

# Classroomphysics

The newsletter for affiliated schools

December 2014 Issue 31

## Awards

# Celebrating teaching excellence

This autumn, six outstanding teachers received Teachers of Physics awards from the IOP. These were presented at the Institute's Awards Dinner on 15 October, an annual event that recognises and celebrates excellence in a range of physics endeavours.

The three awards presented to teachers in England were made on the basis of their achievement in: promoting the progression of pupils to A-level physics; the progression of girls to A-level physics; or the outstanding attainment of pupils in A-level physics. The awards to a teacher in Scotland, in Wales and in Northern Ireland were each made through nomination and recommendation by colleagues. All of the recipients were praised for their excellent and inspirational teaching and their dedication to their students and the profession.

Honorary fellowship (the highest honour that the Institute can bestow) was given to Dr Becky Parker, founding director of the Langton Star Centre and head of physics at Simon Langton Grammar School for Boys, for her contributions to physics education.

The Langton Star Centre is a specialist facility with laboratories, classrooms and an observatory where students are given the opportunity to join collaborative astronomy and space projects, the most prominent of these being the Langton Ultimate Cosmic Ray Intensity Detector (LUCID). Becky's innovative and inspiring approach to teaching can be seen in the large number of students (both boys and girls) taking A-level at Langton and through those going on to study physics and engineering at university.

The awards were announced by two A-level physics students from London, Jade and Renato. Both are on the Social Mobility Foundation's Aspiring



Renato and Jade, two students currently studying A-level physics, presenting the awards.



IOP President Dr Frances Saunders presents an honorary fellowship to Dr Becky Parker.

Professionals Programme. This scheme targets high-achieving Year 12 students from less-privileged backgrounds to enable them to access top universities and professions. The programme consists of: an internship with a top employer; e-mentoring by a professional; tailored career and skills workshops; and university support and

guidance. To be eligible, students must live within an hour of Birmingham, Glasgow, Leeds, Liverpool, London, Manchester or Nottingham.

The Social Mobility Foundation also offers a residential internship programme to disadvantaged students who live anywhere outside of London. Successful applicants are provided with an all-expenses-paid summer residential placement with a prestigious organisation in London such as the Civil Service, Clifford Chance, J.P. Morgan, KPMG, Linklaters and NHS Health Education England.

The application deadline for both programmes is 22 December 2014.

**For more information:** on the IOP award winners, visit [www.iop.org/awards](http://www.iop.org/awards). Details of the Social Mobility Foundation's programmes are available at [www.socialmobility.org.uk/get-involved/teachers](http://www.socialmobility.org.uk/get-involved/teachers).

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

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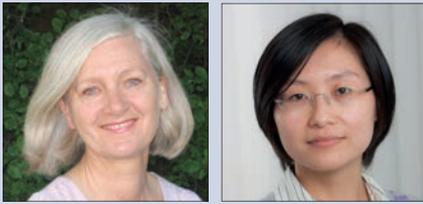
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Editorial



Welcome to the final newsletter of 2014.

It is always a pleasure to be able to celebrate the success of physics teachers at the IOP Annual Awards Dinner alongside distinguished research scientists, and this year has been particularly noteworthy (p1).

It's not just teachers who contribute to education: to nominate an outstanding science technician in your department for an award, see the Salters-CLEAPSS nomination scheme (p3).

Affiliated schools and colleges will have received a bumper mailing of posters, careers literature for students and our newest education brochures that outline the education policy work of the Institute and the direct support we offer teachers of physics.

A copy of the Royal Meteorological Society's recent special report for science teachers, *Climate Change Updates: 10 New Figures from the 2013 Intergovernmental Panel on Climate Change (IPSS)*, has also been sent to our affiliated schools and colleges.

If you have a project or club activity that needs additional funding, remember that the next round of school grant applications closes on 1 February 2015. You can apply for up to £500 to engage and inspire your students.

There will be a modest increase in the cost of affiliation from 2015 onwards: the annual cost will increase from £48 (€60) to £50 (€63) per year for schools in the UK and Ireland. Please ensure that any renewal reminders received are paid promptly to guarantee your school/college renewal at this year's price.

