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Researchers and educators meet at Lund University

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Conference: The Big Bangor Day Meeting Lecture: Charterhouse plays host to a physics day
Festival: Science on Stage festival 2013 arrives in Poland Event: Scottish Physics Teachers'
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YOUR NEWS WANTED

The news section gives updates on what has been happening in physics education worldwide. Items included show how events in one country could be relevant to good practice elsewhere in the world. Contributions are welcome from all of our readers. They should be about 200–300 words long and can include pictures. Please e-mail your news items for the November issue of Physics Education to ped@iop.org before 19 September 2013.

CONFERENCE

The Big Bangor Day Meeting

The sixth conference for all those teaching physics in North Wales took place at Bangor University 11 June 2013. Dr Lyn Evans of CERN fame stopped off on his way to Japan, where he was going to discuss the next linear collider project. This was indeed a generous act—he left immediately after his talk for the airport to fly to Japan. His lecture ‘From the Large Hadron Collider to the next linear collider’ brought us up to date on what was going to happen next.

The rest of the day saw the 63 participants from 27 schools attend workshops, from which they went away with rainbow boards, a small wave generator, a singing rod and plenty of new ideas for the classroom. The weather was almost perfect, but could have been sunnier for the outdoors-based workshop.

Helen Francis from the WJEC provided updates on 14–16 and 16–18 qualifications in Wales,



Listening to light: a solar cell linked directly to headphones allows you to hear 50 Hz mains hum.

Professor Andy Newsam ran a workshop on robotic telescopes and Frank Lane and Lee White made yet another selection of gear. Gareth Kelly’s workshop looked at the mathematics used in 16–18 physics, which was the focus of his recently published book.

Feedback from the teachers

included:

- ‘brilliant and inspiring day’;
- ‘full of good ideas that can be used’;
- ‘it’s awesome!’;
- ‘a brilliant day’.

Next year’s conference is 18 June 2014.

Andrea Fesmer

LECTURE

Charterhouse plays host to a physics day

On 6 July Charterhouse school hosted the south-east’s Stimulating Physics Day. It started off with a talk by Professor Paddy Regan, specialist in radiation physics at the University of Surrey, ‘Radioactivity everywhere: how do we date the Earth?’. The

lecture was both extremely interesting and well delivered.

After that there followed a massive selection of workshops: cloud chambers, dragsters, Data-mouse, wind power, ‘What happens next?’, electromagnetic spectrum, and more, in what

seemed like an endless list.

Glorious sunshine and a fantastic venue made for a brilliant day as around 100 teachers gave up their own time to improve their teaching. Seeing those attending so keen to help out with tidying up after workshops and

always asking ‘can I help?’ created an atmosphere of the whole day being about constructing knowledge, rather than it being ‘delivered’.

Check out the Stimulating Physics web pages for next year’s event, as well as similar ones in other regions at www.stimulatingphysics.org/.

Gary Williams



Lunch on the lawn in the sunshine at Charterhouse.

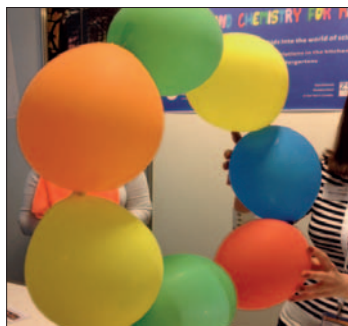
FESTIVAL

Science on Stage festival 2013 arrives in Poland

In late April, about 400 science educators from 22 European countries and Canada arrived at the tiny town of Slubice in Poland. Most had travelled via Berlin: then, arriving by train at Frankfurt (Oder), had crossed the river Oder (see picture opposite) on foot, by taxi or bus into Poland. The motto of Science on Stage is ‘By teachers for teachers’, and the title of this year’s event, appropriately for an event organized jointly by Germany and Poland, was ‘Crossing borders in science teaching’.

Stalls displaying the participants’ projects were spread throughout the Collegium Polonicum. The UK delegation had 12 displays, one of which showed the work of members of the College of Primary Science Teachers, 14 of whom were there and funded by AZSTT. Alessio Bernardelli’s video showing some of the highlights of the event can be seen at www.tes.co.uk/teaching-resource/Science-on-Stage-2013-6331806/.

