

Classroomphysics

The newsletter for affiliated schools

December 2013 Issue 27

New resource

Students think on their feet

Sixty students and their teacher descended on the Emirates Stadium in London last summer to attend a day of football-based physics activities.

The morning saw the students exploring various aspects of the beautiful game using blow pipes and balls to investigate projectile motion, and bean bags flying across the room along with spinning cups to model the movement of a football during a match.

This was followed by an afternoon of football practice at a nearby park with some of the Arsenal Football Club coaches. To round off this unique day, the students and teachers were treated to a grand tour of the stadium.

Using football to engage

IOP has been collaborating with Arsenal Football Club to produce a pack of enrichment materials for after-school clubs. The aim of the resource *Thinking on your feet: football and physics* is to use the context of football to engage students who might not usually be drawn to physics.

An important aspect of each session is that football is central. It is about looking at what happens in real football matches and seeing how physics can provide an insight. Another important aspect is that the output from the practical activities tends to be a design for a demonstration that could illustrate these insights to others.

Students can show their practical demonstrations to each other, and if time is available produce their own presentations using photographs, videos, etc. The practical work is intended to be creative and engaging.



Students practising their football skills at Highbury Fields.

A game of two halves

The resource is designed to support a programme of eight sessions – each dealing with a different aspect of the game. Schools will be able to use these materials flexibly, but the resource has been primarily written for use in an after-school-club setting.

Each session is split into two halves of 45 minutes – just like a football match. The first part is spent in the classroom, looking at a key football idea and then doing a student practical activity that gives insight into what happens on the pitch. The second part applies these ideas to actual football activities.

The titles of the sessions indicate the key football idea and some are listed below with the physics ideas explored in the session.

- **How can you kick and throw the ball further?** Velocity, distance, angle, projectiles, effects of drag
- **How can you take better penalties?** Probability, experimental design
- **How can you control a ball effectively?** Motion, collisions, dissipation of energy

- **Using your body for balance and stability.** Centre of mass and stability, control, dynamic stability

For a taster of the kind of activities included in the resource, turn to p8 for details of an investigation featured in the pack.

Future plans

We have been developing the resource with Arsenal Football Club, who run lessons and coaching sessions with their local schools. We hope to develop partnerships with other football clubs to encourage them to take on the project with their local schools. If you have close links with your local football club, you may want to consider linking up with a coach or player to run these activities in your own after-school-club.

For more information: and to request a copy of the resource, please contact us with your name and school/college address (e-mail education@iop.org with “Football and physics” in the subject line).

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

In this issue



News

Important guidance on keeping radioactive sources.

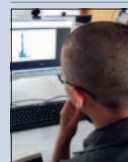
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Event

Lab in a Lorry to visit schools in Scotland and Wales.

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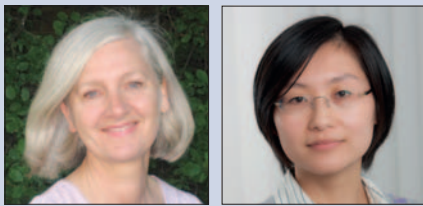


Resource

CERN software now freely available to schools.

6

Editorial



Welcome to our final issue of the newsletter for 2013. Thank you to everyone who responded to our survey regarding the benefits of affiliation; your opinions help us to make decisions about the future of the scheme. The two most highly valued items were our resources, posters and careers material, followed by the print copy of *Physics World*. If you need further copies of any resource or help with electronic access to *Physics World* and *Physics Education*, please e-mail affiliation@iop.org.

This issue has news of two new resources produced by the Institute on pages 1 and 5. We know that our resources are always popular, so we hope you will find the time to explore them. If you come to the ASE annual conference in Birmingham on 9–11 January 2014, you will be able to pick up copies of these, as well as new posters and the DVD of the most recent Schools and Colleges Lecture, “Defying Gravity”. Entry to the exhibition only is free and our stand number is BS20; we hope to see you there.

