IOP | Institute of Physics
Education *Supporting Teachers*

Classroomphysics

The newsletter for affiliated schools

March 2008 Issue 4

PEEP puts science under microscope

PEEP stands for Physics and Ethics Education Project. It is an interactive website and virtual learning environment for secondary-school science teachers and their students. The project has been developed to highlight the moral, ethical, social, economic, environmental and technological implications and applications of physics.

When I started teaching physics in the context of 21st-Century Science, I was pleased to see how the pupils thought about ethical issues. With the subject of radiation and reducing the associated risks, for example, the "as low as reasonably achievable" and precautionary principles all form part of the curriculum. Considering an ethical question is also one of the coursework possibilities, with students being asked to write a case-study of an area of science where they need to express the different sides of an argument.

The project was launched initially in 2006 and the website has been developed and expanded since then. Looking through the site I was impressed by the range of topics covered and the degree to which the ideas were developed. As I thought about how fashion and society have an influence on whether we choose to use sunbeds or the implications of the communication revolution, I started to see the value of including these ideas in physics lessons.

I took my year-10 class to the computer room recently as part of their work on radiation, giving them the opportunity to explore and work with the PEEP site. I offered them a choice of investigating either the ethical issues behind weapons or imaging in medicine. I gave them some guiding questions and the task of creating a "for and against" argument in relation to the question of whether or not it is right to use radiation in these fields.

I was immediately impressed by how they tackled the online resource and used it to investigate these ideas. My students navigated around the site, discovering information that was new to them. They found it interesting and motivating. I was often called over to be shown something and was asked: "Have you seen this, Sir?". The class demonstrated a good ability to understand the issues raised and used the information that they found to construct strong arguments. The students finished the lesson having gained a fair insight into the question and could communicate what they had researched with the others in the group.

Exploring the ethical issues behind physics is not something that I as a physics teacher find immediately natural. However, having worked with the PEEP site and witnessing how the students enjoyed thinking through the different arguments, I have become convinced that it is an important and valid part of pupils' learning. We live in a society where the ethics of technological advances are becoming increasingly blurred. Addressing these issues during lessons is a worthwhile activity, and the PEEP site provides valuable information to help students to do this. The topics are relevant to both pre- and post-16 courses, and they provide teachers with a varied and useful resource. Detailed teacher help notes and a comprehensive glossary of the relevant ethical terminology are also available online.

David Richardson

For more information:
http://www.peep.ac.uk/.

In this issue

Editorial

Welcome to the fourth edition of *Classroom Physics*. Once again we have an issue full of ideas to support your physics teaching and news of competitions and events for both you and your students. You may be gearing up for National Science and Engineering Week and be busy putting the final touches to special activities and lectures. Good luck and have fun. You may also be grappling with new GCSE coursework requirements, hoping that your paperwork is all straight and that you have managed to follow your board's requirements accurately.

News about the launch of the Physics and Ethics Education Project website in November last year was reported in the January issue of *Physics Education*. This web-based resource supports the teaching of scientific issues arising in physics that have a significant controversial or ethical component.

continued >>

Editorial (continued)

Our front-page story reports on the benefits gained from using this material in your teaching. I hope that you will feel encouraged to give it a try and perhaps even make a contribution yourself.

Another web-based resource that you may not yet have come across is the Teaching Advanced Physics (TAP) website. This is aimed at people starting to teach advanced physics for the first time, but it should have useful suggestions and resources for anyone, however experienced (p5). The Virtual Physical Laboratory (VPLab) is a set of simulations covering all areas of physics and is the product of many hundreds of hours of hard work by John Nunn, a physicist at the National Physical Laboratory (NPL). More information about how you can get hold of this valuable resource is given on p4.

The Researchers in Residence scheme has been around for quite a few years but has recently been relaunched by a team at the University of Edinburgh. On p5 you can find out more about this scheme, which allows you to have a real researcher in your laboratory to assist you and inspire your students. If you are in the north west, you might want to consider taking your students to a performance of the musical *BIG BANG!* in Liverpool in July (p3).

