IOP | Institute of Physics
Education *Supporting Teachers*

Classroomphysics

The newsletter for affiliated schools

September 2009 Issue 10

New Stimulating Physics Network is set to inspire teachers and students

STIMULATING PHYSICS NETWORK

Institute of Physics

Teacher Network coordinator Helen Pollard leads a workshop with teachers of physics.

The Institute of Physics is embarking on a major programme of school-based support in partnership with the National Network of Science Learning Centres. The Stimulating Physics Network will build on the successes of the existing Physics Teacher Network and the Stimulating Physics pilot – both set up and managed by the Institute. The initiative will be funded by the Department for Children, Schools and Families (DCSF) and will, in the first instance, be run in England until March 2011.

The network will be built around 60 physics network coordinators across the nine government office regions supported by the Science Learning Centre in each region. The physics network coordinators will work with both teachers and pupils to improve the image, enjoyment and uptake of physics in their schools.

Central to our approach is the desire to encourage the view that physics is an accessible, rewarding and valuable subject in its own right, as well as one that opens up opportunities in other areas of science and engineering and in finance, law, business and beyond. We will use our experience to make physics attractive to all groups, including girls and non-specialist teachers, catering for all current and prospective teachers and pupils of the subject.

The original Physics Teacher Network will be expanded to bring its good work to more schools and more teachers; this will be enhanced by the connections and regional marketing of the Science Learning Centres. The network will share good practice, disseminate new ideas and nurture the interest and enthusiasm of new and experienced teachers through workshops, peer-to-peer links and online support, which will be available to all schools and all teachers of physics.

The workshops will be based on those developed by the Teacher Network and will include "New ideas", "Rockets", "Shocked and stunned" and other tried-and-tested favourites, as well as workshops from coordinators building on their own interests and experience. With the expanded network, these will be brought to more schools and more teachers, tailored to their needs and availability. All teachers will be able to access e-mentoring and enrichment and enhancement activities for pupils.

The new network will also work intensively in some targeted schools to reinvigorate a culture of physics where this has been lost. In these schools, the model developed in the Stimulating Physics pilot of visiting the school, working with the science department to identify its needs and providing bespoke support will continue. We know that one of the issues is likely to be a shortage (or even lack) of specialist teachers. Physics teaching and learning coaches (TLCs) will provide intensive, tailored support for whole departments, based on the Supporting Physics Teaching resources, to improve their confidence and enjoyment of the subject. In addition, the physics TLCs will work directly with pupils, supported by a dedicated teaching and learning ambassador, who will provide taster lessons and ready-made, highly interactive demonstration lectures.

This unique partnership between the Institute and the Science Learning Centres is excellent news for physics education. It will allow us to expand activities that we have shown to work; we will be able to support more teachers, revive physics in more schools and give more pupils access to physics lessons with life, depth and clarity. Look out for more information about this work in the near future.

Charles Tracy, head of education (pre-19)

For more information: If you are interested in becoming an Institute of Physics Teacher Network coordinator or physics TLC in your area and you can offer the equivalent of at least half a day per week, visit www.iopjobs.org for further details and an application form.

Editorial

Welcome back to the new academic year. I hope that you are still feeling refreshed and invigorated by your holidays. This issue is filled with plenty of news, ideas, information and support to enhance your physics teaching.

The Institute's education department is busy with plans for the extension of our Teacher Network to become the Stimulating Physics Network, as you will see from our front-page story. We are pleased that some of our long-term strategies are beginning to bear fruit. Our work on teacher recruitment has developed, so that we now have a new member of staff supporting teacher-training establishments in their marketing. There is more on this page about helping the TDA with its career-exploration programmes.

If you would like to refresh your teaching there are details about our "Physics updates" (p2) and courses at the Science Learning Centres (p3). If you want to offer extra clubs or activities to your pupils but you don't have the funds, have a look at the opportunities that exist to apply for grants from the Royal Society or the Institute (p4). The new STEM Clubs Network has plenty of ideas and information to help with this (p3). If space science is a big pull for your students, then the Space Academy may be the place to go for extra resources and experiences (p4).