News of other resources include the University of Birmingham Discover the Cosmos activities (p6) and IOP Biological Physics (p2). Extracurricular opportunities include the Higgs Boson competition for Scottish schools and the Technopop event in London (p4). Lab in a Lorry will be in Scotland and Wales in 2014; to register your interest see p4.

We want to be able to facilitate conversations between teachers around resources and other mutual support; remember that www.talkphysics.org is here to help you do this. If you haven't yet joined in, now is the time to try. We also have a Twitter presence @TakeOnPhysics if you prefer this communication channel.

As ever, your comments or suggestions are most welcome and we look forward to a good 2014.

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Resource

Got a physics query? Visit the Talk Physics website

More than 7500 teachers, trainers and lab technicians with an interest in physics education have signed up to TalkPhysics.org – the online community network for discussions, tips and exciting new resources for the classroom.

A glance at “The Hub” (the central discussion forum) gives a flavour of the range of conversations currently taking place. A discussion on mobile phone sensors sits alongside a request for help with a particular teaching issue. Whatever the topic, there is always someone willing to contribute a nugget of information, a useful classroom resource or share their own experience.

Outside The Hub, special interest groups are busy promoting national and regional events ranging from individual workshops to summer schools. For those who haven't discovered TalkPhysics yet, the website



also plays host to the invaluable library of Supporting Physics Teaching (SPT) resources, which are designed to inform and guide classroom practice.

As TalkPhysics continues to grow, we're working to increase resources. Furthermore, we have recruited three experienced physics teachers to seed and steer high-quality conversations, as well as lend their expertise to the community: Dennis Waugh, Alessio Bernadelli and David Cotton.

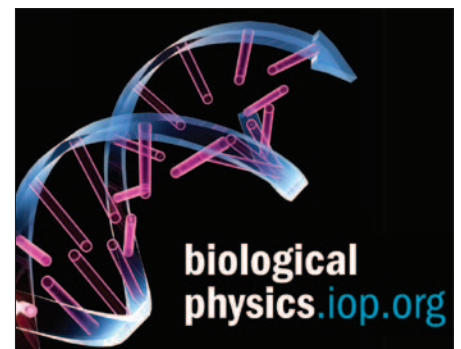
For more information: and to join in the discussion, register at www.talkphysics.org. It's entirely free to sign up and get involved.

Website

Helping you to connect physics with biology

One of the ways in which IOP supports the teaching of physics is by providing resources in related or developing curriculum areas – which are free for all to access. By listening to our members we can understand what is needed, and then access our network to commission experts who can advise and provide materials in teaching areas that aren't available from mainstream publishers. One existing resource aimed at undergraduate level, but that may be of interest to those teaching physics at A-level is biologicalphysics.iop.org.

This resource was developed to support tutors within higher education to introduce mainstream physics students to key areas of biology; to show how physics has provided insights and learning in areas a long way from what we might traditionally think of as “physics”. There are currently nearly 30 articles in areas such as cell structure, biological molecules and regulatory networks. However, once you start reading



through the articles, it quickly becomes clear how physics has a part to play.

For teachers, this site would be useful to refresh (or develop) their own understanding of key elements of biological physics, but also a way to show able students how much more integrated science can be once they're away from traditional A-levels; particularly at a time when they're making decisions about university courses and where to go next.

For more information: visit biologicalphysics.iop.org or contact Christina Walker (e-mail biologicalphysics@iop.org).