Our teaching tips have an Easter theme this time, with some entertaining "eggsperiments" devised by David Featonby (p7). If you are planning to do these with students, you should carry out your own risk assessment first. Our worksheet is a magnetic-field lines puzzle (p8). There are also some suggestions for using printable paper rulers – a free online resource (p2).

We have news about a popular physics course run by the NPL (p2), and the events listings for students (p3) and teachers (p6) look ahead to the summer term. They include, in particular, the one-day teachers' conferences taking place across the UK in June. These are always good value in terms of CPD and networking opportunities.

If you have any comments about this month's *Classroom Physics* or requests for future issues, do get in touch.

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

Corti Trust calls for student science competition entries

The closing date (30 April) for entries to the 2008 Corti Trust Science Competition is fast approaching, so don't delay.

If your students are starting an engineering-, science- or mathematics-based university course in the UK, they could be eligible for this prestigious £2000 science prize, paid in three annual instalments.

The Corti Trust is dedicated to encouraging UK A-level students to undertake science-based courses at university. Each year the Trust awards £2000 to a student starting university in the coming academic year to obtain a BSc, MSc or equivalent in a traditional mathematics, science or engineering subject in the UK. Combined honours courses (e.g. physics with philosophy) are also eligible.

To win, students must submit an essay describing a piece of recent research in their scientific discipline, how it was achieved and its potential significance in the wider world. They must demonstrate a solid understanding of the scientific concepts behind the specific breakthrough or discovery that they have chosen and be able to communicate them clearly and concisely. Students will have to put scientific issues in the wider context of our everyday experiences and have a strong appreciation of why science is important to our way of life.

The prize embraces all scientific disciplines (non-medical) and welcomes innovative, thought-provoking essays about the cutting edge of science in 2008.

Teachers can download leaflets and entry forms in the teachers' pack from http://www.cortiscienceprize.org. Entries should be no more than 1500 words.

For more information:
http://cortiscienceprize.org/.

NPL satisfies teachers' hunger for knowledge

Protons for Breakfast is a six-week course that is open to anyone who is interested in science and its impact on our lives.

If you are a non-specialist teacher of physics and you would like to feel more confident about teaching complex physics topics, this might be for you.

Key features include:

- Three sessions of demonstrations and hands-on activities leading to a simple but sound understanding of science and technology. The sessions will focus on:
  - the size and scale of the universe
  - the astonishing electric force
  - light
  - atoms
- Three discussion sessions focusing on current issues, including the problem of how we as human beings, citizens and voters can make decisions about complex scientific matters, such as:
  - The greenhouse effect and global warming.
  - Will we need nuclear power in the future?
  - Is my mobile phone affecting my brain?

For more information: The Protons for Breakfast course is run by the National Physical Laboratory (NPL), Hampton Road, Teddington, Middlesex TW11 0LW. Course sessions run from 7.00 a.m. to 9.00 p.m. once a week. The next session starts on 26 February and there will be an additional course running in late autumn. For more details and registration, visit http://www.npl.co.uk/protons_for_breakfast.

For details about the resources available through the NPL, including some excellent PowerPoint presentations on climate change and nuclear power, visit http://www.npl.co.uk and click on "Educate and Explore".

Free printable paper ruler resource measures up

At first glance this may not seem to be a very useful resource but, if you read through the comments from users, you will quickly see how it might prove to be a simple but effective addition to your lessons.

Numberless rulers provide a very useful introduction to linear measurement and are an excellent way of focusing on gaps in the understanding of the principles of devising a scale, with 10 subdivisions. The rulers can be copied onto acetate sheets and their transparency makes them very useful for measuring odd things like leaves or tadpoles.

For more information: The printable paper ruler resource is free to download from http://www.vendian.org/mncharity/dir3/paper_rulers.

Physics students to take centre stage

BIG BANG! is an original musical show aimed at a range of audiences that promises to present physics, life, love and the universe like you've never seen them before.