There were some amazing displays of teaching ideas: from kindergarten to senior school, encompassing mathematics



teaching as well as science.

The pictures above show a Polish stall with linked balloons levitating and spinning spectacularly in the draught from a hair-dryer beneath the bench, and a display from Portugal designed to create images of the universe for visually impaired people.

One prize-winning exhibit was



an account of a teacher and pupil project with a solar balloon from the Lycee Jacques de Vaucanson, Tours, France, see www.vaucanson.org/php5/Accueil/index.php/les-articles/80-communication/536-version-anglaise-phaeton-the-solar-balloon.

These and more can be seen by following the links at

www.science-on-stage.eu/?p=214.

One idea that I will be trying is a tank filled with layers of sugar solution of decreasing concentration to show refraction. We were assured that this would be stable for two months once set up, which is an improvement on the salt solutions that we have used in the past.

One interesting feature of the festival was the accomplished on-stage presentations by groups of children from Poland, Germany and Denmark. These included a stunning rendition of tunes on water-filled glasses, building a Leonardo bridge and a review of the history of the light bulb. The presentations had been used at science festivals, fairs and school open days. The UK delegation also appeared briefly on stage: filling long balloons and making Marvin and Milo 'loud lollies'.

David Featonby from the UK delegation presented the popu-



lar 'What happens next?' IOP workshop in collaboration with colleagues from Slovakia and Poland. This workshop began at a previous festival. It has since been developed jointly as participants are encouraged to make links with teachers from other countries to develop projects and plan visits.

There were some fascinating insights into teaching across Europe: for example, it appeared that many physics courses for 16–18-year-olds are much more

mathematical than their UK equivalents. There are also huge variations in the funding available in schools for science teaching. The exhibits provided us all with much to inspire, discuss and take back to our own countries. Weeks after the conference, members of the UK delegation were still sharing ideas and working out how best to apply them.

Science on Stage 2015 'Illuminating science education' will be held at Queen Mary, University of London. In the closing ceremony (see picture above) the symbolic baton was passed from Poland and Germany to UK National Science Committee representatives Charlotte Thorley and David Featonby. The dates are 17–20 July, so book the date now, find an inspiring project, and get your pupils practising!

Ruth Wiltsher

EVENT

Scottish Physics Teachers' Summer School

The annual Summer School organized by the IOP and SSERC began with the IOP's Stirling meeting 22 May 2013. There was a good blend of education sessions, where teachers spoke about their experiences introducing the new curriculum (www.scotland.gov.uk/Topics/Education/Schools/curriculum/qualifications/faqs/faqsscqf), including the national 4 and 5 courses, and sessions showcasing cutting-edge physics. There was also a chance to visit the exhibitions and network with the 150+ people present.

The 24 summer school delegates, increased from the 20 or so of previous years due to the



Left: Gregor explains how to adapt a webcam to detect infrared.

Right: exploring the photonics explorer kit.



high demand for places, then transferred to Dunfermline for the night. However, it was up early and onto a bus in the morn-

ing to visit the University of St Andrews for a mix of lectures, talks and lab sessions expertly co-ordinated by Bruce Sinclair



(Left) Getting to grips with the netbooks. (Middle) Delegates explore fun experiments at the Best of Science on Stage session. (Right) Gregor demonstrating the Doppler effect with the help of the delegates.

and his colleagues. This offered a chance to find out about the research being done by a number of postgraduate students, the special and general relativity being introduced to the new Higher and Advanced Higher and the search for exoplanets; there was also the opportunity to do some practical work suitable for Advanced Higher students. Having returned to Dunfermline there was a more light-hearted after-dinner session when Tim Browett and Stuart Farmer did a Best of Science on Stage session, showcasing lots of cheap and novel ideas gathered from recent festivals.

On Friday, delegates spent the day in SSERC in Dunfermline, where delegates were presented with a netbook loaded with lots

of useful free software such as Audacity (<http://audacity.sourceforge.net/>) and Tracker (www.cabrillo.edu/~dbrown/tracker/).

