IOP | Institute of Physics
Education *Supporting Teachers*

Classroomphysics
The newsletter for affiliated schools
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The Stimulating Physics Network inspires teachers at ASE 2011

The Association for Science Education's (ASE) Annual Conference was once again a busy time for the Institute of Physics and the Stimulating Physics Network. The team of Teaching and Learning coaches and Physics Network coordinators put on a fantastic and varied programme of more than 40 workshops, which included sessions ranging from "Toys and physics" to "Radio astronomy", as well as "Engaging with girls". The workshops were universally well received with 97% of those attending rating the overall quality of the sessions as either high or very high. The valuable feedback from teachers helps to shape the support offered and the workshops are being continually refined and developed.

- "Very useful – I will definitely be using what I have learned today!"
- "Very enjoyable! Great fun, with some physics that made you think."
- "Really useful ideas covering so many areas of the curriculum – thanks!"

In 2009 the Institute of Physics and the Science Learning Centres were awarded a contract by the then Department for Children, Schools and Families to establish the Stimulating Physics Network and work with specialist and non-specialist teachers across England (and recently in Wales too, with Welsh Assembly Government funding). The long-term aim is to increase the number of students taking A-level physics by working with teachers to reinvigorate a culture of physics, increase their confidence and improve students' classroom experience of physics. A team of physics specialists offers bespoke support in schools, works with whole departments and offers a complete package of on-going support relevant to specialists' and non-specialists' needs.

Now, just over one year on, through the provision of free global support to all schools and intensive support for 270 schools, the network has reached more than 3000 teachers of physics, of whom 88% have reported increased confidence in their own understanding of physics and their teaching of it.

Teaching and learning coach Rachel Hartley leads a workshop.


Workshop participants discuss the rope-loop model for electric circuits.

Although it is too soon for the network's efforts to be reflected in the number of students choosing A-level physics nationally, early pilot projects have shown that the strategy is working. The 2006–2009 pilot involved 29 schools and resulted in participation rates in A-level physics shooting up from –4% below the national average to 14% above the national average.

Dean Park, SPN project manager

For more information: Local teams run an extensive programme of regional workshops throughout the year. Visit the "Regional" tab at www.stimulatingphysics.org or check out www.iop.org/network to find out what is happening near you.

Editorial

Welcome to the spring issue of *Classroom Physics*. If you are in an affiliated school you will also receive a copy of our education brochure for 2011 – *The Classroom and Beyond* and a copy of our 2010 Schools and Colleges Lecture DVD, *Powering the Future – The Physics of Fusion*. You will also have a set of Marvin and Milo reward cards (p5) and a CD of resources from the OU.

Our front-page story is an update on the Stimulating Physics Network and its workshops at the ASE Annual Conference. We were busy on the Institute exhibition stand and our new posters *See the World Differently* were a runaway success. It was great to meet and chat with some of you there.

There is news of other new Institute resources (p3); short films of physics demonstrations and careers clips, as well as new posters from the NPL. You might like to involve your students in the OPAL climate survey (p5) or find out more about climate issues via a free Earth-physics workshop (p7). Our events listings (p6) include a large number of day-long courses in June – there will be one near you! In addition, there are sessions to find out about using STEM ambassadors or Getting Practical (p7).

Our Autumn Update course was held in Oxford this year and there is a review on p4. There is information about the extension of our work to support trainee teachers and NQTs as well as opportunities for students, including a great offer for 16–19 members (p2) and regional Big Bang fairs (p7).

For those interested in contributing to the call for evidence regarding the National Curriculum, see p4. We are seeking contributions via the Education Forum and *talkphysics.org*. If you are in an affiliated school, make sure that we have up-to-date details for you, including an e-mail address, as both member and branch newsletters are disappearing in print format. More details on Institute branch activities and talks are on p2.

Our teaching tip (p8) (adapted from *practicalphysics.org*) focuses on the pinhole camera and its use to help understand the physics of the eye and the workings of a convex lens.