It follows the careers of two young scientists from their student days, in the present time, through to their rival claims to the Nobel Prize, 20 years on. Their progress is followed by four famous scientists from the past: Albert Einstein, Marie Curie, Isaac Newton and Galileo Galilei, who take an increasingly active part as the story proceeds. Through comedy, songs, live music, dance and drama, the show explores aspects of both the content and the process of science, and also the importance of scientists as people.

The show was devised and written by Dr Dominic Dickson, a reader in physics at the University of Liverpool, and his colleague Phil Freeman as part of their work in the Science Communication Unit. *BIG BANG!* aims to be both entertaining and informative, while raising awareness of the importance and relevance of science, and motivating young people towards scientific careers. The production had an extremely successful run in 2006, when it was seen by more than 3000 school students, and it is being revived for summer 2008.

The musical will be one of the University of Liverpool's flagship contributions to Liverpool 2008 European Capital of Culture, with major shows in July 2008 for schools and in September 2008 to coincide with the British Association Festival of Science. These productions are also supported by the Institute of Physics as its contribution to the 2008 celebrations in Liverpool.

The two central characters test out the laws of attraction in a scene from this explosive musical.

For more information: www.liv.ac.uk/physics/bigbang. The performances for schools are at 10.00 a.m. and 1.00 p.m. on 7–23 July. For advance bookings, contact Jackie Sharp (e-mail j.sharp@liv.ac.uk, tel 07971 640 381).

EVENTS FOR STUDENTS

Wrexham Science Festival

North-East Wales Institute of Higher Education, Plas Coch Campus, Wrexham
13 March 2008, 4.00–5.30 p.m.

Hunting for Asteroids
A practical workshop using images from the Liverpool Telescope, led by Dr Andy Newsam and Dr Chris Leigh of the National Schools Observatory at Liverpool John Moores University.
This event is suitable for teachers and/or small groups of accompanied pupils. Refreshments, including sandwiches, will be provided free of charge so that teachers can network while waiting for the lecture to begin.
6.30 p.m.

Extrasolar planets: a Spotter's Guide!
Dr Andy Newsam gives a lecture on how to find extrasolar planets and what they can tell us about life elsewhere in the universe.
Details and booking: visit http://www.wrexhamsf.com or contact Andrea Fesmer, (e-mail andrea.fesmer@talk21.com).

Institute of Physics 2008 Schools and Colleges Lecture: Rock in 11 Dimensions: where Physics and Guitars Collide!

This free lecture, given by Dr Mark Lewney for 14–16-year-olds, continues its tour around Britain. It will be in the east of England in April and in the south east and London in July.
Details and booking: visit www.iop.org and click on "Schools and Colleges" for further information regarding dates and venues, or contact Joanne Page (e-mail joanne.page@iop.org).

Advancing Physics Revision Roadshow for 2008

All venues will feature sessions for both AS and A2 students
20 March: Science Learning Centre, York
27 March: University College London
28 March: University of Bristol
31 March: University of Birmingham
17 April: University College London
The cost is £20 per student, which includes revision sessions, revision handouts, lunch and refreshments. Accompanying teachers are free. Book early to avoid disappointment.
Details: booking forms are available on the Advancing Physics website at advancingphysics.iop.org/teacher/roadshow.html, or contact Anastasia Ireland (e-mail anastasia.ireland@iop.org).