National Science and Engineering Week (p3) and The Big Bang (p2) will be coming up in March next year. Make sure that you have the dates in your diary, so that your school can be involved. Our unique physics and enterprise activity "Ashfield music festival" provides an opportunity for 14–16-year-olds to use their physics skills in an unexpected context (p5). The resources for this one-day, off-timetable activity have been extensively trialled and rewritten and they are now available free of charge. Affiliated schools have a set of sample resources with this newsletter. All of our other resources are available by e-mailing education@iop.org, if you need any posters, stickers or copies of *Best Pocket Handbook*, for example.

If you have any comments or suggestions for future issues of *Classroom Physics*, do get in touch.

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

Have you thought about attending a 'Physics update'?

If you think that your physics and your teaching could do with a refreshing boost, then you will enjoy coming to a "Physics update" course. These are two-night/three-day weekend residential courses for physics teachers, which are organised three times a year at the end of the autumn, spring and summer terms at different universities across the UK.

The programme consists of a mixture of lectures and workshops, many of which are given by members of the university department hosting the course. The lectures cover new developments and research in physics and its applications. Hands-on workshops give teachers opportunities to explore new ideas, learn new experimental techniques, try out novel investigations and engage with alternative teaching and learning strategies.

These high-quality courses are always popular with teachers of all ages and experience and they are a great opportunity to improve your skills, share your teaching experiences and enjoy a stimulating environment. The courses are subsidised, costing only £110 for members of affiliated schools, including accommodation. The courses for 2009/2010 are as follows:

- University of Cambridge, 11–13 December 2009
- University of Southampton, 26–28 March 2010
- University of Sheffield, 9–11 July 2010

For more information: visit www.iop.org/update or contact Manchi Chung (e-mail manchi.chung@iop.org).

The TDA calls for help to recruit new teachers

The TDA Career Exploration programme offers a range of opportunities to help enquirers make an informed decision about a teaching career. The Institute is working with the TDA to encourage more suitably qualified people to consider teaching science (particularly physics) as a career. We're looking for schools and practising teachers to participate in our programmes.

Open schools

Could you give prospective ITT applicants an opportunity to spend an observation day in your school to gain an insight into the role and responsibilities of a teacher? A typical school visit could include opportunities to sit in on different lessons, attend a pastoral session and have a discussion with your senior management team.

Teaching advocates

If you are an enthusiastic and experienced teacher, you might be interested in joining the Teaching Advocates programme. You would provide honest and objective answers to enquirers' questions about life in school. Enquirers can talk to you by phone or e-mail and you will also have an opportunity to express an interest in taking part in TDA events and careers presentations.

For more information and registration:
If you would like to participate in the Open Schools programme and/or the Teaching Advocate programme, further details including remuneration and how to register can be found at www.tda.gov.uk/partners/recruiting/careerexploration.aspx.

Fair will create a 'big bang'

Make a note on your calendar: The Big Bang is set for 11–13 March 2010 at Manchester Central. Why not take part in the UK's biggest celebration of science and engineering under one roof?

The fair will bring together industry, government and education sectors in a giant, interactive extravaganza to excite young people about science, mathematics and engineering.

The Big Bang will feature the National Science and Engineering Competition where the UK Young Scientist of the Year and UK Young Engineer of the Year will be announced.

The Big Bang
UK Young Scientists & Engineers Fair

For more information: visit www.thebigbangfair.co.uk.

After-school inspiration aims to unlock scientific talent


STEMNET

An after-school STEM club nurtures a bright spark.

A network of after-school clubs focusing on science, technology, engineering and maths (STEM) has now gone live, making a whole host of resources available to teachers and students across the country.

The STEM Clubs Network was launched on 8 July by former science minister and president of STEMNET, Lord Sainsbury, with the aim of inspiring more young people to study STEM subjects. STEMNET is calling on every secondary school in the UK to join the STEM Clubs Network by 2012. This builds on the highly successful After School Science and Engineering Clubs pilot, funded by the Department for Children Schools and Families (DCSF), which began in 2006 and has involved more than 10 000 students in 500 schools.