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

Legal

Don't throw away radioactive sources

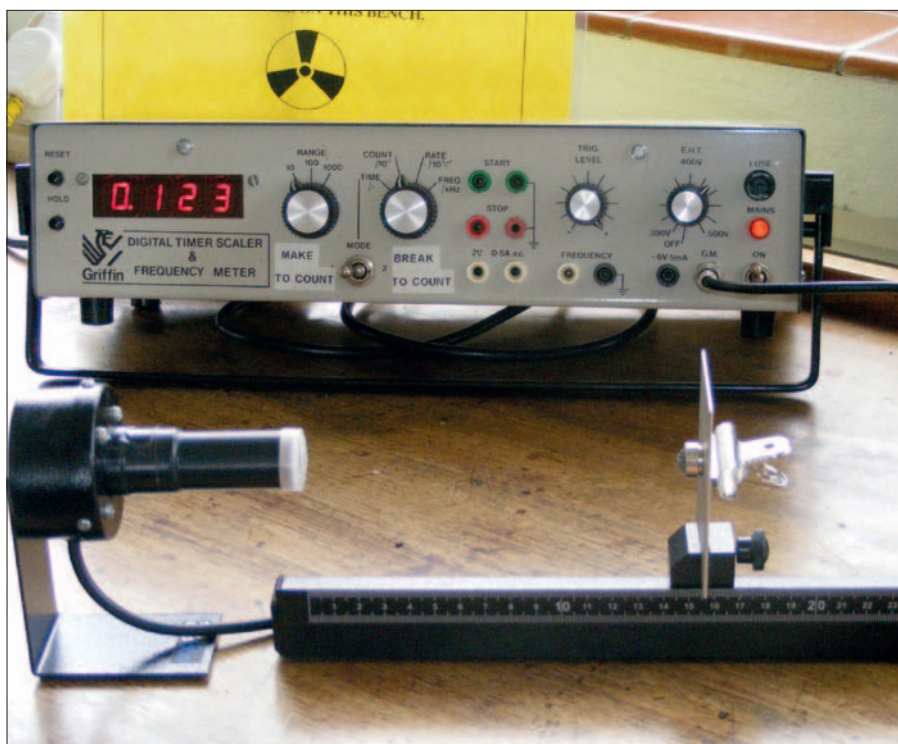
This article is a plea to do all that you can to hang on to your radioactive sources. We've been contacted by some schools reluctantly seeking to dispose of their radioactive sources. They have been forced to do so because of the apparently unavoidable increase in the cost of accessing a radiation protection adviser (RPA) – a requirement of all radiation employers. In each case, by shopping around, they have found a cheaper route to an RPA.

In short, we recommend contacting CLEAPSS – the advisory service for schools. They will be able to put you in contact with at least one radiation protection officer (RPO) who can act as your link to a CLEAPSS RPA.

The best source of advice about anything to do with safety in schools is CLEAPSS. It is a local government organisation that works in the interests of schools, science and safety. I am relying heavily on their expertise to write this article. In 1999, the regulations about using and storing radioactive sources changed. It became a requirement for any employer holding sources (above a certain level) to appoint a RPA with a qualification recognised by the HSE (before 1999, a science adviser could act as the RPA to schools). Given the likely costs to schools, CLEAPSS set up a team of 16 qualified RPAs. Schools could access these RPAs through a network of RPOs who were based in local authorities.

Recent changes to schools and local authorities have meant that some areas no longer have an RPO. In some cases, they have stopped offering a service altogether and in others they are using a private contractor as their RPA. This tends to be more expensive.

We have found that science departments have often been given information that is confusing and misleading – either by their local authority, a private RPA or a risk-management company. The legislation means that schools are required to appoint a qualified RPA. This has been the case since 1999. The changes to schools and local authorities may appear to mean that you have lost your link with an RPO; you may even feel that you are not entitled to use



Equipment used in classroom experiments to investigate radioactivity.

the CLEAPSS RPA service. However, that is not the case. Whether you are an academy, a free school, a college or a local authority school, that service is still available to you. You may need to contact a few local authorities before you find an RPO at a price that you can manage. But it is likely to be worth it and CLEAPSS can provide you with contacts.

Finally, if you need to make a case to a senior leader, here are some thoughts.

- There is no substitute for demonstrating real physical phenomena (simulations and animations help but are no replacement for seeing stuff happen in the real world).

Whether you are an academy, a free school, a college or a local authority school, the RPA service is still available to you

- If practical work disappears from the radioactivity topic (because of cost) what message does that send about the importance of practical work in general?
- If schools do not use real sources, this sends a message that radioactivity is inherently unsafe – too hazardous to use even low-level sources in school. What are the implications of this for public awareness at a time when the need for a new generation of nuclear-generating capacity is being discussed?
- There is a disposal cost (it is not the case that you can dispose of all sources by putting them in a container filled with mortar and adding this to the normal refuse).
- The cost of replacement is very high, so reversing any decision will be expensive.