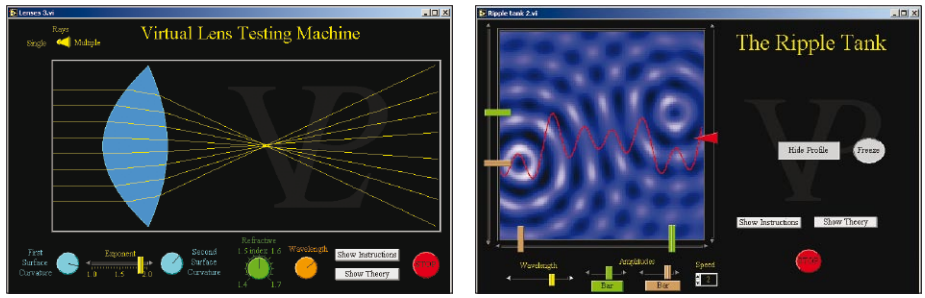
Large Hadron Collider Masterclass

Queen Mary, University of London, Department of Physics, Mile End Campus
30 June 2008, 10.00 a.m. – 4.00 p.m. (to be confirmed)
Suitable for year-11/GCSE physics students. They will learn about the workings of the LHC, and the massive computer Grid, which is going to be used to analyse the data, as well as having the chance to build their own particle accelerator and search for their own particles. In the afternoon they will be introduced to string theory and the impact that the LHC may have on it.
Details and booking: contact Laura Jackson (e-mail l.f.jackson@qmul.ac.uk, tel 0207 882 3020).

Virtual experiments enhance learning

"I can thoroughly recommend this resource, which contains a truly amazing range of virtual experiments."

Comment from Bernard Taylor, reproduced from a review in *Physics Education* (Vol. 42, No. 1)



Screenshots of simulated physics experiments taken from Virtual Physical Laboratory version 6.0.

One year after the launch of version 5.0 of the Virtual Physical Laboratory (VPLab), sponsored by the National Physical Laboratory (NPL) and the Institute of Physics, there are more than 1200 registered teacher users in the UK and the Republic of Ireland.

Version 6.0, which has just been launched, contains more than 200 simulations (37 new ones), including completely new chapters on measurement uncertainty, X-rays, fluids and circular motion. The interactive experiments and activities can be used by teachers and students individually. They demonstrate physical principles and applications, and they are pitched at physics GCSE and A-level, although the simulations may be of value at other academic levels.

VPLab was written specifically so that it could run on low-specification computers and requires no additional hardware (except a microphone if you want to make use of the spectrum analyser and other sound-recording programmes). Sponsorship from the NPL and the Institute enables teachers in the UK and the Republic of Ireland to install VPLab on their school or college network for multi-user access, completely free of charge, to enhance self-learning and the safe exploration of many areas of physics. VPLab allows experiments and demonstrations to be implemented quickly without needing the time and budget to set up the real thing. Students can experiment and investigate at their own level and pace without the fear of breaking something.

The creator of VPLab, John Nunn, is a research scientist at the NPL who has spent several years teaching in India. He wanted to have an animated and interactive way of communicating scientific concepts that cover most of the topics in the school physics curriculum and he has spent many hours developing the software. His philosophy is that these simulations should complement rather than replace practical work, textbooks and teachers, enriching the learning experience in the physics classroom.

For more information: Visit http://www.npl.co.uk and click on "Educate + Explore", where you will find VPLab as a menu item.

This remarkable educational resource is provided free of charge to teachers from UK and Republic of Ireland schools and colleges who attend a demonstration. To find out where the next teachers' event will be taking place near you, contact Gary Williams (e-mail gary.williams@iop.org).

If you are a registered VPLab user and haven't received details of the new upgrade to VPLab version 6.0 by 1 April 2008, contact John Nunn (e-mail john.nunn@npl.co.uk).

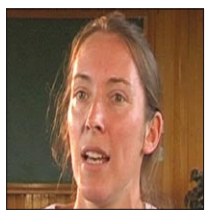
Films focus on particle physics

Ever wondered why you're not made of antimatter, or how small a quark is?