The network gives you and your students opportunities to share experiences and achievements through an online forum and it provides invaluable professional advice, resources, contacts and personal support. It will also showcase how schools are making use of resources such as STEM ambassadors to run effective clubs. Teachers who run STEM clubs can access free CPD and invitations to regional best-practice and networking events.

The free affiliation network is open to all secondary schools and colleges, whether you are thinking of starting from scratch or already have a successful club running. All are encouraged to sign up and make use of the information and guidance available. Each STEM club can create its own public profile, publicise activities and projects and write a regular blog.

STEM clubs will also be invited to take part in exciting national initiatives, such as the 10 STEM Challenges, which will see young people tackling a range of real-life issues relating to the London 2012 Games, such as sustainability, construction and even the design of athletes' clothing.

For more information: visit www.stemclubs.net or www.stemnet.org.uk.

Inspire students to study post-16 physics with the network of Science Learning Centres

The Science Learning Centres (SLCs) have an exciting range of physics courses to offer science educators this autumn. With a network of 10 centres across the country, access to innovative and inspiring continuing professional development is within easy reach.

The "Inspiring post-16 physics" course at the National Science Learning Centre (NSLC) is aimed at those who want to update their own knowledge and understanding of contemporary physics. Working alongside research scientists, teachers and examiners to practise new activities, participants will identify how this can inform and change classroom practice. The course will look at issues affecting post-16 physics, the search for a richer texture of experience and the outcomes of the Institute of Physics' groundbreaking research on girls in physics (the Girls into Physics Action Research project), which provides lessons for the teaching and learning of both genders. The course has two residential periods, with the opportunity to implement activities and review them between sessions. This course is eligible for an Enthuse award.

The Action Research for Physics Programme is being run at regional centres and it aims to explore how new approaches to teaching physics can increase young people's engagement with the subject and encourage them to pursue physics beyond GCSE level. The programme will comprise three, one-day professional development sessions over a two-year period. There will be an initial professional-development day, which will introduce new ideas and approaches. This will be followed by action research in school or college to test out ideas and then two further professional-development sessions to reflect and refine approaches and to add new ideas to the school-based research activity.

With generous Impact awards available to your school and courses nationwide, there has never been a better time to update and develop your skills.

Haley Cox, NSLC

For more information: To find out more about available SLC physics courses, visit www.slcs.ac.uk/network/courses/physics.

Annual event calls for physics teachers to help celebrate science in the UK

National Science and Engineering Week (NSEW), held annually in March, is a 10-day long celebration of science, engineering and technology, which sees people of all ages taking part in and organising in the region of 3500 events across the UK.

Are you interested in taking part? For example, why not organise an event or activity to celebrate the week? If so, come along to a free NSEW information session and find out how you can get involved.

These sessions are set to take place across the country in early autumn and they will allow you to network with other organisers for advice and inspiration. Each session will give potential participants the opportunity to collect free resources to help you to get started.

For more details and to register for an event: visit www.britishscienceassociation.org/informationsessions.

Royal Society funds young scientific research

Do you have an idea to give your pupils a practical taste of science and engineering? Do you want to liven up science in the classroom but you don't have the funds to do so? If so, then the Royal Society (RS) may be able to help you.

The RS's Partnership Grants (PG) scheme is at the forefront of initiatives seeking to ignite enthusiasm for science among young people, develop skills and interest in genuine scientific investigation, and support teachers and scientists learning from each other. Grants of up to £3000 are now available for teachers and scientists or engineers to work together on creative investigations involving 5–16-year-olds.

Over the past eight years PG has awarded more than £1 m to 568 projects giving pupils and their teachers the opportunity to work on stimulating and inspiring projects, forging links with universities and organisations, such as GlaxoSmithKline, BT and Rolls-Royce.

The Royal Society

Students explain to HRH the Duke of Kent how they are using CERN technologies to detect cosmic rays at the RS Summer Exhibition.