For more information: there is a discussion group on TalkPhysics if you would like to share your experience on getting a low-cost service. Visit www.talkphysics.org/groups/4589.

Social media

Follow Stimulating Physics on Twitter

We're celebrating the one-year anniversary of the Stimulating Physics Network Twitter feed. Join more than 1800 other followers to receive advice, event details and ideas for the physics classroom.



@TakeOnPhysics



STIMULATING
PHYSICS
NETWORK

Tour

Mobile lab to visit Wales and Scotland

Lab in a Lorry is the IOP's mobile science laboratory that has been travelling around the UK since 2005. Visiting secondary schools to engage with Key Stage 3 pupils, the lab offers students a chance to get their hands on the experiments and explore physics concepts for themselves in a relaxed environment. Volunteers from the local community with a STEM background come along to help run the event. This helps to show the scientific opportunities available to the pupils nearby and gives pupils a chance to interact with people from the world beyond school.

There are two labs on the road; this year, one has toured Scotland while the other has spent a term in each of Somerset, Wales and the north west of England. Each lab aims to engage with around 10,000 pupils and visit 50 schools annually.

In 2014 Lab in a Lorry will be operating in Scotland and Wales and we welcome requests to host an event free of charge. Schools can apply by visiting www.labinalorry.org.uk.



Tim Winteburn/HIE

Pupils exploring optoelectronics and their uses in the world around them.

labinalorry.org.uk and filling in the school application form. Schools from outside our operating regions are welcome to place their details on the waiting list should we visit a new area in the future.

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



Competition

New Higgs competition for Scottish schools

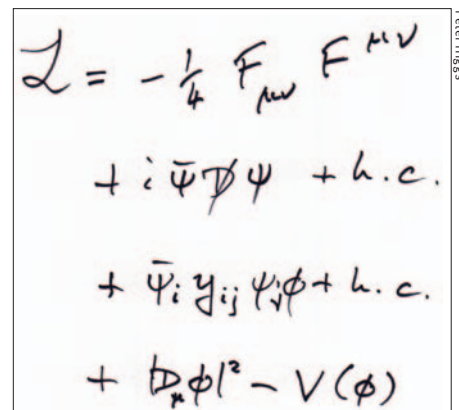
Join in the worldwide excitement surrounding the discovery of the elusive particle that confers mass on the elementary building blocks of nature. Let your students conduct research into the next challenge in the quest to understand our universe and win prizes.

The Institute of Physics in Scotland has launched the first in a series of biannual competitions for Scottish primary- and secondary-school students. This year, in recognition of Prof. Peter Higgs' work and his winning of the Nobel Prize for Physics, the first competition will be called the "Higgs Boson Competition" and will be open to teams of students in Primary 6 and 7, and

S1 to S4.

Teachers can use a specially set up website (iopscompetition.org.uk) to register their teams, download promotional flyers and certificates for participants, and upload competition entries. Schools will also be able to see how the competition has been created to support Curriculum for Excellence.

Teachers will need to register their student teams by 30 May 2014, and will have until 27 June 2014 to submit their entries. Winners will be announced in September 2014. Prizes include CERN crystals and personally signed certificates from Prof. Peter Higgs for the national winners. Prof. Higgs has also donated a handwritten copy of the Lagrangian of the Standard Model, which will feature on the competition certificates, along with an illustration of the famous Higgs Boson reaction.



Peter Higgs

Prof. Peter Higgs has donated a handwritten copy of the Standard Model Lagrangian, which will feature on the competition certificates.

For more information: visit iopscompetition.org.uk.

Event

Technopop London

A new science festival is launching in London. Running from 1 March to 21 April 2014, Technopop London offers eight weeks of free, cutting-edge science, technology, design and innovation, for students aged 6 to 19. There will be an interactive exhibition that includes 3D printing and the science behind smart cities. In addition, there will be a programme of workshops and activities that explore a different theme each week.