A series of short films about particle physics and the Large Hadron Collider (LHC) – the new experimental facility that is due for launch this year at CERN – is now available for anyone to download and use. The films are the result of a collaboration between particle physicist Tara Shears and science communicator and teacher Alom Shaha. Each film is no longer than four minutes and aims to convey important particle-physics concepts in a visually striking way. Topics include:

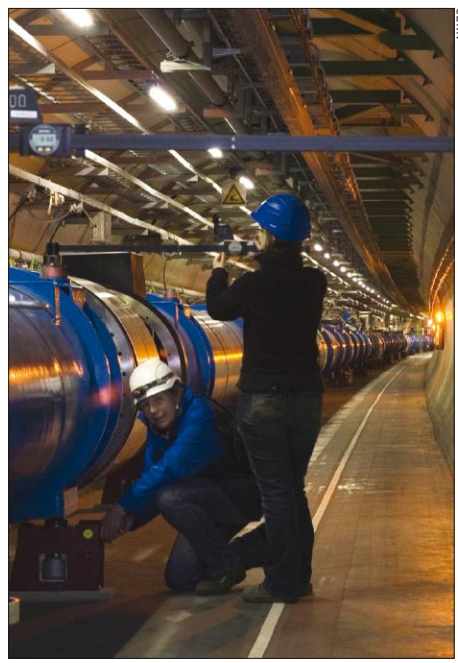
- how small nature's building blocks are;
- the LHC facility and what particle physicists hope to find with it;
- what scientists understand by dark matter;
- the problem of antimatter;
- what the elusive Higgs is.

The films were originally made for the general public, but there has been very positive feedback from teachers who have seen them. They are an ideal resource to include in lessons and the ideas are clearly explained in a way that should appeal to 14–16-year-olds as well as to older students.



Tara Shears is a member of the Particle Physics Group at the University of Liverpool, which is constructing components that will detect "beauty" quarks created by the collision of protons in the LHC. She splits her time as an experimental physicist between helping to build the detectors and devising methods to understand the data that they will produce: "I'm not an expert on detectors, so I mainly help with testing components for them." Shears regularly gives public talks and devotes a lot of time to helping the public to understand particle physics.

For more information: http://www.labreporter.com.



CERN

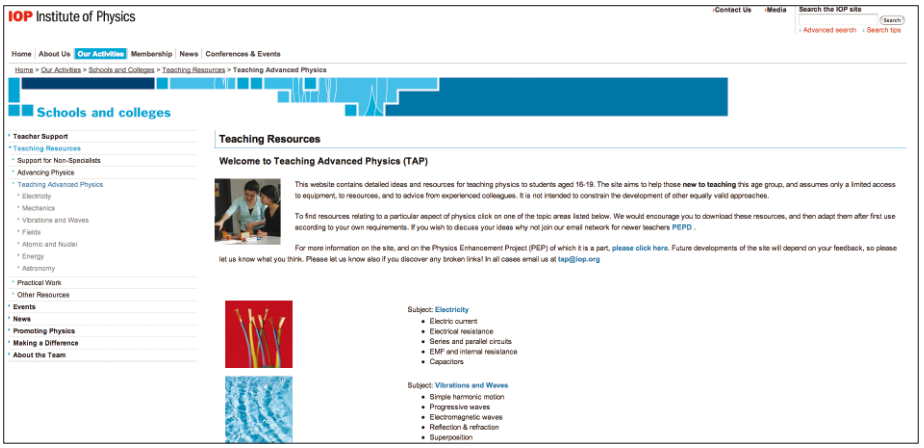
Important checks are performed on the alignment of the magnets in the Large Hadron Collider tunnel. It is vital that each magnet is placed exactly where it has been designed to be so that the path of the beam is controlled precisely.

Teachers tap into advanced physics website

One of the most popular resources that the Institute provides for teaching physics to older pupils is the TAP website, www.tap.iop.org. This contains a range of detailed ideas, tips and resources for teaching physics to students aged 16–19. Although the site is geared towards helping those who are new to teaching this age group, experienced teachers should also find it a useful source of ideas and information.

The website contains helpful introductions to each topic, highlighting the resource implications and the prior learning that pupils will need to be able to tackle this area. It draws on a number of established resources, such as *Advancing Physics* and *Salters Horners Advanced Physics*, and we are grateful for permission to use these. It also refers to other useful websites and web resources for each topic.

All of the materials can be downloaded easily as Word documents and there is a wealth of illustrations of experiments in the form of clipart, proved by well known physics author Keith Gibbs. All material can be used for educational purposes without charge.