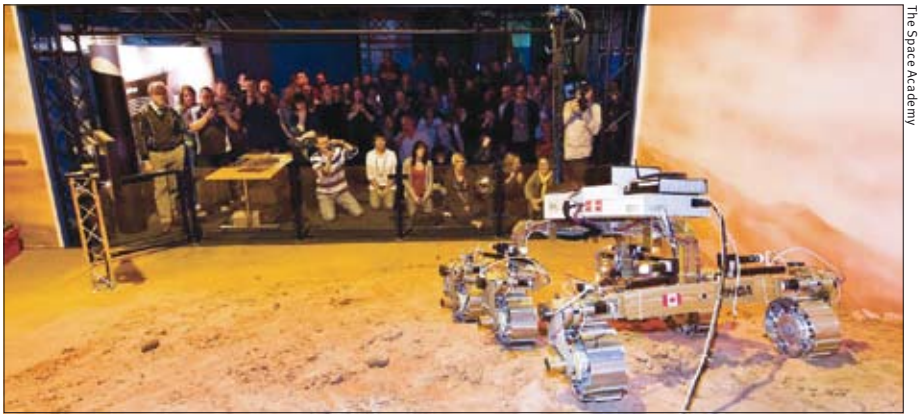
One of the most successful projects has been the partnership between Simon Langton Grammar School for Boys, Kent, and Prof. Steve Rose at Imperial College London, working on plasma physics in the sixth form. This has given students the opportunity to work with world-class researchers at an internationally renowned university. Becky Parker, the physics teacher who arranged the grant, says: "This acted as the catalyst for developing a research base in the school. Prof. Steve Rose set our students a challenging problem, which needed solving, and our students set about tackling it with great success."

A dedicated team at the RS offers support at all stages of the application process, including advice on investigations that you may be considering and guidance in finding a suitable scientist/engineer partner. The next round of PG applications opens in September and the closing date is 6 November.

For more information and application forms: visit www.royalsoc.ac.uk/education/partnership.htm or contact the RS directly (e-mail education@royalsociety.org).

The Space Academy continues to inspire the next generation of scientists

The Space Academy is gearing up for another year inspiring the next generation of scientists and engineers along with their teachers. The ever-popular curriculum-focused A-level physics and GCSE space-science masterclasses are scheduled to continue throughout the academic year and they will be joined by a new suite of masterclasses, including A-level chemistry, A-level biology, GCSE applied science, GCSE geography and Science in the Workplace coursework support. All of the Space Academy masterclasses are curriculum focused. They are delivered by expert teachers who use a space theme to teach aspects of the syllabus.



The Space Academy

Space Conference for Science Teachers delegates observe the ExoMars prototype rover tests.

The first Space Conference for Science Teachers, held in Leicester in April 2009, provided a three-day residential experience where teachers were able to attend workshops to learn how to use space as an exciting context for teaching all sciences. They were also able to improve their own subject knowledge through attending lectures about the Hubble Space Telescope and Satellite Navigation Systems given by leading professors from the universities of Leicester and Nottingham. EADS Astrium's ExoMars prototype rover (due for launch to Mars in 2016) was carrying out testing during the conference on the National Space Centre's Mars Yard and the delegates were able to have a full demonstration of the rover's capabilities during the "Awayday to Mars" session.

Thirty-five East Midland's students produced excellent "So you want to be an astronaut" projects to win themselves fully funded places on this year's Space School UK and finally the Space Academy Roadshows are in full swing with students from Leicester City and Nottingham City. The roadshows include a GCSE space science masterclass, a trip to the National Space Centre and the experience of indoor skydiving at the Airkix vertical wind tunnel to demonstrate fundamental aerodynamics.

For more information: contact Dr Sarah Hill, Space Academy project manager (e-mail sarahh@spacecentre.co.uk or tel 0116 258 2125).

