

Classroomphysics

The newsletter for affiliated schools

September 2013 Issue 26

Resource

Making it easier to engage a physicist

Engaging Physicists is a new contacts database that will make it easier for teachers to find high-quality physics outreach activities provided by local universities and national research laboratories.

All activities offered through the scheme are free of charge (although travel expenses may occasionally need to be paid).

Jessica Hamer, gifted and talented co-ordinator, from Lampton School in Hounslow said: "I became involved in the project because I believe that having physicists from academic institutions within the classroom can make a huge difference to pupil aspiration and motivation."

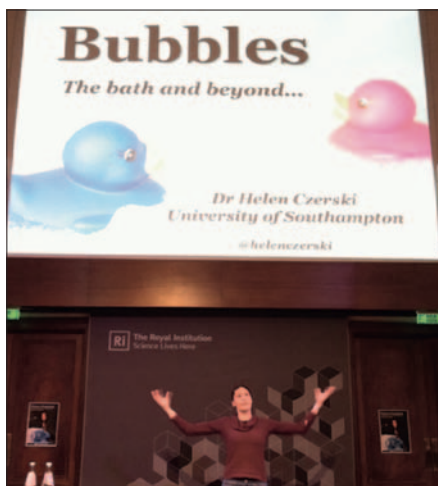
This online tool is designed to take the hassle and uncertainty out of finding a physicist for your event by linking you with specialist outreach officers who understand the needs of both schools and physicists, enabling them to find your perfect match.

A gateway into organisations

Outreach officers are members of staff in universities and research laboratories who have responsibility for organising activities for the physicists that they work with to get involved with.

Ally Caldecote, Ogden physics teacher fellow, from the University of Warwick's physics department said: "I think *Engaging Physicists* is a fabulous resource. It allows me to see what would suit a teacher's needs best in terms of age of student, topic and type of session and I can arrange something that will be the most helpful to them."

The outreach officers are keen to talk with you about your individual circumstances and they will work with you to get the best out of any activity. So don't just think about having someone in to give a talk – what



Top: Dr Hugh Hunt, University of Cambridge, giving a talk on the bouncing bomb.

Bottom: Dr Helen Czerzki, University of Southampton, giving a talk on the physics of bubbles to an audience of sixth-formers.

about a debate or a workshop? How about arranging a series of visits over the course of the academic year? Perhaps a trip to your local university for a tour of its physics lab might kick-start your students thinking about their future?

Each organisation's entry on the database states their location, lists the kind of outreach activities they can offer your school or college and links to an online form where you will be able to make a request.

Requesting an activity

To help the outreach officers find your perfect match, we ask that you complete an online form with your contact details and what you're after.

It doesn't matter if you're still a bit vague – there's a free text box that allows you to make specific requests or simply ask for a call back from the outreach officer to discuss your options further. There is also no need to register, simply visit www.iop.org/engagingphysicists to find yourself an engaging physicist today.

Outreach officers aim to respond to all enquiries that they receive within two working days, but in exceptional circumstances it may take slightly longer. They will also do all that they can to satisfy all your requests, although in busy times this might not be possible.

Engaging Physicists is co-ordinated by the Institute of Physics on behalf of the physics community. For general feedback on this new initiative, please contact Caitlin Watson, head of public engagement (e-mail physics.society@iop.org).

For more information: visit www.iop.org/engagingphysicists.

The latest physics education news, resources and classroom ideas – from the IOP education team

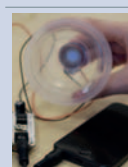
In this issue



School support team 3
The start of the academic year is an opportunity to re-introduce members of the team

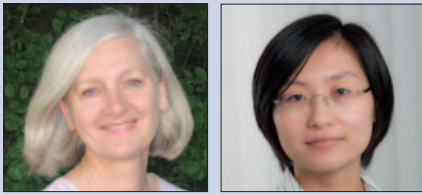


National Demo Day 5
Try out a new demo on the UK's first National Demo Day on 20 March 2014



Model a music stage 8
A fun way for students to learn about some real-world applications of physics

Editorial



Welcome back to a new academic year. We hope you return refreshed from your summer break and ready for the challenges ahead. More and more schools and colleges are recognising the benefits of affiliation to the Institute and we now have more than 1700 affiliates across the UK and Ireland, as well as a few British schools overseas.