Next year marks two major events: the UNESCO International Year of Light (p4) and ESA astronaut Tim Peake setting off for his six-month space journey, flying under the mission name of Principia. We will be providing regular updates on both in 2015 and you may wish to start gearing up for Tim's mission via some of the activities and resources on p6.

Wishing you a good end to the term and a relaxing Christmas break.

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Teacher recruitment

# Trainee teacher scholarships



IOP Scholars at the 2014 Scholarship Celebration Event.

The IOP Teacher Training Scholarships programme is in its fourth year of supporting exceptional trainee physics teachers. To date, 350 scholarships have been awarded so we were delighted when the Department for Education renewed its funding for a further 150 scholarships for the 2015/16 academic year.

Scholarships are prestigious awards and are only available to the very best candidates planning to do university-led or non-salaried school-led teacher training in England. Each award provides £25,000 tax-free funding, free IOP membership and

mentoring support.

Scholars also benefit from a programme of educational trips to science venues around the country. The trips provide an additional networking opportunity and a chance for scholars to draw on peer support during the challenging training year.

If you are involved in physics teacher recruitment, please pass this information on to anyone who might be eligible to apply for a scholarship.

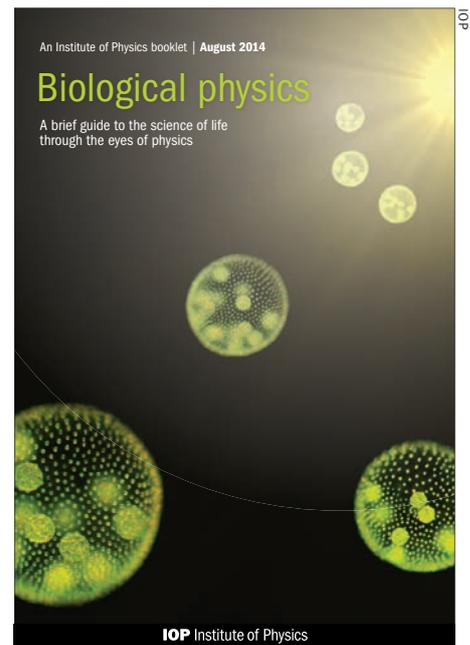
**For more information:** on eligibility and full details, see [www.iop.org/scholarships](http://www.iop.org/scholarships).

Resource

## New publication about biological physics

For students interested in both physics and biology, the IOP has produced a booklet highlighting the interdisciplinary research area of biological physics. Within this rapidly expanding field, there is an urgent demand for physicists who are familiar with biological concepts and terms. This demand is reflected in a wave of new staff appointments within universities as well as new opportunities within industry. The booklet encourages students to think outside of traditional subject areas and see a physics degree as a gateway to a broad range of scientific research.

Examples of current research and their applications are covered across eight articles, including topics such as molecular motors and cellular scaffolding. These give students tangible examples of how their physics degrees could be used to help, for example, develop new drug delivery methods or model the spread of infection through a population.



Front cover of new Biological physics publication.

To order a copy of *Biological physics: A brief guide to the science of life through the eyes of physics*, e-mail [education@iop.org](mailto:education@iop.org).

## Teacher blog

# IOP seeks writers to share their classroom experiences: ‘The first time I taught...’

The Institute is looking for writers for a new blog series aimed at NQT and very-early-career physics teachers. We want to hear about the first time you taught a particular topic or ran a particular practical: perhaps something that presented more challenges than you had originally envisaged. How did you learn from this and how did your practice develop as a result?

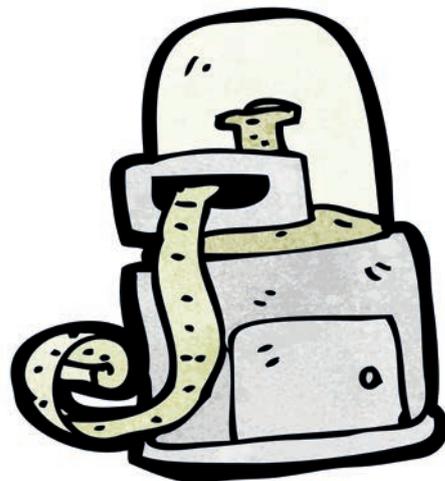
We have a great example by Lauren who qualified five years ago. During her PGCE, she needed to teach a lesson on measuring speed and followed a colleague's recommendation to use ticker-timers.