For further copies of any of our resources, e-mail education@iop.org.

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

Learning to teach physics?

Remember your early days as a teacher – balancing lesson planning with getting on top of the physics, mastering classroom management and understanding the law of the staff room? Learning to teach physics can be a challenging process, whether you're a trainee, an NQT or even an established science teacher teaching physics for the first time.

The Institute's new Learning to Teach Physics (LTP) project offers new teachers of physics support with tried-and-tested resources. Its aims are to increase the number of new teachers of physics staying in the classroom and to improve the confidence of all teachers teaching physics at secondary level. In turn, the Institute will benefit from knowing more about the career decisions of new teachers and it will gain a deeper understanding of retention issues.

The Institute has created a Personal Affiliation scheme for trainee science teachers. Designed to raise awareness of what the Institute offers, it will create a sense of community and link trainees to their local Physics Network coordinator.

In its first year, almost 1000 trainees have signed up. As they move into their NQT year – and beyond – LTP will continue to support them. Perhaps you have a trainee teacher on a placement in your school, or know an NQT or other teacher who could benefit from LTP's support?

For more information: visit www.iop.org/education/ltp. For more about Personal Affiliation (available to trainee teachers only), contact student.teacher@iop.org.

Institute of Physics 16–19 members get discount on tickets for Prof. Brian Greene spring event

Brian Greene, professor of physics and mathematics at Columbia University and the author of the bestselling book *The Elegant Universe*, will discuss his most ambitious book to date, *The Hidden Reality – Parallel Universes and the Deep Laws of the Cosmos*, at the Southbank Centre's Queen Elizabeth Hall on Thursday 17 March.

Greene will show how parallel universes take on different forms – some are separated from us by enormous stretches of space and time, while others are just millimetres away. Don't miss this chance to learn about life-changing theories by a brilliant communicator. If your A-level or Higher students are not Institute of Physics 16–19 members, they can sign up for free at www.iop.org/16-19.

For more information: visit www.southbankcentre.co.uk or call the Southbank ticket office on 0844 847 9910. The Institute's 16–19 members get a 50% discount on the ticket price by quoting "IOP 16–19" (discount only available for telephone bookings).

The Institute branches out

"Star formation" in Liverpool, "Chaos in action" in London, "Astro-imaging" in Salisbury and "Ubiquitous computing" in Edinburgh are just some of the talks that are being arranged by Institute branches around the country over the next few weeks. Many of these branch evening talks will be suitable for your post-16 students.

In 2011 the branches will no longer be sending out printed newsletters with their programme of events. To find out what is happening in your area, you will need to check the website regularly to keep yourself and your students up to date.

For more information: To find out about talks near you, visit www.iop.org and select "Activities – IOP in your area", and then the relevant branch calendar. Alternatively, to see all events organised by the Institute, select "Calendar" from the top right.

New videos focus on practical physics

We are sure that you will like the new collection of eight videos that we have produced in collaboration with the National STEM Centre. Each one shows how to set up and run a physics demonstration, including tips on the apparatus, the associated narrative and the background physics. There are some new ideas (the jelly-baby wave machine), new ways of demonstrating old ones (the laser pen and the electric sausage) and some nice explanations to use with students.

Although these videos are firmly aimed at teachers, they will also be useful for technicians and there are some supporting clips that you could use with students (e.g. the monkey and hunter at 1/12th speed).

You are likely to find the ideas inspiring whatever your experience; however, they will be particularly useful for trainee, newly qualified or non-specialist teachers, giving them confidence to set up some demonstrations and use them as part of their teaching armoury. We hope that these videos will encourage more people to discover the pleasure (for teachers and students) of an eye-catching exposition and the effectiveness of discussing physics using apparatus.

Making waves in the classroom: Alom Shaha demonstrates the jelly-baby wave machine.