You should have received an e-mail in the last week offering your affiliated school the chance to order more resources from us. If you did not get this, then it is likely that your contact details (i.e. named contact) need updating, and you should contact Daniel Josman on affiliation@iop.org as soon as possible. If you like to put faces to the names you see or hear about in *Classroom Physics*, then see p3 for details.

News of the day meetings that took place around the country over the last few months is on p5. These usually consist of a mixture of lectures and workshops with lots of input from your local physics network co-ordinators (PNCs). There is also news of the scholarship scheme for teacher trainees in physics.

If you have used our *Physics Activity Pack for STEM Clubs*, you will be pleased to know it has been revised and updated and is now available to download from www.iop.org/stemclubs. An information card about this is included in this mailing, with a new set of Marvin and Milo “Do try this at home” cards, for affiliated schools. You will also receive a copy of *Physics at University* and *Pocket Physics* for your sixth-form students. Affiliated schools will also have a copy of the booklet, *Physics: transforming lives*. This is a series of short case studies, showing how innovations as powerful as MRI have emerged from studies in basic physics and become routine technologies. If you would like further copies of this to use with your students, or any other publication, please e-mail us on education@iop.org. Your comments and suggestions are always welcome.

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Teacher recruitment

Scholarships for new teachers



The 2012–2013 cohort of IOP scholars.

A record-breaking number of applications were received this year for the IOP Teacher Training Scholarships. Altogether 663 candidates applied for the £20,000 scholarships, up from 556 in the previous year. Designed to increase the number of talented graduates entering the profession, the scheme has fulfilled its objectives by attracting a wide range of applicants from the UK and abroad.

All 100 available places for September 2013 seem likely to be filled at the time of writing, at a period when teacher training has been experiencing some significant changes and challenges. Following the successful launch of the idea in 2011, schemes were also run this year in chemistry, mathematics and computer science.

To apply for an IOP scholarship a candidate would have taken an online physics test and filled out an application form. If successful they would then have been invited to an assessment day at the Institute’s headquarters in London. These were held on various dates throughout the year and included a subject knowledge test, an interview, and a group discussion.

An important part of the scheme is the

link that the IOP provides with the rest of the physics community. The Institute undertakes to provide mentoring for all those who were awarded a scholarship, using a team of regional staff, who are a part of the Stimulating Physics Support project (www.iop.org/sps).

Scholarships were available to those with a PhD, a 1st, a 2:1, or any Master’s qualification. While most applicants in previous years had a physics or engineering degree a significant number of the successful candidates did not, but instead had completed a six-month Subject Knowledge Enhancement Course. Since the project is paid for by the Department for Education, it covered anyone undertaking teacher training in England.

If you are thinking about recruiting a new physics colleague please note that the scholarships are likely to be available again for September 2014 for those following the School Direct route (unpaid), as well as those on a PGCE (or equivalent).

For more information: visit www.iop.org/scholarships for further details on all aspects of the scheme and an update on availability.

IOP | Institute of Physics 16-19 membership

Are your students aged between 16 and 19 and studying physics? They can join the Institute of Physics for free at www.iop.org/16-19

Team news

Introducing you to the IOP school support team

There have been some new faces joining the Institute's education team in the last few years, so we thought that we would take this opportunity at the start of the new term to re-introduce members of the team who work closely with our affiliated schools and colleges.

Dan Josman will be a familiar name as he is the main contact for all affiliated schools' queries including updating contact details and sending out classroom resources. Dan also looks after our small grants scheme (iop.org/schoolgrants) that aims to support physics-based projects and activities in schools and colleges.

Our careers and student officer, **Taj Bhutta**, continues to develop careers literature aimed at school/college-aged students including the Institute's myphysicscourse.org website. He manages the IOP's free 16–19 membership category and encourages you to remind your students who are starting their post-16 studies this year to join (visit iop.org/16-19 to sign-up).

Manchi Chung organises events for both teachers and students (Physics Updates and Physics in Perspective), in addition to supporting the development of resources for use in the classroom. Both she and **Clare Thomson**, our curriculum and diversity manager, make up the editorial team for this newsletter. Clare also leads the Institute's programme for encouraging more girls into physics (iop.org/girlsinphysics) and the development of resources linked to the curriculum.

Natasha Plaister looks after the Physics



Left to right: Dan Josman, Taj Bhutta, Manchi Chung, Clare Thomson, Natasha Plaister and Charles Tracy.