Gregor Steele then took the delegates through a series of activities suitable for the new courses using the netbook and the software. This included getting the delegates to adapt a webcam to detect infrared. Brian Redman also delivered a hands-on session on the physics of flight, including investigations with propeller-driven aircraft made from foam plates. The evening was completed with teams of delegates competing for physics toys in a physics pub quiz.

The event was completed on Saturday morning with Gregor Steele, Stuart Farmer and Gordon Doig delivering two work-

shops—one on practical work for the Researching Physics unit for the new Higher and the other on Photonics Explorer (www.eyest.eu/Programs/Photonics-Explorer), which culminated in the delegates taking away a complete kit with class sets of lasers, LEDs, lenses, gratings, filters and the like to allow paired-pupil practical work for many optics and photonics topics.

All in all, a very hectic four days, but one that allowed a great group of people to learn new things, gain knowledge from each other and go home with the kit needed to allow them to implement what they had learned in their classrooms.

Stuart Farmer

MEETING

Researchers and educators meet at Lund University

The Nordic physical societies have arranged joint biannual meetings since 2009, bringing together researchers from all areas of physics (www.fysik.lu.se/english/npd2013).

In June, 328 physicists and teachers from Norway, Denmark, Finland, Iceland, Estonia

and Sweden (and a few from elsewhere, e.g. the UK) met at Lund University, Sweden.

There are separate Nordic sub-committees for different areas of physics, each suggesting an invited plenary speaker for their field, as well as a programme for their parallel sessions. The pro-

gramme thus combined updates of current front-line research across the fields of physics, and opportunities for more specialized talks.

The opening session finished with the education plenary speaker, Paul Doherty from the Exploratorium

(www.exploratorium.edu/) in San Francisco on 'Learning science by doing science'. A background to the work done by the centre was mixed with very interesting bits of physics in a rather unique way. Paul continued to share exciting experiments and demonstrations during breaks and poster sessions throughout the conference. For the very well-attended physics education parallel session he also spoke about the Exploratorium teacher institute, giving science teachers knowledge, support and inspiration during the summer weeks and continued network meetings.

During the education sessions, teachers and researchers shared results, experiences, materials and problems. Two of the sessions took place at the Lund University science centre, 'Vattenhallen', (www.vattenhallen.lth.se/), followed by a physics and laser show. Talks about apps and their use in the classroom and voting systems were among those that took place at Vattenhallen ('the water hall'), which had many hands-on displays—the rain not being the only thing to make those who walked to the centre wet.

Carlos Frenk from Durham University delivered a talk entitled 'Cosmology in your backyard' on Thursday, and the final talk on Friday was given by Jocelyn Bell-Burnell from Oxford



Paul Doherty talks about 'learning science by doing science'.

University, on 'Neutron stars and extreme physics', including of course, the discovery of pulsars. To celebrate the centennial of the Bohr atomic model, Peter Sigmund from University of Southern Denmark talked about 'Niels Bohr (1913) and the interaction of charged particles with matter'.

Lund University hosts the synchrotron radiation facility MaxLab (www.maxlab.lu.se/), with MaxIV under construction, as well as the planned European Spallation Source (<http://europeanspallationsource.se/>). The first evening of the conference finished with a panel discussion about the role of large-scale facil-

ities, for research and society. Participants also had the opportunity of site visits.

The combination of researchers and educators in the same meeting has many advantages.

Teachers and researchers in other fields share an interest in an overview of current research in different areas. University researchers also teach and many show an interest in ongoing research in physics education, even if they would not go to a specialized educational conference.

Ann-Marie Pendrill and Gary Williams

CONFERENCE

Exeter marks the spot

Once again the sun shone and this idyllic, quiet corner of Exeter University hosted the South West Physics Teachers Conference. There's an almost monastic feel

to the surroundings, enhanced this year by a falconer in the quad. I have no idea if he was connected to the conference, but he certainly attracted attention as

well as being interesting to watch.

The day consisted of workshops sandwiched between two lectures. The morning lecture was by Dr Lyn Evans and all

about accelerators and the LHC, with the final lecture by Professor Peter Winlove looking at biophysics. The workshops covered a broad range of topics, with cloud chambers being made from fish tanks, the new IOP physics of football resources being introduced, and apps, music festivals, practicals for 16–18 students: there was something for everyone.