The videos were made by Alom Shaha, David Sang and, from the National Physical Laboratory, Michael De Podesta. Those of you on PTNC will recognise them as must-read purveyors of ideas, clarity and thoughtfulness. So, you've read the posts, now see the movies. They are in the National STEM Centre's e-library, on *Practical Physics* and on *Talkphysics* – where we would really like to hear how you use them.

For more information: visit www.talkphysics.org/demos, www.practicalphysics.org and www.nationalstemcentre.org.uk/.

Clips inform students about careers in physics

The Institute and the National HE STEM programme has produced a series of four short films or "careers clips" to illustrate the breadth of options available to those that study physics at A-level and beyond. The clips have been designed with the GCSE classroom in mind and are both appealing to students and useful to teachers.

The clips provide a lively and engaging insight into the applications of physics in diverse workplaces. Each clip commences with an introduction to a person who invites us to follow them into their working world, where we learn more about the other people and projects that drive their work. Inserted into each clip are clear and engaging animations of those concepts studied at GCSE that underpin their daily work.

The clips sit alongside other National HE STEM programme projects that are working to encourage increasing participation in STEM subjects. All activities undertaken by the programme seek to ensure and renew the interest of the traditional physics cohort as well as to attract those who may not have considered studying STEM subjects beyond A-level. The programme also aims to improve communication between STEM employers, universities and schools.

For more information: To learn about the National HE STEM Programme at the Institute or to watch these videos, visit http://tiny.cc/snn8l. If you would like a DVD of all of the careers clips, e-mail hestem@iop.org with your postal address.

Jess Adams talks about research into solar cells.

NPL posters will hit the right spot with students

The National Physical Laboratory (NPL) has just created two new sets of A2-sized posters aimed at KS2 and KS3+ or equivalent.

At the exhibition at the ASE annual conference in January, teachers at all levels just grabbed the whole lot! The KS2 set examines mass, length and time, while the higher set explains the differences between accuracy and precision; temperature and heat; and frequency and amplitude.

The sets are available at www.npl.co.uk/educate-explore/posters, along with packs of some NPL factsheets in A2 printed format, all free of charge.

For more information: contact outreach@npl.co.uk.

Right: NPL "Accuracy and precision" poster.

Teachers of physics get up to date at Oxford

I recently attended the Autumn Physics Update, held on 17–19 December 2010. Around 70 teachers of physics were warmly welcomed and hosted by the University of Oxford Department of Physics and comfortably accommodated in various university colleges.

For me the key part of this programme was to listen to the excellent lectures given by distinguished speakers, who are actively involved in cutting-edge areas of physics research and debate. The variety of the event was thought-provoking, including Prof. Jim Al-Khalili's talk on chaos theory and an excellent tour of the JET facility at Culham.

A highlight was listening to a lecture entitled "Fancy physics needs fancy materials" given by Prof. Chris Grovenor, from the materials science department, explaining his current work. It was a privilege to listen to someone who is so passionately involved in key research and development.

Another excellent part of the programme was to meet other teachers of physics. As ever, the event proved a useful opportunity for networking, providing plenty of time to chat and compare experiences and ideas.

A teacher works with the resources on show during the Science Enhancement Programme workshop.

The choice of workshops was useful and I loved the practical element of the "Science Enhancement Programme KS4/5" workshop, run by Gerry Blake. Teachers in the workshop were very happy to share their own tips and practical advice for setting up and using the equipment. Overall it was a wonderful experience.

Carole Flanagan, St Christopher's C E High School, Accrington

For more information: about the Spring and Summer Updates and to book a place, visit www.iop.org/update.

Girls get inside view of physics and engineering

George Watson's College, Edinburgh, once again hosted a successful day to promote the uptake of physics and engineering by girls. Around 140 girls from schools across Scotland attended the event, which was sponsored by the Institute of Physics, George Watson's College and the Women's Engineering Society.

The opening lecture was given by Prof. Sheila Rowan, director of the Institute for Gravitational Research in the Department of Physics and Astronomy at the University of Glasgow. She gave an interesting talk on her career, which has included travel and working in different countries.