Teachers Network (iop.org/network) that supports teachers on a local level and is the main point of contact for the Institute's Annual Schools and Colleges Lecture tour (iop.org/schoolslecture). She also supports Clare with the Girls in Physics programme.

And last, but far from least, **Charles Tracy** heads up the education department.

He leads on the Institute's education policy work, which includes consulting with teachers from affiliated schools via the Education Forum (iop.org/educationforum). Charles' department also includes additional teams who work on teacher recruitment and retention, and the Stimulating Physics Network (stimulatingphysics.org).

Website

Institute's degree listing website gets an upgrade



From September, we will be launching an upgraded version of the Institute's degree listing site, myphysicscourse.org. This will include a number of new features, without any of the original functionality of the old website being lost. As always, students can refine results by their expected grade, subject combinations and location in the UK and Ireland.

The upgrade will introduce new shortcuts for popular choices, such as physics as a single subject; astrophysics; and physics with a year in industry, or a year abroad. The status

of degrees will now be displayed on each of the 600+ courses listed, allowing parents and students to easily identify whether a course is accredited by the Institute.

New links to scholarships and bursaries have been introduced on the university department pages, making it easier for students to check their eligibility for such schemes. A new section called "Get Advice" has also been created to tackle commonly asked questions such as "what is an accredited degree?" and "which university is best for physics?". This new section of the

website also offers guidance to students on how to use degree information such as Key Information Sets (KIS) and university league-table rankings.

After a low point some years ago, when a number of physics departments were closed, it is encouraging to see several new undergraduate physics courses being offered. These include courses at Northumbria, Portsmouth, Bradford, de Montfort, Manchester Metropolitan and Reading. The updated website lists all of these new courses.

The Institute also publishes a printed guide for students called *Physics at University: your essential guide*, a copy of which is included in this mailing for affiliated schools and colleges.

For more information: go to www.myphysicscourse.org.

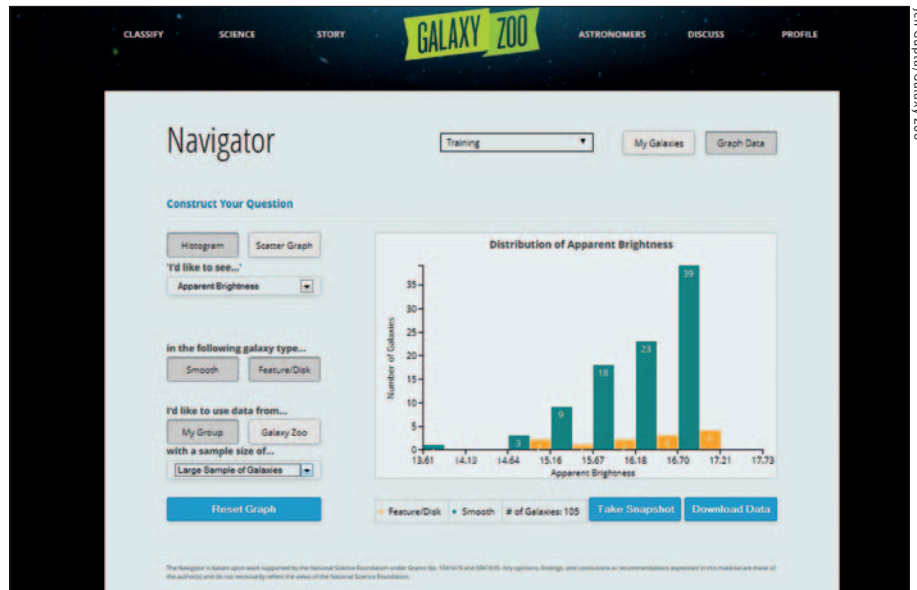
Resource

Navigating the galaxy with your class

Galaxy Zoo is an online citizen science project where members of the public are invited to classify pictures of galaxies, contributing to real scientific research in the process. Although the aim of Galaxy Zoo is to provide classifications for research, citizen science projects are increasingly being considered for use in the classroom and the Galaxy Zoo Navigator is a new tool developed with this application in mind.