She begins: “I hadn't used ticker-timers since I was in school but I felt confident that

I could use them to complete a successful practical activity...” Ah, famous last words! Read it all on the IOP blog at [www.iopblog.org/first-time-taught-measuring-speed-ticker-timers-2](http://www.iopblog.org/first-time-taught-measuring-speed-ticker-timers-2).

**For more information:** contact Caroline Davis ([caroline.davis@iop.org](mailto:caroline.davis@iop.org)) with your idea – we will pay £100 for any that we publish.

**“I hadn't used ticker-timers since I was in school but I felt confident that I could use them to complete a successful practical activity...”**



Shutterstock

## Teacher event

## A New Year's CPD boost: the ASE Annual Conference

Across four days, from 7 to 10 January at University of Reading, the Association for Science Education (ASE) will host more than 300 continuing professional development (CPD) sessions. The Institute will be present with the following workshops:

- **Girls and Physics** This session will look at suggested interventions and resources to help challenge gender stereotyping both at the whole-school level and in the physics classroom.
- **Teaching Energy in the New National Curriculum** The statements about energy in the revised National Curriculum are quite different from those that have gone before. In this session, we will look at how to satisfy the National Curriculum and explore more helpful ways of discussing energy with students.
- **Exoplanets Student Activity** Use far-off planets to inspire students in the classroom. This new IOP resource consists of five curriculum-linked enrichment activities for key stage 3.
- **Effective Mind Mapping and Memory Techniques in Science Education** Mind mapping is a creative and enjoyable process that provides a more natural and effective

 **The Association for Science Education**  
Promoting Excellence in Science Teaching and Learning



Europe's largest science education exhibition.

way to recall information, organise ideas and key points, plan projects, solve problems, and record and communicate findings.

- **Technology Rocks** Explore ideas and approaches for teaching electricity, magnetism, electromagnetism and sound.
- **Thinking on Your Feet – Football and Physics** This session shows how the IOP resource can be used to enrich your teaching of physics.

Alongside this formal programme, there are lots of opportunities for more informal CPD through the science resources exhibition, drop-in activities and networking

with teachers from across the UK and beyond. Here is a glimpse of some of the other sessions:

- **ASE Policy Lecture with Sir John Holman** Professional development lies at the heart of the Annual Conference, so ASE is delighted to welcome Sir John Holman to explore the professionalism of science teachers.
- **Language of Mathematics in Science** To launch a Nuffield Foundation-funded project aimed at supporting the new curriculum focus, ASE invites teachers to discuss issues for their students in effectively using mathematics in science.
- **Igniting the Imagination** Join Fran Scott for hands-on science with a bang.
- **The ASE Annual Conference Dinner** The dinner will be topped off with “Fire and Ice” from husband and wife speakers Dr Helen Mason OBE and Dr John Dudeney OBE. Hear how a leading solar physicist and an Antarctic explorer balance international careers and domestic partnership.

**For more information:** and to explore the full conference programme, visit [www.ase.org.uk/annual-conference](http://www.ase.org.uk/annual-conference).

## Awards

## Call to nominate outstanding science technicians

Award nominations are now open for outstanding science technicians who work in schools and colleges catering for students

up to age 18 and who have a total of five or more years' experience, either full-time or part-time. The closing date for nominations is 31 January 2015.

The aim of the Salters-CLEAPSS National Awards For Science Technicians 2015 is to acknowledge publicly the immense contribution that science technicians make to the well-being and

success of schools and colleges and, in particular, to science departments. It is hoped that the awards will heighten awareness of the importance of science technicians to education in this country.

**For more information:** about the awards and to make a nomination, visit [www.saltersinstitute.co.uk](http://www.saltersinstitute.co.uk).