School grants scheme increases in popularity

Changes to the application process for the IOP and STFC School Grants scheme are being introduced, as a result of its continuing popularity. There will now be three deadlines a year for applications, depending on the term in which the project is taking place. The first deadline, for projects taking place in the spring term 2010, will be 1 November. The other deadlines will be 1 February 2010, for projects taking place in the summer term 2010 and 1 June 2010 for projects taking place in the autumn term 2010. Grants of up to £500 are available for small-scale projects or events linked to the teaching or promotion of physics.

For more information: visit www.iop.org/activity/education/Teacher_Support/ ("Grants") or e-mail schoolgrants@iop.org.

Getting Practical aims to improve practical work in the science classroom

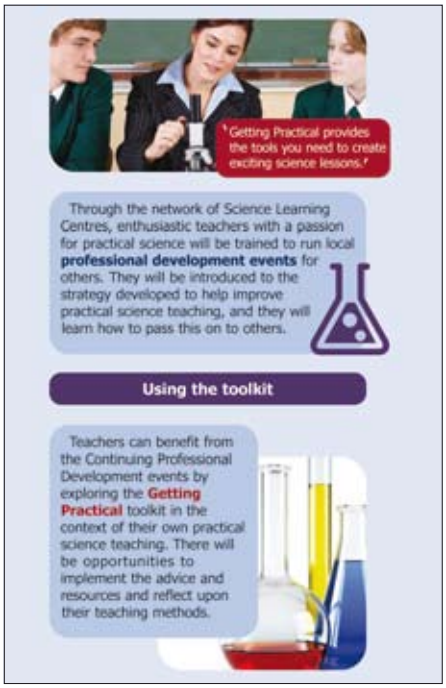
It would be difficult to find anyone working in science education who did not agree that practical work should be an integral part of a young person's science-learning experience. The UK offers its young people more practical science opportunities than any other country in Europe, yet many students will leave a practical-science lesson at both primary and secondary level without an understanding of why they were doing the practical work and what they should have learned by doing it.

Getting Practical is addressing this issue by encouraging teachers, technicians and teaching assistants to consider the ways that practical science is taught in their school and how its effectiveness could be improved. The programme is being offered through a consortium of partners, including the Institute, and it is being led by the Association for Science Education (ASE).

A professional development package has been developed over the summer to offer teachers reflective tools and new resources to help them improve the quality, not quantity, of their practical-science teaching for the benefit of young people's learning. Initially, a group of trainers will be trained through the Science Learning Centre network. These trainers will then take the professional development package back to their local areas and offer events to teachers and their teams. There will be no charge for those who wish to attend these events.

Trainers will be trained during the autumn term in 2009, with the local area events being offered January–July 2010. Look out for the information leaflet in your school (pictured right) or contact the team at the ASE to express an interest in the programme either as a trainer or to attend a local event.

For more information: visit www.gettingpractical.org.uk or contact kirstiehampson@ase.org.uk (Professional Development) or georginawestbrook@ase.org.uk (Communications), tel 01707 283 000.



A page from Getting Practical's school leaflet.

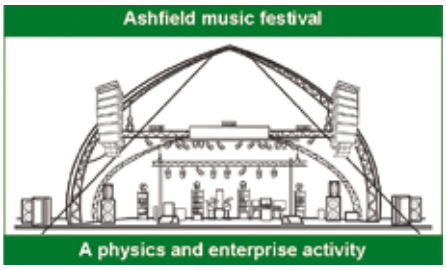
'Ashfield music festival' hits the right notes

With the dual themes of physics and enterprise, the "Ashfield music festival" activity is a unique one-day, off-timetable event for 14–15-year-olds. In this activity the students work in teams and adopt the different roles required to design the main stage at a music festival. Each team member is supported by an "expert" (such as a STEM ambassador) and provided with a full set of resources, including video interviews filmed at an actual music festival. To be successful the students need to use a mixture of creativity and physics knowledge, work to budget and make a profit.

This activity is also an excellent way to share physics-based careers information and it is an opportunity for your students to meet a real-life scientist or engineer. Experts can be recruited via STEMNET (www.stemnet.org).