The Galaxy Zoo Navigator (www.galaxyzoo.org/navigator) is a set of in-browser tools that allow users to classify galaxies in a group and then explore these classifications in more detail. The "My Galaxies" feature lets users see how their latest classifications compare to other people's, illustrating the relative ease and difficulty of classifying different galaxies. Navigator also has tools to create simple histograms and scatter plots of various galaxy parameters, either using the galaxies classified by the group or a random sample. These plots can then be saved as an image or the data downloaded to a spreadsheet for further investigation.

Galaxy Zoo is one of over 15 citizen science projects that make up the



This resource can be used to discuss classification difficulties and their distribution.

Zooniverse. An article on using Zooniverse projects in the classroom appeared in the June 2013 issue of *Classroom Physics*.

For more information: visit www.galaxyzoo.org.

[org/navigator](http://www.galaxyzoo.org/navigator) or contact Dr Laura Whyte (e-mail laura@zooniverse.org). Galaxy Zoo Navigator works on most modern browsers, including recent versions of Firefox, Chrome, Safari and Internet Explorer 9 onward.

Teaching award

Do materials matter to you?

Nominations are now open for the Institute of Materials, Minerals and Mining's Sir Colin Humphreys Education Award. This award was established to recognise the contribution made by teachers to enhancing the scientific or technological literacy of students through the teaching of materials, minerals or mining topics within 11–19 learning.

The award is open to all those teaching in the secondary or further education sectors and nominees do not have to be Institute of Materials, Minerals and Mining (IOM3)



Schools Affiliate Scheme members.

Nominations should describe the environment in which the nominee is working and the expectations of their role, what they are doing above and beyond their normal role, and how the nominee has shared best practice with their colleagues. Nominees should also demonstrate evidence of sustained effort over a period of time.

The recipients of this year's Sir Colin Humphreys Education Award were presented with their medals during the Institute's Premier Awards Ceremony on board HQS Wellington in July. Mark Rogers and Warren Dransfield-Scott from King Edward VI School in Lichfield received their award for developing an extra-curricular project on materials for sixth-formers studying STEM subjects.

The closing date for nominations for the 2014 award is Friday 8 November 2013 and full details of how to apply can be found at www.iom3.org/content/iom3-medals-prizes.

For more information: about education activities at IOM3 contact Dr Diane Aston (e-mail diane.aston@iom3.org) or visit www.iom3.org/sas.

Student competition

Enter the NPL School Science Film Competition

This competition welcomes submissions from groups of students. The entries can be from either a school/college or from a group of independent students. Films must explain an aspect of science correctly in an engaging way, in less than 2.5 minutes using media with copyright permissions (so no music from the *Star Wars* films!).

The deadline for Independent Team

entries requesting a review from NPL experts on a "first cut" version of their film is Friday 27 September 2013. These teams may then resubmit by the overall competition deadline of 18 October 2013.

For more information: visit www.npl.co.uk/ssf for rules, information on how to enter, and the film clips from previous winners.



The NPL school science film competition is now open for entries.

Teacher events

Have you been to a local meeting recently?

Every year, the Institute pays for (or subsidises) meetings across the country where local networks of teachers can attend talks, try out new experiments and share teaching ideas with fellow physicists over a cup of tea. Many of them are free of charge.

Whether you're looking to meet other physics teachers in your local area, freshen up your physics teaching repertoire, or searching for something a bit more intensive in terms of professional development, we will probably have something for you.

Here are just a few examples of the meetings and conferences that the Institute has organised for teachers this year:

A-level physics focus in London

This CPD day was attended by both new and experienced teachers who were keen to hear about the CERN@School project, an update on cosmology, and inexpensive resources to measure the mass of molecules in the classroom. It was also a good opportunity for teachers to share ideas as well as renew old acquaintances within the London network.

Talk of particle accelerators in Bangor

The guest speaker at the sixth annual conference of the North Wales Teacher Network was Prof. Lyn Evans who stopped off on his way to Japan to give his talk "From the Large Hadron Collider to the next Linear Collider", (which is to be built in Japan). This brought the audience up-to-date with developments in the field. The 63 teachers left the meeting with rainbow boards, a small wave generator, a singing rod and plenty of new ideas for the classroom. Next year's conference will be on 18 June 2014 and will feature Dr Jonathan Hare from BBC/OU *Rough Science*.

