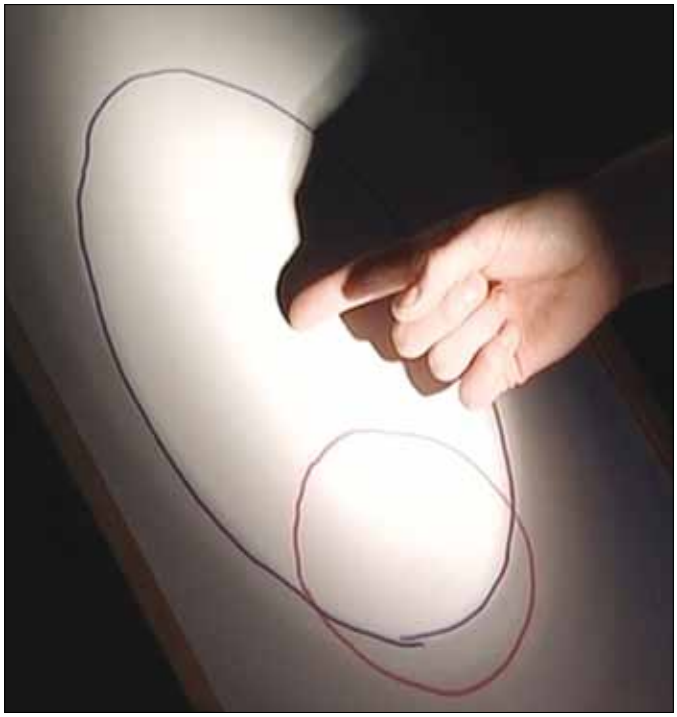
Ian: "Although the solar panels work well (better still with the SEP power meter), my favourite is the thermochromic film on the football for the seasons...another SPT teaching approach."

David: "The thermochromic film is also shown as a classroom demonstration video on the new IOP *Teaching Astronomy and Space* DVD. It is definitely a good one!"

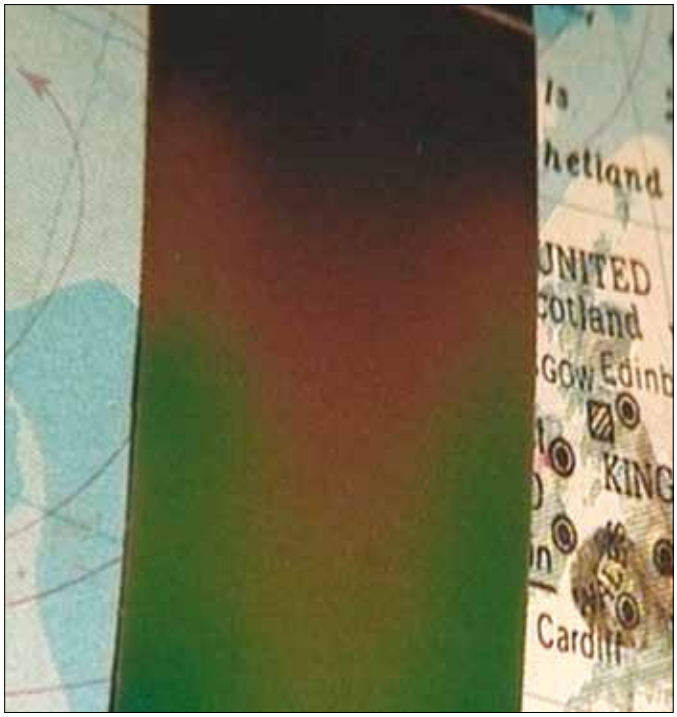
The above exchange gives you a flavour of the useful conversations that are taking place on *talkphysics.org*. Have you yet started to use www.talkphysics.org to ask questions, sort out teaching tricky concepts and get advice from other teachers? If not, why don't you give it a try and go and register now? All of the SPT materials are available to download from the website as well.



‘Teaching Astronomy and Space’ classroom demonstrations



Light hitting a surface at an oblique angle.



Light falling on a thermochromic plastic strip on a globe.

Models of the solar system: Earth, Sun and Moon

Seasons – Part 1

Description:
In this demonstration, a lamp and piece of paper are used to show how the light from the Sun is spread out more on the surface of the Earth when it strikes the Earth at an angle less than 90°.

Resources required:
- a large piece of card
- a board to fix the card to
- a lamp with a cardboard cylinder
- two different-coloured marker pens

Teaching notes:
- This demonstration can also be done as a class practical because the equipment used is quite common in schools.
- The cardboard cylinder is placed around the end of the lamp so that a roughly circular area of light is projected on the card.
- The demonstration shows that when light hits a surface at an angle it is spread out over a greater area than if it strikes the surface perpendicularly. Any energy transfer is therefore spread over a greater area.
- To compare the difference in area, it is easy to draw a line around the area where the light falls when the card is perpendicular to the light source, and when it is at an angle.
- In addition, it is possible to use a light sensor to show that the intensity of the light falling in each area is different.
- In place of the card, a photocopied map could be used to make the demonstration look more like a part of the Earth’s surface.
- Some students may find it difficult to relate a flat piece of card to the curved surface of a planet.

Watch the associated video demonstrations on the *Teaching Astronomy and Space* DVD (see p5 for more information).

Seasons – Part 2

Description:
In this demonstration, a lamp, world globe and a strip of self-adhesive thermochromic plastic are used to show how the the surface temperature of the Earth varies according to the angle of the sunlight reaching it.

Resources required:
- a world globe
- a lamp
- self-adhesive thermochromic plastic

Teaching notes:
- The self-adhesive thermochromic plastic is cut into a strip and placed vertically on the globe next to the country that is of interest to you.
- The lamp will need to be placed at a distance that warms the globe enough to cause change in temperature that makes the plastic change colour. If the lamp is too near the plastic will get too hot, change colour and then go black again. If it is too far away it will not change colour at all.
- The demonstration shows that when sunlight hits the surface of the Earth at different angles, the energy transferred to the Earth by light and heat is spread out over different areas. Where the angle would place the Sun low down on the horizon, the energy is spread over a larger area and the Earth does not heat up as much.
- Thermochromic paper can show a range of colours from brown through to blue. You will need to explain to students that brown is cooler and blue is hotter.
- As with **Seasons – Part 1**, you could extend this idea and use a light sensor to show the difference in light intensity.
- You could try placing a web camera at different places on the Earth and point it at the lamp (i.e. the Sun) so that you can see how low or high the Sun is at that time of year.