There are endless curriculum links as



innovative technology reaches across science and into the arts, but physics teachers may be particularly interested in week 1, which includes space travel, weather and astronomy; week 4, which explores the future of the built environment including renewable energies and intelligent houses; and week 5, which may appear to be more biological in its focus on the human body, but includes mind robotics.

Held at Queen Elizabeth Olympic Park,

Stratford London, Technopop can welcome whole year groups or more, and there is no limit on the number of times that a school can visit, giving students the chance to participate in the different themed weeks. There will also be free Teacher Twilight CPD each week to offer support on how to bring the themed topics into the classroom.

For more information: and to register, visit www.technopop.co.uk.

Workshop

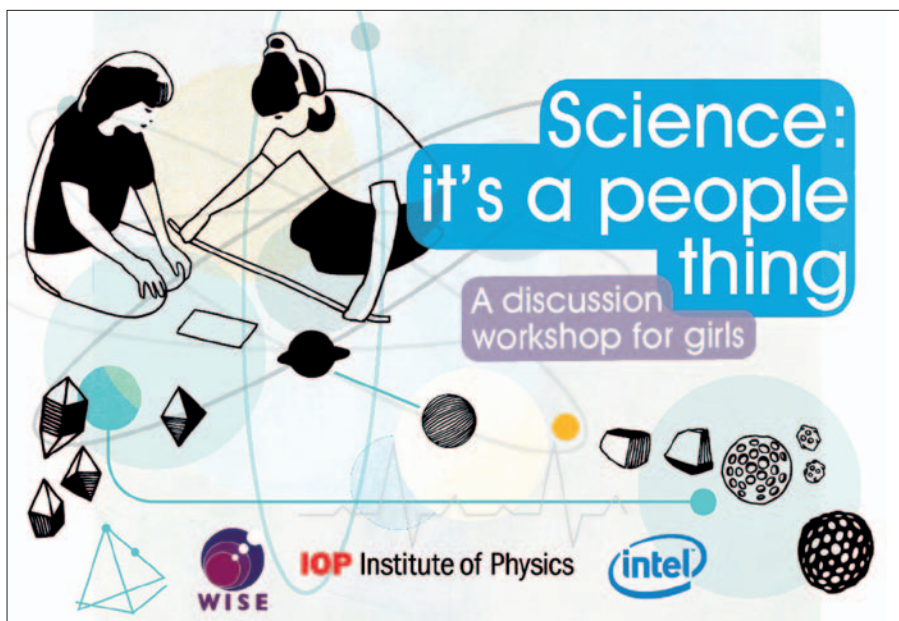
Science: It's a People Thing – a workshop for girls

“Science: It's a People Thing” is a new discussion workshop that was piloted with girls at the Big Bang Science Fair in London in March 2013. They discussed myths and facts about girls and women in science, technology, engineering and mathematics (STEM) careers, and came up with ideas on how to make a lasting difference. Girls who came to the sessions told us that they appreciated the opportunity to discuss these issues with other girls. This was especially important for those who came from co-educational schools.

- “There are a lot of options and opportunities in the science field. It does not only revolve around medicine, etc.” (participant aged 16)

- “I will tell my friends and family about the facts that I have learned and hopefully inspire others as I have been inspired today.” (participant aged 13)

The Institute of Physics worked in partnership with WISE and Intel to create this workshop, designed to inspire girls about the STEM subjects where they are under-represented, such as physics and computer science. It shows them how these subjects connect with issues that girls care about and their importance as a gateway into a wide range of interesting jobs and careers. The workshop uses role models to facilitate small group discussion and explore gender stereotyping in a comfortable and safe environment. The session is suitable



for girls aged 13–16, but could be easily adapted for use with a younger age group, aged 11–12.

The resources have now been revised and extended to include supporting material and advice for organisers and facilitators, with all that is needed to run a session of either 60–90 minutes, or a longer half-day event. The pack is for teachers, as well as ambassadors and role models going into schools. It includes advice on how to find role models and

brief them as well as editable Powerpoint slides to use in the workshop. There is also a call-to-action z-card for students to take away from the event, which can be ordered in bulk from IOP.