For much of the day the girls attended a selection of seven different workshops, hosted by Selex Galileo, the RAF, the Institute of Civil Engineers, Adam Smith College and the universities of Glasgow, Edinburgh, St Andrews, Strathclyde and Heriot-Watt. Workshop topics ranged from heart-rate monitoring and bridge building to cryogenics – where ice cream was made.

There was also a panel session where four young female engineers who are STEM ambassadors, and a postgraduate physics researcher joined Prof. Rowan to answer questions from the floor. The day passed very quickly and most of the girls said that they wished they had been able to attend all of the workshops.

As part of their programme (*Why Girls Don't Select Engineering and Technology*), BBC Scotland sent a researcher to interview some of the older girls to find out why they had selected physics and what they had planned for the future.

Students enjoy the exhibition stands put together by the workshop leaders.

For more information: Similar events are scheduled to take place around Scotland, including an event in Dundee in April. If you would like more details or would like to volunteer to help at any of the events, contact Gail Millar (e-mail gail.e.millar@btinternet.com) or Ronna Montgomery (e-mail ronnamontgomery@physics.org).

Institute calls for teachers of physics to join National Curriculum debate

We have had a National Curriculum for 21 years, during which time it has had a number of revisions. However, over the next year, it is going to be completely reviewed in overall shape and nature as well as all the subjects therein. The revised National Curriculum in core subjects will be available to start teaching in 2013.

The DfE has launched the first phase of the rewrite, which is a call for evidence on the structure, timing and, to some extent, the content of the new National Curriculum. You can submit a response at www.education.gov.uk/consultations/index.cfm.

In the next phase, the DfE will develop recommendations for the new programmes of study – to be published in early 2012 for consultation. The DfE will be guided by an advisory committee and will be provided with evidence from an expert panel. We understand that the DfE will also seek advice from subject specialists and organisations, so we hope that the Institute will be involved in this process.

As with all consultations, we will work closely with the Education Forum in developing our responses. So, if you would like to contribute to the Institute's input to the initial call for evidence and/or the contributions to the development of the programme of study, then now is a good time to join the Education Forum.

For more information: Visit www.talkphysics.org and register at www.talkphysics.org/pg/groups/17332/education-forum/ by clicking on the "Request membership" link on the left-hand side.

New postcards aim to reward future rocket scientists and physics geniuses

Bored with the run-of-the-mill certificates offered by reward-card printing companies? Unimpressed with the photos of microscopes or glass beakers that typically feature on such resources?

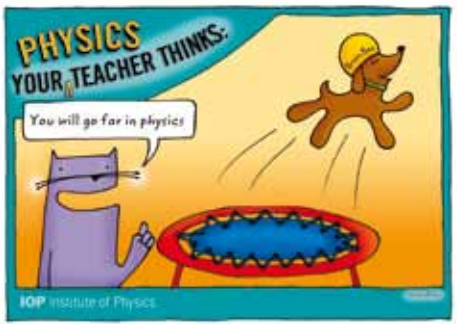
Following on from the ever-popular Marvin and Milo "Do try this at home!" postcards, the Institute has specially commissioned a new series of six illustrations entitled "Your physics teacher thinks".

These playful postcards make eye-catching commendation certificates to reward achievement in physics lessons. Affiliated schools will have a set of these cards in this mailing.

For more information: For access to the downloadable and editable PDF files of these postcards, visit www.iop.org/rewardcards to print out multiple copies of your own reward cards.

To order an additional set of postcards for your department, e-mail education@iop.org.

The full series of Marvin and Milo "Do try this at home!" experiments is available at www.physics.org/marvinandmilo.



The ever-popular Marvin and Milo feature on the Institute's new commendation reward cards.

Bubbles help scientists to understand climate change

What impact do we have on the climate and how good are we at adapting to climate change? Take part in the OPAL Climate Survey – launching in March – and contribute to a nationwide survey that is investigating these issues. Dr Geoff Jenkins of the Royal Meteorological Society explains: "We're asking people to get outside observing and measuring the weather. What they see and record will be really useful for forecasting weather and predicting climate."