Student events

# Helping you to light up 2015 in schools

The United Nations has designated next year as the International Year of Light. It marks several significant scientific anniversaries, not least the first proposal of the electromagnetic theory of light propagation by James Clerk Maxwell in 1865. It is an opportunity to celebrate the importance of light in our lives and the UK's success in developing light-based technologies.

Through the "Study after Sunset" programme, the UN also aims to help bring solar lighting to some of the 1.5 billion



people in the developing world for whom night-time means either darkness or the dim, smoky glow of a kerosene lamp or candle.

Throughout 2015, light-related events will be held around the UK and the Institute will be giving preference to light-based proposals for our School Grants Scheme. A special light-collection of the ever-popular Marvin and Milo postcards will be sent to affiliated schools with the next *Classroom Physics*.

**For more information:** on the International Year of Light, visit [www.light2015.org.uk](http://www.light2015.org.uk). To make an application to the School Grants Scheme, visit [www.iop.org/schoolgrants](http://www.iop.org/schoolgrants).

Student activity

## Students can study high-energy particles

HiSPARC is an international project for schools where students study the nature and characteristics of cosmic rays, particularly those with high energy. These cosmic rays are the highest energy particles known to scientists – far more energetic than any man-made particles created in a collider.

The origins of ultra-energetic cosmic rays are still a mystery and schools have an opportunity to join a real-world research project that could potentially lead to their work being published in a research paper. The project's hands-on approach is fun and educational at the same time.

The HiSPARC collaboration network has recently extended out to the Midlands, with the University of Birmingham's Dr Cristina Lazzeroni, reader in the particle physics group, and Dr Maria Pavlidou, an Ogdent Trust Fellow and teacher, leading on the project.

Two local schools have already joined



Maria Pavlidou, University of Birmingham

Students from Bordesely Green Girls School assemble a detector.

the network: King Edwards School for Girls, and Bordesely Green Girls School (the latter thanks to a Royal Society Partnership Grant), with four other schools joining soon.

**For more information:** contact Dr Cristina Lazzeroni ([c.lazzeroni@bham.ac.uk](mailto:c.lazzeroni@bham.ac.uk)) or Dr Maria Pavlidou ([maria.pavlidou@ogdentrust.com](mailto:maria.pavlidou@ogdentrust.com)).

Student event

## New exhibition explores engineering careers

The Science Museum's engineering careers exhibition *Engineer Your Future* opens on the 17 December. Aimed at 11–15 year olds, this interactive exhibition aims to inspire and engage young people with the opportunities that a career in engineering can offer.

Students can explore what engineers do, through games that give them the chance to see, experience and develop engineering skills for themselves. Inspiring films and graphics will connect these skills to the men and women who work in engineering today.

Through interactive games, students can design a vehicle to travel as far as possible



RSL Steeper

Visit the exhibition to see this bionic hand and hear about its engineers.

across a rugged alien landscape. In other challenges they will use team-work to navigate the complex systems involved in our everyday lives: balancing electrical flow through a power grid, guiding trains through a rail network, and managing luggage through an airport baggage handling system.

Students can also explore a futuristic cityscape, encountering more than 30 people working across engineering, from energy generation to transport, and health to creating visual effects for films.

The exhibition is free to visit and will be open to the public for three years.

**For more information:** or to plan your class visit, see [www.sciencemuseum.org.uk/educators](http://www.sciencemuseum.org.uk/educators), or follow [#engineeryourfuture](https://twitter.com/engineeryourfuture).

## Invitation

# Join your local Link School network

New for the Stimulating Physics Network in spring 2015: local networks of physics teachers, each centred on one of 30 Link Schools. Our Teaching and Learning Coaches will provide a series of CPD workshops at each Link School, available free to all teachers of physics in the area. These workshops aim to develop subject knowledge, pedagogical repertoire and suggest approaches to engage pupils with physics.

As well as providing high-quality CPD from the Institute of Physics, the Link School networks have longer-term objectives:

- To give local teachers the opportunity to meet, share ideas and reflect on their own practice;

- To develop the capacity of staff in the Link School to lead effective CPD and coaching.