The website is easy to navigate. To find resources relating to a particular aspect of physics, simply click on one of the topic areas that are listed on the homepage. A new page will open and this in turn has a list of various topics and subjects, which can all be accessed with a further click of the mouse. We would encourage you to adapt these resources after first use according to your own requirements.

Future developments of the site will depend on your feedback, so just send us an e-mail (tap@iop.org) and let us know what you think.

Researchers in Residence scheme is relaunched

Do connections between schools and researchers excite you? Are you interested in helping your school students to engage with contemporary research? If so, Researchers in Residence (RinR) is for you.

RinR is an initiative that aims to enrich the classroom experience of school students through placing a contemporary researcher in that school. We facilitate a partnership between a researcher and host teacher who plan a series of interactive activities together that the former will carry out during their short-term residency (14–24 contact hours). This partnership helps to ensure that the residency meets both the curriculum aims of the teacher and the development aims of the researcher. The visitor is not there to teach, per se, but to enhance what is already happening in the classroom and provide school students with a novel and stimulating experience. The researchers are drawn from a broad range of subjects, including the physical sciences.

The emphasis of a placement is on helping school students to connect with:

- researchers as people;
- the process of conducting research;
- topics in contemporary research;
- the social, ethical and legal implications of research;
- the relevance of what is being learned in the classroom.

This is achieved through interactivity, practical work/discussion groups, co-operative learning and project work. Training and CRB checks are provided for visitors, and support, advice and orientation for both researcher and teacher is provided by a regional coordinator.

The scheme has benefits for both sides. A recent physics researcher who took part in the scheme said: "It was a very rewarding and challenging experience, and my confidence and presentation skills have improved. The Key Stage 3 students asked some awesome questions about the universe and the night sky." The host teacher commented that both he and his students greatly enjoyed working with this researcher, so much so that he has invited her back next year when they will be covering the GSCE physics topic on space.

We currently have a selection of enthusiastic researchers from across the UK who are available to go in to schools.

For more information: If you are interested in finding an RinR in your area, register at http://www.researchersinresidence.ac.uk as soon as possible.

A physicist leads an interactive classroom activity.

Alternatively, contact your nearest RinR regional coordinator:

- Scotland, Lara Crossland (e-mail lara.crossland@ed.ac.uk, tel 0131 650 7743)
- Northern Ireland, Colin Press (e-mail press.colin@btinternet.com, tel 028 9084 9389)
- north west, Belinda Bray (e-mail belinda.bray@manchester.ac.uk, tel 0161 275 7700)
- north east, Holly Hennell (e-mail hh510@york.ac.uk, tel 01904 432 688)
- Midlands, Carole Galant (e-mail carole@createafuture.co.uk, tel 0121 414 4318)
- east, Phil Smith (e-mail phil.smith@bbsrc.ac.uk, tel 01603 450 304)
- south west and Wales, Kate Isaak (e-mail rinrsww@cf.ac.uk, tel 029 2087 0187)
- south east, Rebecca McKelvie (e-mail r.mckelvie@sussex.ac.uk, tel 01273 877 984)
- London, Annalisa Alexander (e-mail researchersinresidence@imperial.ac.uk, tel 0207 594 8134)

Events

EVENTS FOR TEACHERS

Physics Update: a Course for Practising Teachers of Physics

School of Physics and Astronomy, University of Leeds

4–6 April, Friday 12.30 p.m. to Sunday 1.00 p.m.

An exciting programme has been put together for this course, with comfortable en suite accommodation provided at Weetwood Hall, Leeds. Lectures will focus on "Physics in archaeology" and "Climate change". Workshops will include "Mega magnets" and "The Virtual Physical Laboratory".

Course fees: residential £130 (£110 for members and affiliated schools); non-residential £70 (£55 for members and affiliated schools).

Details and booking: Leila Solomon (e-mail leila.solomon@iop.org, tel 020 7470 4821).