Scientists at the Met Office and the Royal Meteorological Society are asking everyone in England to get involved: spot plane trails to measure air temperature and humidity, watch cloud movement to record wind direction at cloud level, blow bubbles to measure wind speed and note down the clothes that you wear to contribute to research into thermal comfort.

Global climate change is predicted to result in milder winters and hotter summers across the UK, with more frequent heat-waves. Part of the survey will look at our ability to cope with these changes and to help answer questions, such as "How does climate affect how hot or cold we feel?" and "Do people in the north of England really feel more comfortable at lower temperatures than southerners?"

For more information: Download your free survey pack from www.opalexplorenature.org/climatesurvey. The results from all four activities will be published on the OPAL website, where you can see how your findings compare with others' across the country. For more information about OPAL, visit www.opalexplorenature.org.

Schoolchildren take part in the climate survey.

'Galileo' DVD will bring humour into science and drama lessons

Have you ever wished for a novel and amusing way to teach your students about the physics of pendulums and falling weights, how telescopes work and came to be invented, how Galileo's telescopic observations of the Sun, the Moon and the planets provided irrefutable evidence for a heliocentric universe and upset the Catholic church? If so, then this new DVD may be just what you need.

To celebrate the 400th anniversary of Galileo's telescopic discoveries in 1609–1610, a member of the Institute's Lancashire and Cumbria Branch has written a comedy drama about the life of Galileo. The Duke's Theatre, Lancaster, in collaboration with the branch and local student actors, has now produced both a stage and a film version of the play, in the style of the *Horrible Histories* TV series.

The stage production in March 2010 was well reviewed and the film version is now available free to schools in the north-west region. The DVD also includes science-lesson plans, the script and a compilation of the visuals used within the film. It can also be shown in drama lessons and redirected and performed as part of the drama curriculum.

The initial release of 100 DVDs will be restricted mainly to schools in the North West but it is hoped that its availability will be extended later this year.

For more information: contact Robert Jones (e-mail robert.jones@lancaster.ac.uk).

Right: student actors perform the stage version.

Events

EVENTS FOR TEACHERS

Spring Physics Update
University of York
15–17 April
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 "Seeing inside the body" from Dr Drinnan.
Details and booking: visit www.iop.org/update or contact Manchi Chung (e-mail manchi.chung@iop.org).

Stirling Meeting
University of Stirling
8 June
The 37th annual meeting organised by the IOP in Scotland will feature a day of lectures and workshops, as well as an exhibition.
Details and booking: visit www.stirlingmeeting.org or contact Lauren Stacy (e-mail lauren.stacy@iop.org).

Rugby Meeting
Rugby School, Rugby CV22 5DW
9 June, 9.30 a.m. – 4.00 p.m.
The 23rd annual meeting for teachers of physics in schools and colleges will provide a mixture of information, stimulation and communication, as well as an exhibition.
Details and booking: visit www.iop.org/rugby or contact Manchi Chung (e-mail manchi.chung@iop.org).

Welsh Teachers Conference
Bangor University
21 June
This free conference is open to everyone who teaches physics. Speakers will include Prof. Dame Athene Donald on "Physics at the interface with biology" and there will be a variety of engaging workshops.
Details and booking: contact Andrea Fesmer (e-mail andrea.fesmer@talk21.com).

Manchester Teachers Conference
Manchester Metropolitan University, Oxford Road, Manchester
22 June
This one-day event provides a forum to reflect on current challenges in teaching physics and science at KS4. Presentations from local and national institutions and organisations will provide ideas and strategies to aid classroom teachers in preparing and presenting materials. There will be free admission to the conference for secondary-education delegates and exhibitors.
Details and booking: visit www.sci-eng.mmu.ac.uk/physics2011 or contact V Vishnyakov (e-mail v.vishnyakov@mmu.ac.uk).