We are currently recruiting SPN Link Schools across England. We would like to tap into existing local school networks, so suitable candidates for Link Schools will include:

- Science Learning Partnership lead schools;
- Teaching Schools;
- Independent schools with established outreach links to other state-funded schools.

**For more information:** on becoming a Link School, visit [stimulatingphysics.org/join](http://stimulatingphysics.org/join). To find your local Link School events, visit [stimulatingphysics.org/regions](http://stimulatingphysics.org/regions).

## Teacher and student events

# There is no substitute for hard Qwerk!



A-level students are submerged during WOW!

The Qwerky Physics competition is back, bringing investigations, presentations and a very special physics roadshow. Organised by Teaching and Learning Coach (TLC) Gerry Blake, this competition is just one of the regional events supported by the Stimulating Physics Network and offers the chance to see how physics and fun collide.

The latest event saw Year 9 students from 28 schools across East Anglia tackle unusual physics challenges. There was an impressive array of inventive science on display, including experiments on magnetic levitation, thermocolour materials and orbiting pennies. As Jo Bradley, a teacher from St Bede's School, confirmed: "Every single experiment was new, stimulating and interesting."

To decide the Qwerky Physics winner, students prepared a presentation and poster to illustrate their favourite experiment of the day. The presentation allowed students to demonstrate skills in scientific reasoning, while ensuring teachers could test what students had understood. The competition was close and Colchester Royal Grammar School battled it out against three other schools to win this year's grand prize.

The day meant students could speak to

teachers outside of formal lesson structures and, perhaps more importantly, teachers had the chance to collaborate, share ideas and develop their own practice.

Participants were also treated to a performance of WOW!, a touring physics lecture from the Extreme Physics Roadshow designed by TLC Helen Pollard to empower and enthuse young people to pursue physics post-GCSE. Nine A-Level students, brought together by a passion for physics, presented this action-packed show covering a range of topics, from soap bubbles large enough to submerge pupils, to a daredevil experiment with liquid nitrogen.

For these Extreme Physicists it was a great buzz to share their knowledge with such enthusiastic spectators. As one of them said: "It was a brilliant end to the day and a chance to really wow everyone. I think you can relate physics to absolutely anything... hopefully this show managed to inspire other young physicists to think the same!"

**For more information:** on our pupil support programme, visit [stimulatingphysics.org/pupils](http://stimulatingphysics.org/pupils). To find local student and teacher events, visit [stimulatingphysics.org/regions](http://stimulatingphysics.org/regions).

## Signal boost



STIMULATING  
**PHYSICS**  
NETWORK

### Misconceptions at KS3

We are launching a series of London workshops on pupil misconceptions at KS3. Explore teaching approaches and consider topics in light of recent changes to the National Curriculum. Workshops are led by the IOP's Niloufar Wijetunge, and start in January 2015.

More details are available at [stimulatingphysics.org/regions-london-southeast.htm](http://stimulatingphysics.org/regions-london-southeast.htm).

Find all local workshops at [stimulatingphysics.org/regions](http://stimulatingphysics.org/regions).

### An appetite for apps

This term's digital highlight is our new Pinterest board, featuring the best apps for physics teaching and learning. With the growing popularity of flipped learning, and accessibility of mobile devices, this board provides a solid starting point at [pinterest.com/teachphysics](http://pinterest.com/teachphysics).

### Activities this autumn across the regions

- 275 NQTs across England graduated from our early-career mentoring programme.
- The physics of *Angry Birds* took pride of place at The Market Bosworth School, Leicestershire.
- The South East gained a new Teaching and Learning Coach, Christina Astin.
- More than 250 pupils went to the Gravity Fields science festival in Grantham.
- The Bolsover School became our latest Partner School in Derbyshire.
- Our first Link School workshop was held at Urmston Grammar School in Manchester, covering Energy in the new National Curriculum.

### Twitter



Follow **@TakeOnPhysics** to build your own teacher network and connect with the wider physics community.