Salters Horners Advanced Physics Residential Courses

University of York

7–9 April: AS preparation, teachers course

9–10 April: AS and A2 preparation, technicians course

9–11 April: A2 preparation, teachers course (focusing on the current course and its assessment)

2–4 July: AS preparation, teachers course (a repeat of the April course)

These courses will be particularly valuable for teachers and technicians preparing to teach the new Edexcel GCE physics from September 2008 and who are intending to adopt a context-led approach for all or part of their teaching. The courses will be based on the Salters Horners course materials and activities, and they will show how these can be used to support the Edexcel specification.

Details and booking: visit www.york.ac.uk/org/seg/salters/physics or contact Sandra Wilmott (e-mail slw5@york.ac.uk, tel 01904 432 601).

Physics Teacher Network Conference

Education Department, Bangor University

3 June, 10.30 a.m – 3.45 p.m.

A day of lectures and workshops for anyone who teaches physics, with plenty of opportunity to network and exchange ideas for the classroom. The conference, including lunch, is free to participants.

Details and booking: contact Andrea Fesmer (e-mail andrea.fesmer@talk21.com).

Stirling Physics Meeting

University of Stirling

4 June

Speakers will include Dr Bob Lambourne of the Open University (who will talk about the expansion of the universe), a member of the Scottish nanosatellite team, and a representative of the SQA review group (who will talk about the proposed reform of Scottish qualifications). The meeting will include an exhibition and time for networking.

Details: information will be circulated to all schools in Scotland in mid-March and will appear on the Institute of Physics in Scotland website http://www.iopscotland.org/.

20th Rugby Physics Meeting

Rugby School

5 June

For all teachers in schools and colleges, this meeting promises to be a mixture of information, stimulation and communication. It will include an exhibition and workshops.

Details and booking form: contact Leila Solomon (e-mail leila.solomon@iop.org, tel 020 7470 4821).

Scottish Physics Summer School

Department of Physics, University of Glasgow

23–27 June

A week-long event, with en suite accommodation provided in university halls. The programme will include keynote speakers, discussion with researchers, practical laboratory work and optoelectronics for schools. Fee: £180.

Details: visit www.iopscotland.org.

Teacher Network Physics Day

Department of Physics, Clarendon Laboratory, University of Oxford

24 June

A one-day conference for all physics teachers including NQTs. The programme will include lectures and a choice of workshops.

Details: contact Robert Strawson, South Midlands Teachers Network (e-mail robert@strawson.net). The draft programme is available at http://www.jphys.org/activity/education/Teacher_Support/Teachers_Network/South_Midlands/page_5274.html.

Annual Liverpool Physics Teachers Conference

University of Liverpool, Chadwick Laboratory

26 June

This free event is organised jointly by the University of Liverpool and the Institute's Merseyside Branch. It will include lectures, workshops and discussions.

Details: http://www.liv.ac.uk/physics/schools/index.html.

Perspectives on Science

University of York

26–27 June

A residential course designed primarily for those preparing to teach the AS perspectives on science course for the first time in September 2008. Participants will be able to explore approaches to teaching the history, philosophy and ethics of science, promoting discussion and debate, managing the student research project, and extended project assessment.

Details: contact Sandra Wilmott (e-mail slw5@york.ac.uk).

CERN Physics High-School Teachers Programme

Geneva, Switzerland

29 June–19 July

This is an international three-week programme. Participants will attend lectures and workshops, visit experimental facilities and produce new teaching resources. A grant will cover basic living expenses (on-site accommodation and subsistence) and travel (based on real cost up to a limit of SFr500).

Details: to apply (by 15 March), visit http://education.web.cern.ch/education/Chapter1/Intro.html.

Advancing Physics Teachers and Technicians Courses

Department of Physics and Astronomy, University of Birmingham

1 July: Introduction to AS

2 July: Introduction to A2

3 July: Technicians course

These courses, run jointly with OCR, will cover all aspects of teaching and learning, including a session on coursework and an introductory CD session, reflecting the revisions made to the specification for September 2008. Special rates are available for early bookers and affiliated schools.