During lunch there was the chance to chat as well as to look around the large number of stalls from retailers and other organizations, such as the Met Office.

This was the last conference to be organized by Alison Alexander, who started the conferences, and made them a great success. Alison and the staff at the University of Exeter and the SW Science Learning Centre have managed to make a conference that feels like it belongs to the university while at the same time creating the feeling among the teachers that the university belongs to them. It has a unique atmosphere about it. Next year's conference will have a new main organizer, but will no doubt be another roaring success.

Gary Williams



(Top) Alison Alexander welcomes everyone to the conference.

(Bottom) Making cloud chambers from fish tanks.

RECOGNITION

European Physical Society uncovers an historic site

The European Physical Society (EPS) has—after a nomination from the Swedish Society—decided to declare the place where the astronomer Tycho Brahe (born in 1546) made his famous observations of the planetary system to be an EPS historic site. For more than 20 years—in the period 1577–

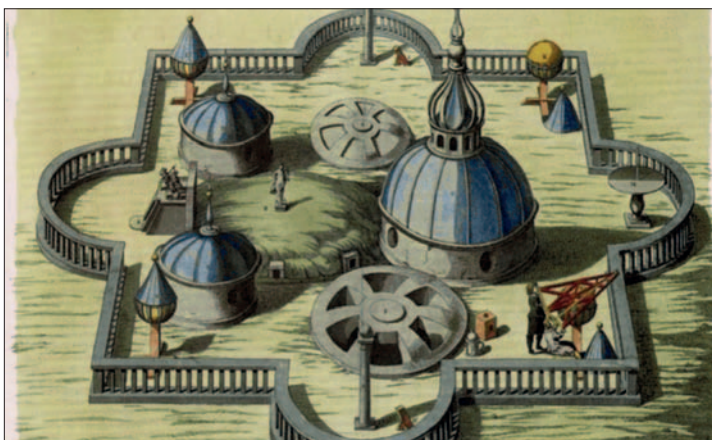
1597—Tycho Brahe's observatory on the island of Hven was the most advanced research centre in Europe. The work done there played an essential part in shaping our modern picture of the world. His detailed notations of the positions of the planets were, after his death in 1601, analysed carefully by

Johannes Kepler. From this analysis Kepler was able to formulate his three laws describing the movements of the planets. Three-quarters of a century later, Kepler's laws contributed to Isaac Newton formulating his laws of power. The site of Tycho Brahe's observations—on the central part of the island Hven

in Øresund between Denmark and Sweden—today contains a small museum, some remains of the observatory Stjerneborg, and some fragments of the combined renaissance castle and observatory Uraniborg.

The ceremony to mark this research place as an EPS historic site will take place 11 September 2013. It is being arranged by the Swedish Physical Society, the town of Landskrona to which the island Hven belongs and Lund University. A report on the ceremony will be published in a later issue of *Physics Education*.

Ragnar Hellborg



Stjerneborg, the second observatory built by Tycho Brahe on the island of Hven, was designed with five great cellars/amphitheatres to house giant instruments. Stjerneborg was purpose-built as an observatory. Uraniborg, the first observatory, was a combination of observatory, chemistry lab and family home. (William Blaeu, c. 1595)

EDUCATION

Initial teacher education undergoes big changes

Initial teacher education (ITE) for physics teachers in England (specifically: education is devolved in Northern Ireland, Scotland and Wales) has, along with ITE in other subjects, been undergoing significant change over the last two years.

ITE in England had been evolving slowly since major changes in the early 1990s. A series of government circulars in the late 1980s and early 1990s required higher education institutions (HEIs), mostly universities, delivering teacher training to set up partnership schemes with schools, with two-thirds of the trainees' time spent in school and one-third in the HEI, and also allowed institutions outside higher education (such as schools and local authorities) to deliver ITE. The diversification of routes into teaching was accelerated by the Labour government from 1997 onwards, partly in response



to shortages of secondary school teachers, especially in the sciences and maths. The Graduate Teacher Programme (GTP) was one of those alternative routes and was introduced in 1998 in England and Wales for graduates who wanted to gain qualified teacher status while working as an

unqualified teacher. Teach First, another employment-based route, was introduced in 2002, although it makes a relatively small contribution to the pool of science teachers (see table overleaf).