## Student competition

# Win big money for innovative satellite data ideas

To mark the 300th anniversary of the original Longitude Prize, the innovation foundation Nesta will engage young people all over the UK with satellite navigation in a completely new way.

The Longitude Explorer Prize is a challenge for students aged 11–16 to come up with innovative ideas for products, technologies and systems that are of benefit to their communities, using information from satellites. Schools and youth groups have the opportunity to win £25,000, be supported by experts and attend national events in prestigious locations.

The Longitude Explorer Prize was launched at the National Maritime Museum as part of the Clocking Off Late event *Ships, Clocks & Stars: The Quest for Longitude*. The deadline for entries is 30 January 2015.

Nesta will be working alongside partners such as the UK Space Agency, Raspberry Pi, and STEMNET to provide the entrepreneurs, scientists and technologists of the future with new opportunities to explore how space technologies affect their everyday lives



This round of the challenge will focus on the use of satellite information.

in these themed areas: personal safety, friends and family, transport, education, environment, and active and healthy.

**For more information:** and to register your interest in the Longitude Explorer Prize, visit [www.longitudeprize.org/schools](http://www.longitudeprize.org/schools).

## Events

### Your mission for 2015: train like an astronaut

Thousands of UK students are about to embark on a unique mission to train like an astronaut and boost their health and fitness, with the launch of Mission X 2015 in January. Astronauts need to be in peak condition even before they journey into space so that they can help combat muscle loss and the changes their bodies will experience in a micro-gravity environment.

The Mission X programme is supported

by the UK Space Agency and astronauts such as Samantha Cristoforetti and British ESA astronaut Tim Peake, who said: “It is so important to exercise and eat healthily while you are young. Getting fit and staying fit will help you to do whatever you want with your life, even reaching for the stars!”

Mission X teams participate in several physical exercises and classroom lessons to become as fit as an astronaut. The students, aged 8–12, will take part in the mission for eight weeks and will have scores awarded after each exercise. At the end of the mission, the winning class for each country

will be announced. The Mission X website will allow teams to upload results, download educational material, check the results and share comments.

Team challenges will include 18 different physical and science “missions” including: Energy of an Astronaut, Base Station Walkback, Let’s Climb a Martian Mountain, Crew Assembly, and Do a Spacewalk.

**For more information:** schools can register for Mission X 2015 at [www.trainlikeanastonaut.org](http://www.trainlikeanastonaut.org) (mission challenges will start in January).

## Resource

### New space resources for the classroom

The education teams from the European Space Agency (ESA) and the National Space Academy have released five new teaching films which are aimed at an A-Level student audience or equivalent. The films mark the successful July launch of ESA’s final automated transfer vehicle, ATV-5, sent on its way to rendezvous with the International Space Station (ISS).

Each episode includes an introduction to one of the five ATVs – all named after scientists and visionaries – and an explanation of the science concepts associated with each one:



- *ATV-1 Jules Verne* looks at gravity, ballistics and multistage rocketry;
- *ATV-2 Johannes Kepler* covers orbits, Kepler’s Laws, simplified orbital mechanics and orbital reboost of ISS;
- *ATV-3 Edoardo Amaldi* includes cosmic rays, solar weather and the challenges of operating ATV in the space environment;

- *ATV-4 Albert Einstein* explores special relativity, general relativity, time dilation, GPS and relativity;
- *ATV-5 Georges Lemaître* explains the Doppler effect, spectroscopy, the expansion of the Universe and dark energy.

Accompanying the ATV videos is a new set of classroom video resources. The first of a new series of teaching resources called “Teach with Space”, these seven videos show experiments that can be performed in the classroom. They demonstrate the application of basic curricular physics and chemistry topics to real-life space science and engineering, such as rocketry and orbits.

**For more information:** and to access the videos, visit [bit.ly/1nLUApj](http://bit.ly/1nLUApj).

**EVENTS FOR TEACHERS****Solar Storms and Northern Lights**

Robert Gordon's College, Aberdeen  
1 December, 7.00 p.m.