NE Physics Teachers Conference
Durham University
22 June, 9.30 a.m. – 2.30 p.m.
Teachers will enjoy a free day of lectures, workshops, ICT resources, "Ask a physicist' and more (with lunch included but places must be pre-booked through the SLC NE).
Booking: contact Nicola Hall (tel 0191 370 6200, e-mail n.l.hall@durham.ac.uk) or visit www.sciencelearningcentres.org.uk/northeast.

SW Physics Teachers Conference
Exeter University
24 June
This will be an inspiring day of lectures and workshops for all teachers of physics and their technicians.
Details: contact Alison Alexander (e-mail alisonalexander@aol.com) or visit www.stimulatingphysics.org/regions-southwest.

Annual Liverpool Physics Teachers Conference
University of Liverpool
30 June
For the first time this conference will combine with the 'Physics Can be Easy!' conference as a major free event for all teachers of physics. Dame Prof. Jocelyn Bell Burnell will give a keynote talk and leading national facilitators will provide a wide selection of practical workshops.
Details and registration: contact Lucas Hayhurst (e-mail lht@blueyonder.co.uk).

IOP Yorkshire Branch Teachers Day
University of Leeds, Department of Physics & Astronomy
2 July, 10.00 a.m. – 4.30 p.m.
This is a free event and there is no limit on the number of teachers per institution. There will be workshops, seminars and lectures on both classroom and cutting-edge physics.
Details: contact Dr Alex Brabbs, IOP regional officer (e-mail alex.brabbs@iop.org, tel 07795 831 434).

Summer Physics Update
H H Wills Physics Laboratory (Department of Physics), University of Bristol
8–10 July
This three-day residential course for physics teachers 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

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).

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-wide institutes (March–May).
Details: www.particlephysics.ac.uk/teach.html (make sure you book early!)

Headstart Inspire Courses
Newcastle University, 13–15 July
BT labs at Adastral Park, Ipswich, 25–27 July
These new courses are a valuable preparation for STEM A-levels. As well as taking part in hands-on practical activities, both courses offer the opportunity for the girls to gain some personal development skills, such as presentation, project management, team work and study techniques.
Details: visit www.headstartcourses.org.uk/courses.php or e-mail info@headstartcourses.org.uk for an application form. Places are limited so completed applications need to be returned as soon as possible.

SEPnet GCSE Taster
University of Oxford, 20 June
Royal Holloway, University of London, 21–23 June
University of Surrey, 27–29 June
University of Southampton, 30 June/1 July
University of Kent, 4–6 July
University of Sussex, 12–14 July
Queen Mary, University of London, 1–3 November
A half-day event for year-9 students at a SEPnet partner campus. The event covers energy and energy resources, as detailed in the GCSE specifications.
Details and booking: visit www.sepnet.ac.uk or e-mail gcse@sepnet.ac.uk.

SEPnet How to Ace Your A-levels
University of Surrey, 23 June
University of Kent, 8 July
Queen Mary, University of London, 13–14 July
This full-day, university-based activity for year-11 students is designed to introduce key concepts at A-level. Talks and workshops will introduce core concepts, plus lots of tips for passing with flying colours.
Details and booking: visit www.sepnet.ac.uk or contact the individual universities.

Networking events bring teachers and STEM ambassadors together in 2011

Across the UK, STEMNET is holding networking events, joining teachers and STEM ambassadors together to share resources and to identify new opportunities to work together.

STEM ambassadors are a free resource for teachers across the UK, volunteering their time to inspire young people in science, technology, engineering and mathematics, using their professional experience in STEM backgrounds. Networking events aim to highlight how teachers can take advantage of ambassadors' expertise to assist with club activities, provide career insight and add real-life applications to curriculum topics, among other opportunities.

Teachers who attended networking events in Bexley and Southwark gave the following positive feedback:

Teachers at a London networking event get to grips with some classroom experiments, with help from STEM ambassadors.

- "A very useful session! It showed us the diversity of careers in STEM that would motivate students."
- "It gave me a chance to find out more about careers in STEM and how I can relate it to the classroom."