Workshop rich in Durham

Fifty teachers attended the day meeting that featured talks on: innovative practical ideas that have appeared in recent issues of *Physics Education*; the opportunities



Teachers attending the North Wales Teacher Network Day at Bangor University.

offered by "Extreme Physics" – a residential event for gifted and talented students; and planetary landscapes. The central part of the day was occupied by workshops: physics of tops; the best of SEP; iPad apps; make-and-take rockets; and, "Miss, my bulb won't light!". After a full and well-received day, teachers departed heavily laden with goody bags. The next Durham-based day will be on 19 June 2014.

Intensive update in Leicester

This year, the Summer Physics Update residential course was successfully organised by the University of Leicester.

Teachers attended a three-day packed programme updating their knowledge of recent developments in physics, attending hands-on workshops and visiting the National Space Centre for a rewarding conference dinner. The next Physics Update course will be hosted by the University of Cambridge, 13–15 December 2013

For more information: on meetings happening this term take a look at our Events section (p7). The calendar featured on www.iop.org/education is also updated on a regular basis with IOP-organised teacher meetings.

News

UK's first National Demo Day is to be next year

Earlier this year, the Get Set Demonstrate team asked science teachers and technicians to nominate their favourite science demonstrations. The top-rated six have now been developed into high-quality video clips, which will be made available soon. There will also be an accompanying



Get set... demonstrate
Running inspiring science demos

documentary on the "art of demonstrating".

As part of this initiative, the British Science Association is asking all UK secondary schools to make a pledge to try out a new demonstration on the UK's first National Demo Day, 20 March 2014, as part of

National Science & Engineering Week.

For more information: on National Science & Engineering Week visit www.britishsienceassociation.org/get-set or follow the project on Twitter #demoday.

Resource

Tim Peake's mission to inspire

British Astronaut Tim Peake is set to launch for a long-duration visit to the International Space Station on 1 December 2015. His preparation for the visit has included a degree in flight dynamics, a 16-year stint as a helicopter test pilot and more recent adventures in cave exploration in Sardinia, and underwater missions to Aquarius off the coast of Florida.

As he gets ready for launch, Tim is using every opportunity he can to inspire children and the public. As well as the science missions on board the International Space Station, Tim is keen to use his mission to inspire interest in fitness, nutrition and space physiology. His body will be subject to huge changes in the extreme environment of the International Space Station and he wants to be prepared not just for the launch but for the landing as well. It can take astronauts up to two years post-flight to recover their full health and bone strength. Space provides an excellent context to learn about forces and gravity – both at launch, off-world and at landing.

One of the ways that Tim is reaching out to schools is through his public support for the NASA-led project, that the UK Space Agency is also supporting, Mission X – Train like an astronaut. Mission X is an international programme that is free to schools across the UK. It provides schools with a series of science, food technology and fitness challenges aimed at students aged 8–12-years-old, but which can be adapted for use with older children. By completing these challenges schools can gain points that help the Mission X mascot Astro Charlie reach the moon.

Already over 120 schools and 6000 students from across the UK have taken part



Heather MacRae

Tim Peake meeting Mission X students.

in the Mission X programme. The target is to double this number for 2014 and having our own British astronaut provides a perfect context to encourage school children across the UK to train like an astronaut.

Schools should register as soon as possible in the autumn term to ensure that their school is part of the initiative. The international challenge runs from January to March 2014. Teachers who take part may have an opportunity to undergo

astronaut training themselves. Earlier this year, teachers were invited to explore whether they had the skills for space travel, with an opportunity to try out the long-arm centrifuge at QinetiQ Farnborough.

The programme is now looking for the astronaut class of 2014 and schools can sign up online.

For more information: visit www.trainlikeanastronaut.org.

Student events

New nuclear physics Headstart course in 2014

EDT Headstart has recently announced that the University of Manchester will be hosting a new nuclear physics course to start in the summer of 2014.

These residential university-based summer schools for year-12 students are an opportunity to sample degree-level study and undergraduate life. Headstart courses cover the full range of STEM subjects and the Manchester course is a welcome addition to the existing physics course organised by the University of Leicester.

In 2014, there will be almost 50 courses to choose from, based at various universities around the UK. If your students want to



experience physics at university to help them make informed decisions about higher education, then encourage them to find out more and apply online.

For more information: including application details, visit www.headstartcourses.org.uk. Please note



Headstart

A-level students attending the Headstart physics course at the University of Leicester.

that Headstart will be offering attendance bursaries on a similar criterion to the old Educational Maintenance Allowance.