If you don't have time to organise or run the activity yourself, it may be possible to get an outside agency to run it for you. For example, Science Oxford (www.scienceoxfordnext.com) is offering to run the activity for schools in Oxfordshire. Any costs can be paid for out of the school enterprise budget. If your school is affiliated to the Institute you will have received a set of sample resources with this issue of *Classroom Physics*.

For more information: contact Taj Bhutta (e-mail taj.bhutta@iop.org). To order the free resource pack, contact the Institute's education department (e-mail education@iop.org). To have a look at the videos that accompany the physics and enterprise activity, visit www.iop.org and click on "Schools and Colleges".




Students design a main stage for a music festival.

Science film-making competition extends 2010 deadline for submissions

SciCast Physics is already a fixture in many school calendars but now there's even more time to enter the 2010 competition. After feedback from schools, the deadline for submitting your mini-science-movies has been extended to 16 April 2010.

The rules remain the same – just make a film under 2 minutes 30 s that explains a principle of physics in an entertaining way. For film-making hints and tips, take a look at the website, which has entries from previous years to spark your students' creativity.

For more information: visit www.planet-scicast.com.

Events

EVENTS FOR TEACHERS

East Midlands Network Day
Oakham School, Rutland
19 September
This will be a great opportunity for anyone teaching or supporting physics classes to share ideas, get up-to-date information and collect some free resources.
Details: contact Neal Gupta (e-mail ngupta@ockbrook.derby.sch.uk) or Helen Pollard (e-mail hjp@oakham.rutland.sch.uk).

North of Scotland Teacher Network Day
Fortrose Academy, Ross-shire
19 September
This event will feature a full day of workshops, including a rocket workshop, Optoelectronics College ("Solar buggies"), "AH investigations" and more.
Details: contact Nick Forwood (e-mail nick.forwood@googlemail.com).

West Central Scotland Teacher Network Event
Glasgow Science Centre
21 September, 4.00–8.00 p.m.
This event is aimed at all physics teachers, faculty heads and other interested parties. It will include a variety of workshops ("Shocked and stunned" and "Using teltron tubes") and an exhibition.
Details and booking: contact Ronna Montgomery (e-mail ronnamontgomery@yahoo.co.uk).

Frontiers of Physics 2009
Waterford Institute of Technology
26 September, 9.30 a.m. – 4.00 p.m.
This is the popular Teachers of Physics Annual Conference, jointly organised by the Institute of Physics in Ireland Education Group and WIT School of Science. The day will consist of lectures, demonstrations and workshops for post-primary teachers of physics.
Full programme and registration details: visit www.wit.ie/News/frontiers/ or contact IOP Network coordinator Paul Nugent (e-mail paulnugent@eircom.net).

Welsh Physics Teachers and Technicians Annual Conference
Christ College, Brecon
7 October
This event organised by the IOP in Wales will consist of a day of workshops, lectures and discussion for teachers and technicians. There will also be an exhibition.
Details and registration: contact Cerian Angharad (e-mail cerian@angharad.fslife.co.uk).

Science Learning Centre London 5th Anniversary Event
20 October, 1.30–5.30 p.m.
This free event will celebrate the International Year of Astronomy and it will offer teachers the opportunity to hear a keynote address by Francisco Diego, UCL, as well as to take part in a choice of workshops. Light refreshments will be included.
Booking: visit www.slcs.ac.uk/london/courses (search for LNE09502) or tel 020 7612 6325).

West and West Central Scotland Teacher Network Event
Glasgow Science Centre
22 October, 4.30–8.00 p.m.
This event is aimed at all physics teachers, faculty heads and others. Workshops will include a demonstration of version 7 of VPLab and Optoelectronics College. There will be stalls in the mall exhibition.
Details and booking: contact Ronna Montgomery (e-mail ronnamontgomery@yahoo.co.uk) or Tom Clark (e-mail tomwc_41@hotmail.com).

Physics Update: a Course for Practising Teachers of Physics
Engineering Department, University of Cambridge
11–13 December
This course will feature a stimulating mixture of lectures and workshops, with accommodation at Trinity College (single-occupancy rooms with en suite). Further details and an application form will be sent out to schools in September.
Details: contact Manchi Chung (e-mail manchi.chung@iop.org or tel 020 7470 4820).