Networking events support the launch of *STEMNetworking*, a web-based platform that makes it easier for teachers and ambassadors to share information by uploading their experiences onto the site. Visit http://networking.stemnet.org.uk to view enhancement and enrichment activities in your area.

For more information: To find an event in your region, visit the events calendar at www.stemnet.org.uk. To find out more about STEM in your area, visit www.nationalstemcentre.org.uk/.

Spring-clean your practical-physics teaching this year!

Do you feel that it is time to dust off some of those unused pieces of equipment and spruce up the practical elements of your scheme of work?

If so, come along to one of the free Getting Practical CPD courses for science teachers being run all over England. This course could transform the effectiveness of your classroom practice and help to improve your learners' experience of practical science. It will show you how to plan, rehearse and stage your practical activities to produce learning outcomes with impact.

Networking and discussing best practice is an important part of any teacher's professional development. Getting Practical is a reflective course, exploring the pedagogy behind practical-science teaching, linking "hands-on" with "minds-on".

The website brings together high-quality practical activities that teachers can use within their teaching. Visit the "Outdoor Science" section to see how teachers have used the outdoor environment and field trips to support and enrich a pupil's practical-science experience.

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). Visit www.gettingpractical.org.uk to discover resources and to find out where courses are running near you.

Teachers get hands on with Earth physics

These three free CPD workshops show teachers how 14–19 physics can be taught through Earth contexts. Each 90 minute workshop uses a range of hands-on practical activities showing how physics can be taught in clearly relevant Earth-related ways that can be used to increase student motivation and interest.

The three workshops were developed by the Earth Science Education Unit, in collaboration with the Institute of Physics. They are available through a network of facilitators across the UK and each contains a range of practical hands-on activities with real-life applications.

Career opportunities and profiles of specialists within the field are included in the materials, available on CD-ROM.

For more information: contact ESEU (e-mail eseu@keele.ac.uk) or visit www.earthscienceeducation.com.

Regional fairs will give STEM students chance to celebrate their work

The Big Bang Regional Fairs invite schools, colleges, clubs and individual students to celebrate their STEM project work throughout June and July.

A total of 11 events will take place across Scotland, Northern Ireland, Wales and England to showcase a large variety of STEM project work undertaken by 11–18-year-olds.

Competitors will compete for a prestigious place at the finals of the National Science & Engineering Competition the following March and also take part in many activities, such as workshops, talks and shows.

These activities are also open to visiting school groups to help inspire and engage students in STEM subjects, and provide teachers with an opportunity to network with others.

For more information: visit The Big Bang Regional Fair website for your region – just click on the dot closest to your town at www.thebigbangfair.co.uk/map.

A clear focus on optics: the pinhole camera

The pinhole camera is a wonderful introduction to the physics of the eye and the lens camera. It can help students to understand the action of a convex lens in forming a real image and to understand why the image is inverted.

Although pinhole camera kits are available from equipment suppliers (e.g. https://extranet.fisher.co.uk/webfiles/uk/web-docs/Grif039.pdf) and you may have some sitting in the back of a cupboard, they are very easily made from tin cans open at both ends or plastic piping of approximately 70 mm diameter, cut into 150 mm lengths.

Class experiment

Apparatus and materials:

- carbon filament lamps 200 W (up to four groups may share each lamp);
- mounted lamp holders (safety pattern).

For each group of students:

- pinhole camera box (15 cm × 10 cm × 10 cm) or other arrangement;
- black paper;
- greaseproof paper;
- elastic bands or paper clips to secure paper in place on camera ends;
- lens (+7D or 150 mm focal length) – the focal length should be equal to the length of the box;
- pin for making holes.

Technical notes

1. The pinhole camera kits available from equipment suppliers will contain either dismantled card boxes painted black on the inside or square-section black plastic tubes, with some or all of the other items listed above.
2. The lenses suggested are designed for a camera approximately 150 mm from front to back. If other sized boxes are used, the lens provided should have a focal length equal to the length of the box.
3. Each camera needs one end covered with a piece of black paper (pin holes are made in this) and the other end covered with greaseproof paper to make a screen.
4. Carbon filament lamps are rated at 200 V. They will last longer if a 200 V supply is available.