EVENTS FOR TEACHERS

STEM in Education Evening at the British Science Festival

Newcastle Civic Centre

8 September

An evening of free educational resources and displays from organisations supporting science. Refreshments and a light buffet will also be served. You can attend the bookable sessions in the main programme beforehand to make the most of your visit. The British Science Festival takes place

7–12 September with programmes for families, adults and school groups.

Details and booking: visit www.britishscienceassociation.org/british-science-festival or e-mail yp@britishscienceassociation.org.

Frontiers of Physics: Teachers of Physics Annual Conference

University College Cork

28 September

This will be a day of lectures, demonstrations, workshops, resources and networking for all teachers of physics including junior science teachers.

Details and booking: visit tinyurl.com/frontiersofphysics.

East Midlands Teacher Network Day

Ockbrook School, Derby

28 September

The programme will feature a talk on “Exoplanets: the Search for Other Earths” from Dr Pete Edwards, Durham University and a choice of workshops covering topics such as: how to stage a physics show, the electromagnetic spectrum, toys to teach physics, and alternating current.

Details and booking: contact Natasha Plaister (e-mail natasha.plaister@iop.org).

12th Annual Welsh Physics Teachers Conference

Christ College, Brecon

2 October 2013

A full day of activities that can directly benefit your work as a physics teacher or technician. Find out all there is to know about the changes in specifications and examinations from expert examination officers, with practical workshops in the afternoon, and opportunities to try out new equipment.

Details and booking: contact Cerian Angharad (e-mail cerianangharad@gmail.com).

SPEED 2013: Stimulating Physics East of England Day

Netherhall School and Sixth Form College, Cambridge

5 October

The region’s leading physics teaching experts will lead a selection of hands-on

workshops and there will be a fascinating talk from Prof. Jim Hough “What astronomy can tell us about the origins of life on Earth”. This day is completely free for science teachers or trainee teachers based in the East of England.

Details and booking: contact Ally Davies, physics network co-ordinator (e-mail a.davies@jynxy.net).

Yorkshire Physics Teacher Network Day

University of Leeds

9 October

This free conference for everyone teaching physics is a mix of practical workshops, inspiring talks and networking. Sessions will be suitable for those new to physics as well as experienced teachers and will concentrate on ideas that you can use in your labs and classrooms. Technicians and trainees are also very welcome. Lunch is provided.

Details and booking: contact Natasha Plaister (e-mail natasha.plaister@iop.org).

A Day of Physics CPD for Teachers and Technicians

Dulwich College, South London

23 October

This day of free CPD for teachers and technicians will feature a full programme of interactive workshops of ideas to use in the classroom. The varied selection of workshops includes sessions tailored for technicians and non-specialist teachers of physics, as well as sessions designed to stretch more experienced and specialist physics teachers.

Details and booking: visit www.stimulatingphysics.org/regions-london.htm or contact Misbah Arif (e-mail spn@london.slcs.ac.uk or call 020 7612 6325).

Autumn Physics Update

University of Cambridge

13–15 December

This three-day residential course is hosted by the engineering department at the university with accommodation provided at Trinity College. The programme will feature a mixture of talks and practical workshops with ample opportunity to share and discuss classroom experiences with fellow physics teachers.

Details and booking: visit www.iop.org/update.

ASE Annual Conference

University of Birmingham

8–11 January 2014

The ASE conference is open to everyone with an interest in teaching science, members and non-members alike. There is a large (free) exhibition as well as talks, seminars and booked courses.

Details and booking: visit www.ase.org.uk/conferences/annual-conference.

EVENTS FOR STUDENTS

IOP 2013 Schools and Colleges’ Lecture – Defying Gravity: Make Physics Your Launchpad

This free lecture for 14–16-year-olds, given by Laura Thomas, explores how scientists and engineers have used physics to make the dream of space exploration a reality. Details of venues round the country and booking: visit www.iop.org/schoolslecture.

Collider: Step Inside the World’s Greatest Experiment

Science Museum, London

13 November 2013 to 30 April 2014

This is a new exhibition about the LHC, transporting visitors into the heart of one of the greatest scientific experiments of our times. Collider will provide a behind-the-scenes look at the famous CERN particle physics laboratory, offering visitors the closest experience possible to visiting the famous site itself.

Details and booking: visit www.sciencemuseum.org.uk or call 020 7942 4777 to book; tickets cost £4 per student. The target audience is 16+, although younger groups are welcome.