ASE Annual Conference
University of Nottingham
7–9 January 2010
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 will include the John Lewis lecture, given by Dame Jocelyn Bell Burnell, and sessions run by the IOP Teacher Network.
Details: visit www.ase.org.uk.

EVENTS FOR STUDENTS

Schools and Colleges Lecture 2009: Exploring the Universe: a Tale of Telescopes, Time Travel and Extraterrestrials
This free lecture for 14–16-year-olds, given by Dr Andy Newsam, continues its UK tour. It is in Scotland in early September, followed by dates in the Midlands and the West Country.
Details and booking: visit www.iop.org and click on "Events" under "Schools and Colleges" or contact Clare Mills (e-mail clare.mills@iop.org).

Trust Physics!
Penrhyn Castle, Bangor, North Wales
30 September
The National Trust and the Institute will be holding a day of physics workshops with 40 places available for pupils from years 5–7. The workshops will include:
- "Making ice without a freezer"
- "Physics in the kitchen"
- "Physics and conservation"
- "Physics in the engine sheds"

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

Girls into STEM – a WES Event Supported by the Doris Gray Fund
George Watson's College, Edinburgh
13 November, 1.00–4.00 p.m.
This event will feature a series of workshops and fun activities for girls from S3 who are interested in finding out about studying engineering at university, with the chance to meet successful female engineers.
Details: e-mail stem@wes.org.uk or visit www.wes.org.uk.

2009 Christmas Science Lectures
Gulbenkian Theatre, University of Kent, Canterbury
These Institute-sponsored lectures are aimed at year-10–13 students. Admittance will be free but booking is essential.
25 November, 10.30 a.m.
"Failures, disasters and catastrophes" (Steve Walls, University of Kent). Why do some major engineering projects end tragically? How do we mitigate against such events?
25 November, 14.30 p.m.
"Cosmic alchemy: how are we made?" (Prof. Paddy Regan, University of Surrey). How are the elements in our bodies created in the cosmic furnaces of the stars?
Booking: tel 01227 769 075.

Physics in Perspective
University College London and the Royal Institution
14–16 February 2010
This three-day course is aimed at sixth-formers and college students, with the purpose of bringing to participants some of the excitement, relevance and fun of physics. The course will consist 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. Good deals on accommodation will be available.
Details: contact Manchi Chung (e-mail manchi.chung@iop.org, tel 020 7470 4820).

How to use electrostatics equipment successfully

When planning an electrostatics lesson you need to be aware that if the atmosphere and the equipment are too damp, you may get no effect at all or any results that you do get may appear to be "wrong" and they could cause confusion. However, there are precautions that can be taken that will usually ensure success.

Best practice

All dusters that are used to charge objects should be freshly laundered, fluffy and kept in a clean bag. When laundering, do not put fabric conditioner in the water – it is an anti-static agent. Other fabrics can be used successfully to charge rods or strips but it helps to have identified them correctly. Students should have clean, dry hands. Polystyrene balls, acrylic, acetate, ebonite and polythene rods should all be cleaned regularly.

It is helpful to store all electrostatic equipment, including the Van de Graaff generator, in a cupboard that is warm and dry. However, even on a dry day, putting all of the equipment close to an electric heater or running a hairdryer over it for some time before the lesson will ensure that it is dry enough.

Earthing options

In modern laboratories with water fed through plastic pipes, it may be difficult to find any point that is electrically bonded to earth. In such cases, an earth for electrostatics experiments can be provided by burying a substantial metal rod in the ground with a wire running through the wall to a terminal in the laboratory.

Staying in charge

It helps to be familiar with the electrostatic (triboelectric) series:

- Perspex (acrylic) ELECTROPOSITIVE
- Glass
- Nylon
- Wool
- Silk
- Cotton
- Ebonite (vulcanized rubber)
- Synthetic rubber
- Polyester
- Polystyrene
- Polyethylene ELECTRONEGATIVE

If two materials are rubbed together, the material higher in the list will gain a positive charge (lose electrons), while the lower material will gain a negative charge (gain electrons). If you attempt to make your own series, you may find that your results differ from these, but in general, items at the top of the list will lose electrons and those at the bottom of the list will gain electrons.