For more information: go to www.iop.org/girlsinphysics to download the resources and contact education@iop.org to order the z-cards. USB sticks with the resources will be available at IOP teacher events and conferences.

Scholarship

£25,000 scholarships to train to teach physics

At the IOP we not only support current teachers of physics, we also work hard to support people who want to train to teach physics, in a bid to tackle the real shortage of specialist teachers in England. We are pleased to confirm that the Department for Education is funding the IOP Teacher Training Scholarships programme for a third year running. The programme has been topped up, meaning that we now have 150 scholarships at £25,000 to award for the 2014/15 academic year.

Scholarships are prestigious awards and are available to exceptional candidates planning to do PGCE or School Direct (non-salaried) teacher training from September 2014. Not only do they offer financial reward, they also provide academic support in the form of IOP membership and mentoring through the IOP Stimulating Physics Support network.

Please do pass this information on to anyone who might be interested in physics teacher training, particularly those who



might be carrying out observational work experience at your school over the next year.

For more information: www.iop.org/scholarships.

Funding

£3000 available for creative science projects

Schools can apply for up to £3000 from the Royal Society to work with a scientist or engineer on creative investigations that inspire students with the excitement

THE
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SOCIETY

and wonder of cutting-edge science or engineering research. The next round of applications opens on 4 January 2014 and closes on 28 February 2014.

For more information: about eligibility criteria and to find out how to apply via the online application system, visit www.royalsociety.org/partnership.

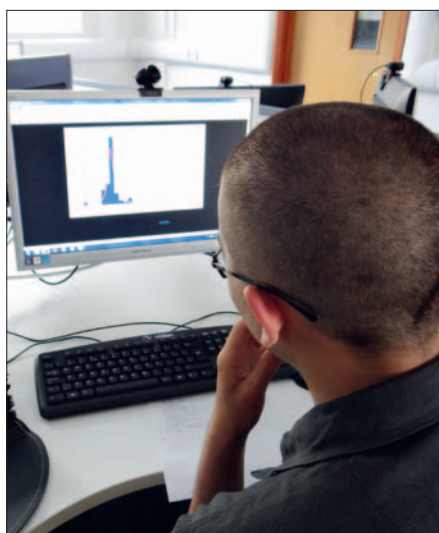
Resource

Free school particle-physics software

The discovery of a Higgs Boson at CERN has really captured the interest of students in schools and now there are many resources available for incorporating these ideas into the curriculum, including opportunities to give students a real experience of analysing particle-physics data.

Researchers have developed a version of the Minerva software (as used by physicists to visualise data in their research) for schools to use. The software is freely available to download from the web and is easy to use on any PC that has JAVA installed. In addition, there are many data files, including collision data collected from the ATLAS detector, for the students to experiment with.

The activities teach students how the detectors work, how to recognise particle tracks for electrons, positrons, muons, anti-muons and “inferred” neutrinos, and how to extract information related to the particle’s energy and momentum. Students can use the principles of conservation of energy and momentum to calculate the mass of particles formed in the proton-



A student working on a case study to use resources for the Extended Project Qualification.

proton collisions that have subsequently decayed into particles seen in the detector – a process very closely related to the way the Higgs boson was recently discovered; a true insight into “how science works”. This

resource shows the real-world applications of standard physics curriculum topics.

Students have been enjoying such activities in masterclasses on the University of Birmingham campus, but now teachers can run their own sessions in school too. The university is happy to support teachers in the use of these resources and can provide links that allow students to interact with researchers working at CERN. Simply contact Lynne Long (e-mail l.long@bham.ac.uk) to organise a teacher-training workshop, set up an e-masterclass in your school or find out how the university can provide other ways to support you in the classroom.

For more information: including starter activities and lesson plans written by a practising teacher visit www.birmingham.ac.uk/schools/physics/outreach/resources.aspx. This work is part of the Discover the Cosmos EU project (portal.discoverthecosmos.eu) where many other enquiry-based resources and lesson plans can be found.