Physics in Perspective

London

16–18 February 2014

This lecture series aimed at sixth-formers and college students offers insights into many different aspects of physics. Students can book individually, as well as teacher-led school groups.

Details and booking: visit www.iop.org/pip.

National Science & Engineering Week

Nationwide

14–23 March 2014

Every March, National Science & Engineering Week (NSEW) highlights how the sciences, technology, engineering and maths relate to our everyday lives, and helps to inspire the next generation of scientists and engineers with fun and participative events and activities.

Details: visit www.britishscienceassociation.org/national-science-engineering-week.

Physics in Concert

You may have used the IOP *Physics in Concert* resource with your students to help them see how physics is used in the context of planning a music event. Designing a stage, with lighting effects and a sound system for their favourite singer or band is a fun way for students to learn about some real-world applications of physics. Here are some practical activities to complement the *Physics in Concert* resources available at www.iop.org/concert.

Investigate lighting, costume and set design

Students investigate how red, green and blue coloured lighting and costume/set design is used to create a visual display at a concert.

Equipment needed per group: red, green and blue LEDs (e.g. using SEP 240 from www.mindsetonline.co.uk); 3V button cells (e.g. EB2 025 also from Mindsets); laptops with internet access and a colour printer; paper and colouring pen/pencils; and, coloured objects (e.g. a rainbow eraser).

Outline:

- Ask students to go online and look up what type of costumes their favourite singer/band wears and print off some examples in colour.
- They can then investigate how printed costumes and other objects appear under different lights, using the red, green and blue LEDs powered by a button cell. For more information on this see the SEP Innovations in practical work publication *Mixing Colours*, available to download at www.nationalstemcentre.org.uk/elibrary/resource/5008/mixing-colours.
- Students can then design costumes and backdrops for the concert and plan lighting sequences to make a dramatic opening to their concert.

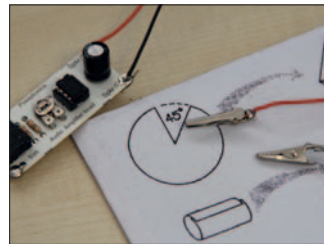
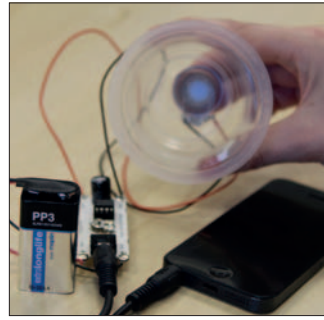
Explore sound using speakers

Students can build an amplifier–speaker system using a vibration speaker kit (a highly recommended and inexpensive bit of kit available from Rapid Electronics).

Equipment needed per group: Vibration Speaker Kit (product: 87-6145, £4.38 from www.rapidonline.com); 9V PP3 battery; soldering iron and solder; heat-resistant mat; safety goggles; different speaker materials (e.g. paper cup, yoghurt pot, sheet of paper and sticky tape to make their own cone); and, scissors.

Outline:

- Solder the components to the circuit board. Get



Top left: Testing different materials to use as speaker cones with the kit. Top right: The kit's components (Rapid, product: 87-6145). Bottom left: Adapting the Vibration Speaker Kit for use with the students' own speakers.

everything checked before connecting the battery (students will need some guidance for this to ensure op-amp and capacitor are connected the correct way round). You may want to do this, rather than get students to do the soldering.

- Plug in an MP3 player/mobile phone using the audio lead provided. Check that the coil–magnet combination vibrates.
- Place the coil–magnet combination against the different materials and see what works best. Ask students whether they can make a better speaker by combining materials or cutting them into different shapes.

Alternatively, get the students to build their own speakers and use the amplifier from the kit to test their effectiveness. To make this easily, add crocodile clips to the output terminals of the amplifier unit. For details about how students can build a speaker see (for example) www.nuffieldfoundation.org/practical-physics/model-loudspeaker or www.instructables.com/id/Build-your-own-speaker-from-scratch.

Build a stage

To finish off, the students can build a model stage using a shoe box (for example) with a lighting system (by incorporating the LEDs) and sound system (using their amplifier and speakers). They can also include a cardboard cut-out of their singer and present their opening lighting sequence in time to the music to the rest of the class. To set the scene and help the students understand what is required to set up a concert use the introduction video from the Ashfield Music Festival activity, available at www.iop.org/ashfield.