Synthetic materials are well known for becoming charged easily – cars and carpets can give quite a nasty shock. A small child can be successfully charged up by sliding down a plastic slide or try to separate bed-clothes in the dark of night and you will really see sheet lightning! Opening a self-seal envelope in the dark can produce the same effect.

This advice comes from www.practicalphysics.org.

Try this

To show that light objects are attracted to a charged surface, put a small spoonful of sesame seeds or dry semolina in a saucer and cover it with clingfilm or put it into a plastic Petri dish with a lid and wipe the surface with a dry duster. The sesame seeds will be attracted to the charged surface.

Duster and uncharged dish of sesame seeds.

The charged clingfilm now has sesame seeds sticking to it.

What next?

1. Bring a charged rod close to the surface and see what happens.
2. Touch the lid or clingfilm to earth it and see what happens now.
3. If you have bought a SEP charge indicator, find out how the clingfilm and duster are charged.

Lesson ideas

For more easy activities to explore the effects of electrostatic charging, look at the Marvin and Milo cartoons "On a roll" and "Forceful comb". Visit www.physics.org and click on "Interact" and then "Marvin and Milo" to find them. The cartoons and instructions are available to print out.

Another electrostatic demonstration titled "Making sweet electricity in your kitchen" is described in *Physics Education* vol. 39 no. 1 January 2004.

Good luck – these lessons can be fun!

Detecting electrostatic charges directly

Electrostatic phenomena were known to the ancients but it was not until the 18th century that a "two-fluid" theory was proposed that accounted for both the attraction and repulsion between different kinds of charged objects. This idea later developed into the theory that we are familiar with today, in which objects become negatively and positively charged according to whether they have an excess or deficit of electrons.

Many materials acquire electrostatic charges when they are rubbed together and the existence of charges on objects are easy to detect, for example, by the way that charged objects attract light, uncharged objects, such as pieces of paper. A bit more "detective" work is required to find out whether something is positively or negatively charged. One way of doing this is to use charged polythene and acrylic rods as a "reference". When rubbed with a cotton duster, a polythene rod acquires a negative charge; if a charged object is brought near the charged polythene rod and it is repelled, then it can be inferred that the object is also negatively charged. Conversely, an acrylic rod acquires a positive charge when rubbed with a duster and it repels other objects that have a positive charge.

The polarity of electrostatic charges can be detected directly using the SEP Charge Indicator. This allows easy and rapid investigation of electrostatic effects. When it is moved towards a charged object, the green and red LEDs indicate whether the object is negatively or positively charged, respectively.

Polythene has a tendency to acquire electrons. Acrylic, which is at the opposite end of the electrostatic (or triboelectric) series, has a tendency to lose electrons. The charge indicator can be used to show that when acrylic is rubbed with a nylon cloth, the acrylic becomes positive and the nylon cloth becomes negative.

Laser-printing technology involves the use of electrostatic charges to direct the powdered ink to the correct places on the paper, and the paper acquires a charge as it passes through the printer. This can be detected using the charge indicator. However, because paper absorbs moisture from the air and becomes slightly conducting, it needs to be removed from the printer tray with a pair of tweezers. This conducting property of the paper can be demonstrated by holding the paper with a hand – the LED on the indicator no longer lights, showing that the paper has become earthed and has lost its charge.

The latest SEP publication titled *Recycling and Sustainability* discusses how different kinds of plastics can be identified and sorted using their electrostatic properties, as well as how the SEP Charge Indicator can be used to demonstrate the principle behind this technique. For more information, visit the SEP website at www.sep.org.uk.

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When a polythene rod is rubbed with a nylon cloth the objects acquire opposite charges, as indicated by the SEP Charge Indicator's LEDs.


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A sheet of paper that has become positively charged on passing through a laser printer loses it charge when it is touched.