Work experience

Apply for Nuffield work experience placements

Applications for Nuffield Research placements will open across the country in January 2014. The programme offers more than 1000 students per year the opportunity to participate in 4–6 week summer research projects to gain hands-on experience of scientific research. Projects are available across all areas of science, technology, engineering and maths (STEM). Placements take place in universities, research institutes and commercial companies.

Students need to be in the first year of a post-16 science or maths qualification, and have an interest in continuing with

STEM at university. Nuffield particularly encourages students who don’t have a family history of going to university or who are from low-income families to apply for a placement. Nuffield ensures that no-one is excluded on a financial basis by covering students’ travel costs. Some students may also be eligible for a weekly bursary in addition to travel expenses.

For more information: contact your local Nuffield co-ordinator, details can be found on the Nuffield website at www.nuffieldfoundation.org/nrp.



Hannah Blyth worked on the Faulkes Telescope Project and discovered a new comet.

Event

Pledge your commitment to demonstrations

National Science & Engineering Week (NSEW) wants to generate a wave of inspiring science demonstrations in UK secondary schools. As part of this year’s NSEW, you nominated your favourite video demonstrations. Six of the best demo ideas have been turned into free video guides with accompanying written resources, which are available on the NSEW website.



Get set... demonstrate
Running inspiring science demos

Now we want you – teachers and technicians – to pledge to give a demo to your students on 20 March 2014 – the first national Demo Day. Take part in an exciting nationwide event that will help you explore new concepts and provoke discussions with your students. Go to the British Science

Association website to make a pledge and enter for a chance to win a free equipment pack for your school.

For more information: visit www.britishsociety.org/get-set or follow on Twitter using #DemoDay.

EVENTS FOR TEACHERS

Autumn Physics Update

University of Cambridge
13–15 December

This three-day residential course will feature a mixture of talks and practical workshops with ample opportunity to share 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. 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.

Practical Work in Physics Intensive Day CPD

National Space Centre, Leicester
5 February and 4 July 2014

This course is for non-specialist teachers of physics focusing on practical work using the inspirational context of space. Details and booking: contact the National Space Academy administrator (e-mail nsa@spacecentre.co.uk or call 0116 2582147).

Astronomy CPD

National Space Centre, Leicester
3 March 2014

This event covers a range of teaching ideas covering concepts from gravity and stellar distances, to using multi-spectral analysis. Details and booking: contact the National Space Academy administrator (e-mail nsa@spacecentre.co.uk or call 0116 2582147).

40th Stirling Physics Meeting

University of Stirling
21 May 2014

A meeting that will bring you into contact with the latest thinking in physics and physics education, and with colleagues from throughout Scotland. Details and booking: visit www.stirlingmeeting.org.

Rugby Meeting

Rugby School, Warwickshire
5 June 2014

The 26th annual meeting for teachers of physics will feature lectures given by leading research physicists and physics education experts, hands-on workshops and an opportunity to browse the extensive exhibition area. Details and booking: visit www.iop.org/rugby.



As well as the national events detailed here, don't forget that the Institute's Teacher Network also runs local workshops for teachers all around the UK and Ireland. These twilight sessions are a great chance to get new ideas, pick up free resources and meet up with other local teachers. The network runs workshops on a variety of different themes, some focusing on new ideas for teaching a specific topic, and some "make-and-take" workshops that allow you to put together and take away a fantastic bit of kit – including homemade rocket launchers and cloud chambers. To find out what's on in your area, visit the education calendar on the IOP website at www.iop.org/events/education.

Teacher Network for North Wales Conference

Bangor University
18 June 2014

Dr Jonathan Hare from BBC/OU Rough Science will be leading sessions on "Hollywood science" and "Rough science: on screen and in the lab". Other sessions include "make-and-take", wind turbines, WJEC and lots more. Details and booking: contact Andrea Fesmer (e-mail andrea.fesmer@talk21.com).