Safety

The mounted lamp holders should have:

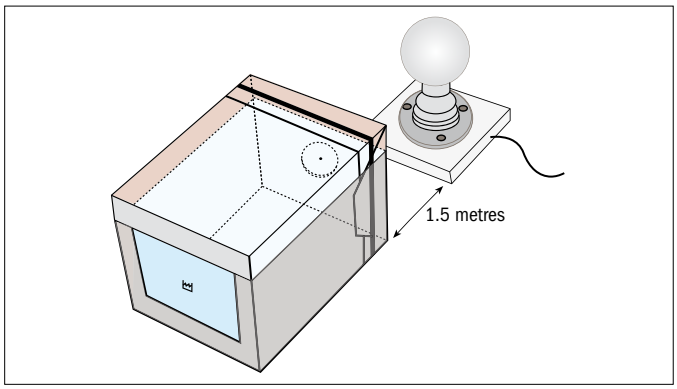
- a double-insulated two-core flex with a 13 A mains plug fused at 3 A;
- a cable anchorage within the mounting;
- a safety-pattern lamp holder that disconnects the pins when the bulb is removed.

Procedure

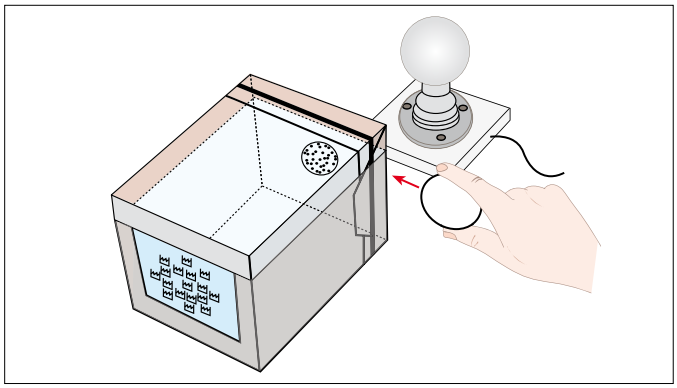
1. Place the lamps and lamp holders around the laboratory so that up to eight students can work with their cameras about 1.5 metres from a lamp. The laboratory can get congested. Placing the lamps high can alleviate this.
2. Pull down the blinds or otherwise shade the room. Ask each student to do the following:

(a) Make a small pinhole in the black paper. Remind students to point the pinhole at the lamp. Look at the screen as they move the box closer to or farther from the lamp.

(b) Enlarge the pinhole and repeat the observation.



A typical pinhole camera set-up (not to scale).



Inserting the lens in front of the pinholes.

(c) Add several more small pinholes and repeat the observation.

(d) Pepper the whole sheet with pinholes and repeat the observation.

(e) Give each student a lens and ask them to slide it in front of the pepper of pinholes while the box is pointed at the lamp. You may need to tell students to move nearer to the lamp and farther from it, and see what happens. They will soon find the position for a single brilliant image.

(f) Push a pencil, then a finger, through the pepper of pinholes. At each stage, experiment with using the lens in front of the pinholes.

(g) Try the effect of moving the lens a little away from the camera. Examine the effect when the box is farther away from, and when nearer to, the light source.

(h) Attach a new piece of black paper on the front of the camera. Make a large pinhole in this paper and then repeat step **(e)**. You are now using a lens camera with a small aperture and students can observe the greater range of focus.

3. Finally pull up the blinds so that students can use their "lens cameras" to look at the view through the window.
4. You can also discuss with students the way that the eye works and the similarity to the pinhole camera plus lens set-up.

For more information:
visit www.practicalphysics.org, click on "optics" and look under guidance for "From pinhole camera to lens camera".

PRACTICAL PHYSICS