Prof. Lyndsay Fletcher, University of Glasgow, will be giving a talk: "Why does activity on the Sun cause the nocturnal displays of Northern Lights, familiar at these latitudes?" The origin of the Northern Lights illustrates how the magnetic influence of our nearest star reaches out to affect us here on Earth, in both benign and threatening ways. No booking required and free to attend.

**Is the Future Nuclear?**

William Penney Theatre, AWE, Aldermaston  
8 December, 7.00 p.m.

Based on his extensive experience of working on the aftermath of the Chernobyl accident, Prof. Jim Smith, University of Portsmouth, will discuss the health and environmental risks of radioactivity, along with how the media has influenced our perceptions of these risks. Details and booking: e-mail [iop.lectures@awe.co.uk](mailto:iop.lectures@awe.co.uk).

**A Day for Everyone Teaching Physics**

University of Leeds  
7 January 2015

A series of practical workshops, inspiring talks, updates 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 lab and classrooms. Technicians and trainees are also very welcome. Details and bookings: contact Judith Higginson (e-mail [spn@dyhne.slcs.ac.uk](mailto:spn@dyhne.slcs.ac.uk)) or visit [www.slcs.ac.uk/go/net/RB814](http://www.slcs.ac.uk/go/net/RB814).

**ASE Annual Conference**

University of Reading  
7–10 January 2015

More than 300 sessions dedicated to science education across all subject areas and phases, offering hands-on activities for the classroom and inspiring talks from the forefront of science research. Details and booking: [www.ase.org.uk/annual-conference](http://www.ase.org.uk/annual-conference).

**ASE Scotland Annual Conference**

Robert Gordon's College, Aberdeen  
6–7 March 2015

Several workshops delivered by IOP Teacher Network Co-ordinators within a wider programme to support the teaching of physics, especially the new Higher and Advanced Higher Physics courses. The early-bird reduced rates deadline is Monday 8 December. Details and booking: [www.ase.org.uk/conferences/scotland2015](http://www.ase.org.uk/conferences/scotland2015).



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 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](http://www.iop.org/events/education).

**41st Stirling Physics Meeting**

University of Stirling  
21 May 2015

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: [www.stirlingmeeting.org](http://www.stirlingmeeting.org).

**Rugby Meeting**

Rugby School, Warwickshire  
4 June 2015

The 27th annual meeting for teachers of physics in schools and colleges will feature lectures given by leading research physicists and physics education experts, hands-on workshops where you can pick up new ideas, and an extensive exhibition area. Details and booking: [www.iop.org/rugby](http://www.iop.org/rugby).

**Science on Stage**

Queen Mary University of London  
19 June 2015

The Science on Stage festival is coming to the UK and will be open to day-visitors on 19 June. There'll be more than 200 stands from primary and secondary school teachers, plus talks, workshops, shows and more. Places are limited, £10 booking fee applies. Details and booking: [www.scienceonstage.org.uk](http://www.scienceonstage.org.uk).

**A Day for Everyone Teaching Physics**

Sjøvoll Centre at Pity Me, Durham  
25 June 2015

A free day of workshops and lectures (subsidised by IOP). Organised by IOP in conjunction with Durham University and the DYHNE Science Learning Centre. Details and booking: contact Ruth Wiltsher (e-mail [ruth.wiltsher@iop.org](mailto:ruth.wiltsher@iop.org)).

**EVENTS FOR STUDENTS****British Science Week**

Nationwide  
13–22 March 2015

British Science Week (formerly National Science & Engineering Week) is a 10-day programme of STEM events across the UK. Anyone can organise an activity, and support is available to help organisers plan their event. Details of free events and support resources: [britishscienceweek.org](http://britishscienceweek.org).