The Day for Everyone Teaching Physics

Durham University
19 June 2014

This free day of workshops and lectures includes trebuchets and the best of physics education. Organised by IOP in conjunction with Durham University. Details and booking: contact Alex Brabbs (e-mail alex.brabbs@iop.org).

EVENTS FOR STUDENTS

Year 12 Careers Event Day

National Space Centre, Leicester
27 January 2014

This free event allows students to find out what it takes to work in the UK space sector. Details and booking: contact the National Space Academy administrator (e-mail nsa@spacecentre.co.uk or call 0116 2582147).

Physics in Perspective – an enrichment day for sixth-formers and college students

University of Bradford
13 February 2014

With lectures on quantum physics, astrobiology, and the physics behind computer games and special effects, this

new IOP-organised event for students is now open for bookings. Details and booking: visit www.iop.org/pip.

Physics in Perspective – an enrichment course for sixth-formers and college students

UCL and Royal Institution, London
16–18 February 2014

Over the course of three days, the Institute's flagship 16–19 lecture series offers insights into many different aspects of physics. Bookings are accepted from individual students and teacher-led school groups. Details and booking: visit www.iop.org/pip.

Collider: Step Inside the World's Greatest Experiment

Science Museum, London
13 November 2013 – 30 April 2014

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. Details and booking: visit www.sciencemuseum.org.uk or call 020 7942 4777.

National Astronomy Week

Nationwide
1–8 March 2014

This is a great opportunity to promote astronomy and the night sky to young minds. Details: visit www.astronomyweek.org.uk or contact the NAW co-ordinator (e-mail naw214@the-observatory.org).

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

Year 10 Careers Event Day

National Space Centre, Leicester
16 June and 30 June 2014

This free event is aimed at students who are interested in taking up the sciences at A-level. Details and booking: contact the National Space Academy administrator (e-mail nsa@spacecentre.co.uk or call 0116 2582147).

Space School

University of Kent
2–3 and 9–10 August 2014

Astronomy weekends for 11–18 year olds to coincide with the annual Perseid meteor shower. Details and booking: visit www.kent.ac.uk/physical-sciences/spaceschool or e-mail spaceschool@kent.ac.uk.

Thinking on your feet: football and physics

Footballers sometimes kick across the ball, rather than straight through it, to impart spin on the ball. They do this either to control how it moves through the air or to actively make it follow a curved or bent path. Students will explore how the forces imparted on the ball affect the way it spins and how this affects the way that the ball moves through the air.



The effects of backspin, topspin and sidespin can be modelled using spinning cups launched by rubber bands.

Materials needed

For each pair of students:

- Safety glasses
- Two polystyrene cups
- Two elastic bands
- Two balloons
- Sticky tape



To extend this investigation, you might want to provide different types of plastic cups to your students. At least two elastic bands will need to be looped together.

Testing the ideas experimentally

Students will be designing a demonstration to show how the way that an object spins affects the way that the object moves through the air. It uses polystyrene cups to show how backspin can create lift, thereby making the cups initially deviate upwards.

1. Two polystyrene cups are taped together at the base to form the spinner, and two elastic bands are tied or looped together.
2. The elastic bands are held on the spinner where the cups join and wound round a few times. To produce backspin, the other end of the elastic should be at the bottom pointing away from you. The spinner can now be “fired” like a catapult and will spin in the air as it travels.
3. Topspin can be created by using the same method upside down.
4. By stretching thin rubber (from balloons) across each end of the cups to increase the time in the air, sidespin can also be effectively demonstrated.



A student carries out the investigation at the Emirates Stadium in London.

The challenge for students in this session is to produce the most convincing demonstration of the effects of different types of spin on the motion of the object. By modifications to the cups used and their launching technique, as well as how they position the video camera for each shot, the students can capture the finer detail of how each type of spin produces a different motion. Pooling the class’s experiences should enable comparisons between the different types of cups and launching techniques, why certain cups work better than others and how this is related to the movement of balls that are spinning through the air.

For further information: and to request a copy of the resource, please contact us with your name and school/college address (e-mail education@iop.org with “Football and physics” in the subject line).