Details: visit http://advancingphysics.iop.org/teacher/index.html.

Oxford University Conference for Teachers of Physics and Chemistry

6–9 July

An opportunity for teachers of physics and chemistry in the maintained sector to spend four days in Oxford finding out more about the University and the physical sciences. £50 funding per participant will be available. Priority will be given to A-level teachers from schools and colleges with the least experience of sending candidates to Oxford, and to teachers who did not themselves study at Oxbridge. Deadline: 28 April 2008.

Details: contact Dr Zareen Ahmed-Stewart (e-mail schools.liaison@mpls.ox.ac.uk).

EGGCITING EGGSPERIMENTS FOR EASTER

Tricks and challenges that apply physics principles to eggs: The "Bed of eggs" challenge proves more than a little nerve-wracking (left). The "inertia application" applies inertia (centre). The "eggshell challenge" (right).

Challenge	Description	Notes
Hard or soft	Distinguish between a hard-boiled egg and a raw egg by spinning them gently then stopping the rotation. The hard-boiled egg stops dead while the raw egg continues to spin.	It is the rotating albumen inside the raw egg that keeps rotating.
Tippee top eggs	A solid egg (including those made of chocolate) can be made to stand erect by spinning it with its main axis horizontal. (Also works with Minstrels.)	The friction between the curved bottom and the surface causes the egg to rise.
Crush an egg	It is impossible (almost) to crush a raw egg in the palm of the hand, held across ways (rings, etc not allowed).	Eggs are strong.
Egg tossing	If you throw a raw egg into a vertically held sheet it will not break. The sheet should be held by two students, making a trough at the bottom to catch the egg.	The sheet cushions the egg. Make sure that the student throwing has a good aim.
Eggstreamly difficult	Float a raw egg in a glass of water so that its centre is above the level of the surface. Use no extra floating aids, only water from the tap and the glass.	Place the egg in the glass with a stream of water flowing into the glass onto the top of the egg and overflowing. The faster the jet, the higher the egg rises.
Egg in a bottle	Place a shelled hard-boiled egg on top of a milk bottle that has had either a lit match or some boiling water in it. (If using boiling water, be sure to warm the bottle first to avoid it cracking.) This can also be done with an egg that has had its shell softened in vinegar.	As the water vapour condenses, reducing the pressure, the outside air pressure pushes the egg into the bottle.
Bed of eggs	If you have plenty of money for eggs, then buy three two-dozen-egg trays, lay them on the floor and lie on them.	Eggs are strong.
Inertia application	Position three tumblers (or similar containers) containing water in a triangle. Put a placemat on top, shiny side downwards. Carefully position a Smarties tube upright on the place mat above each tumbler and gently balance an egg on top of each tube. Place your hand next to the end of the place mat and give the mat a sharp horizontal slap.	The mat shoots out of the way and the eggs fall into the tumblers.
Egg drop	Place an egg on top of a 500 ml bottle, inside a margarine container, on top of a glass of water. Without touching the egg, get it to drop into the glass.	The trick here is to smash the bottle away as fast as you can to the side, taking the margarine tub with it. Since no effective force acts on the egg, it simply falls vertically.
Eggshell challenge	Balance an empty half eggshell on the sharp end of a knife held vertically. Hold the knife handle firmly. By bringing the knife handle down firmly onto a bench/table, make the eggshell pass over the knife end, making a hole in the eggshell.	The problem here occurs because the small mass of the eggshell does not create enough force for the knife to penetrate it. The trick (and it is a bit of a trick) is to release your hold on the knife just before it strikes the table. Thus the knife is now travelling upwards into the shell at the moment of impact. Your explanation can refer to momentum, inertia or energy.

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Magnetic jigsaw

Cut out the pieces of the jigsaw below and rearrange them to show the correct shapes of the magnetic fields around the two pairs of magnets. Complete the diagram, marking on the rest of the magnetic poles and the arrows on the field lines. (Remember: the arrows show the way that a compass needle would point if placed in that position.)