**The Big Bang Fair Near Me**

The Big Bang Fair is a free hands-on science day for key stage 3 and above. With interactive exhibitions and workshops from local, national and international STEM organisations, as well as a student competition, each event offers a fun day to engage with the potential of science, technology, engineering and maths in research, invention and careers. Find out more about your regional event at [www.thebigbangfair.co.uk/nearme](http://www.thebigbangfair.co.uk/nearme). The confirmed venues and dates are:

**The Big Bang Fair Yorkshire & Humber**

Doncaster Racecourse  
23 June 2015

**The Big Bang Fair South West**

The University of Exeter  
25 June 2015

**The Big Bang Fair South East**

South of England Showground  
30 June 2015

**The Big Bang Fair London East**

Newham College  
30 June 2015

**The Big Bang Fair London Centre**

Westminster Kingsway College  
1 July 2015

**The Big Bang Fair London North**

Stanmore College  
3 July 2015

**The Big Bang Fair Eastern**

IWM Duxford  
8 July 2015

# Blue sky thinking: thermal radiation and the greenhouse effect



Figure 1. Measuring the temperature of the sky with an infrared thermometer.

Infrared thermometers are cheap and readily available, making them ideal pieces of equipment for a starter activity on heating by radiation. They are also useful for introducing students to the physics of the greenhouse effect. The following experiment requires taking the students out into the playground for five minutes on a bright clear day.

## Instructions

- Introduce/review the concept of thermal radiation. Remind students that hot objects (such as the Sun) glow visibly, while cooler objects (such as the Earth) emit mainly in the infrared part of the electromagnetic spectrum.
- Ask students to point the infrared thermometers at objects in the classroom. They could also measure the temperature of their hands or foreheads. For small objects, the infrared thermometer needs to be close to the object in order to get an accurate reading – this is best done at a few centimetres distance.
- Once the students are familiar with the controls, take them outside and ask them to point the infrared thermometers at objects on the ground (in the shade) to find the temperature at ground level.
- Next, ask them to point the thermometer at a patch of clear blue sky and record the temperature, being careful to avoid pointing the thermometer at the Sun (see figure 1).
- Return to the classroom and discuss the results.

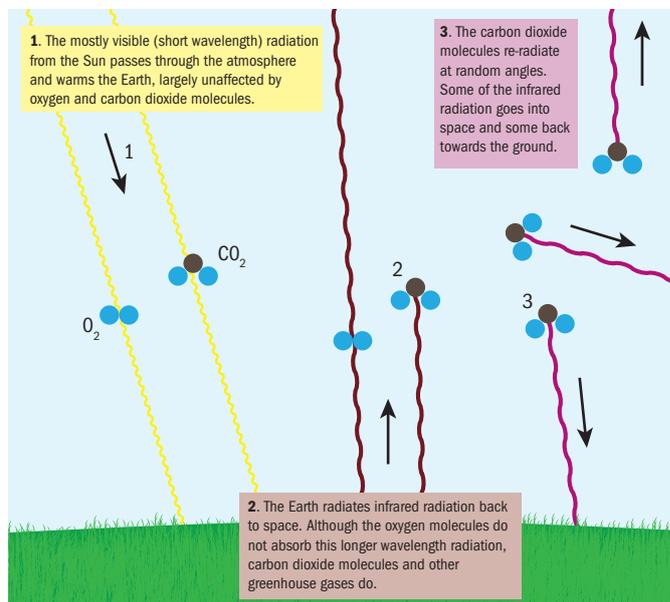


Figure 2. The physics of the greenhouse effect.

## Teaching notes

Ask the students what they think they measured when pointing the thermometer at the sky. Some will respond with “the temperature of the ozone layer”, others may give the answer “the temperature of space”. Point out that space is much colder ( $-270\text{ }^{\circ}\text{C}$ ) and that, although the ozone layer is a sensible answer, it is too high up to have a major impact on the temperature measured.

Discuss the composition of the atmosphere and explain that what they are actually measuring is infrared radiation emitted by, and hence the temperature of, greenhouse gases (see figure 2). If you want to extend this discussion, use the latest data from RMetS’ *Climate Change Updates* booklet, sent to affiliated schools/colleges with this issue of *Classroom Physics*.

**For more information:** and additional weather-related experiments, visit [www.metlink.org/experimentsdemonstrations](http://www.metlink.org/experimentsdemonstrations). To purchase a thermometer, search online for “infrared thermometer gun”; they cost between £10 and £20 each.

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