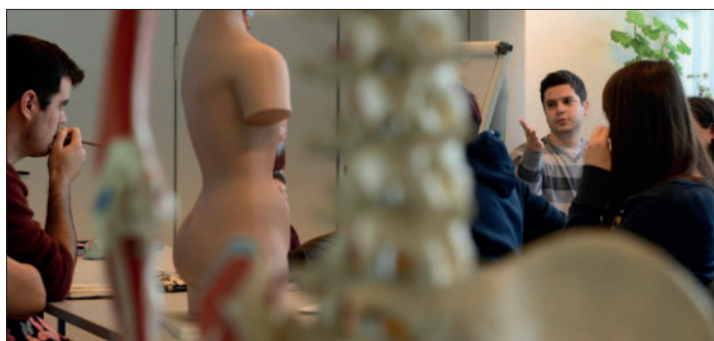
There are fundamentally three qualification routes: a three- or four-year undergraduate degree

focused on education (BE_{Ed}); a one-year postgraduate qualification (PGCE); or a one-year school-based training for graduates (such as the GTP). These all lead to what is currently called qualified teacher status (QTS). In 2007, the then Labour government committed to making teaching a Masters-level profession, following the Finnish (among others) model, but this commitment has largely not been achieved, although the PGCE qualification is at Masters level and can contribute part of a full Masters degree.

Over the same time-frame, trainee teachers (other than those on the GTP and Teach First programmes) were required to pay university fees—£1000 per year from 1998, £3000 from 2004 and now £9000 since 2012. In parallel with this, the government offered bursaries of variable amounts to those trainees in shortage subjects, with physics always being one. Currently, physics trainees with a first-class honours degree are given a bursary of £20 000, with a 2.1 securing £15 000 and a 2.2 £12 000.

Also in 1998, national standards for the award of QTS replaced the more general ‘competencies’ previously set out by the Department for Education. These were substantially revised in 2002, with 42 separate statements. Further revision in 2007 reduced the statements to 33, and the most recent revision came into force in September 2012, with eight teachers’ standards currently in place (see www.gov.uk/government/publications/teachers-standards).

The number of teachers in training has historically been



allocated to providers centrally by government agencies (the Teaching Agency (TA) most recently), so there was a national quota system operating and a central overview of the annual situation. The number of physics teachers successfully completing training has been difficult to estimate for most of this time, as providers trained ‘science’ teachers, catering for the ‘science’ nature of the vast majority of qualifications taken in science at GCSE, the main qualification taken at the end of compulsory education, aged 16. However, in 2010 quotas given by the TA to HEIs first split the numbers into the three separate sciences, significantly reducing the number of biology teachers in training (not considered to be in such shortage as those for chemistry and physics). Undergraduate education degrees have always produced very low numbers of physics teachers (below ten annually), and most physics teachers entering the profession have historically had undergraduate degrees in physics or engineering, and have followed a postgraduate route to QTS.

In a further effort to increase numbers entering the profession, the Institute of Physics, working with Gatsby, the government and

a variety of HEIs, introduced a six-month pre-PGCE course in physics (called the Physics Enhancement Programme). This developed into government-funded courses of varying length (mostly from 12 to 36 weeks), called physics subject knowledge enhancement courses, run by HEIs. Nationally, in the last two years (2010–1 and 2011–2) there have been over 500 SKE trainees per year progressing onto the physics teacher training courses, which is more than half the whole subject allocation of around 900 (from *Evaluation of SKE courses 2010–11* <http://ow.ly/nunOR>). Figures for successful completers in the main routes for the last three years are given below (from *The Good Teacher Training Guides* at www.buckingham.ac.uk/research/ceer/publications):

Route	2010	2011	2012
PGCE (physics)	316	470	639
GTP (physics)	65	50	55
Teach First (science)	51	98	85

The very encouraging increase, particularly from 2011–2, is probably in part due to the SKE courses, and also to the high bursaries supporting well-qualified physics trainees.

Early in the life of the new coalition government (elected in 2010), the new Secretary of State for Education, Michael Gove, announced in the schools white paper (*The Importance of Teaching*) that initial teacher training would be reformed so that more training was on the job, and that teaching schools would be created, giving outstanding schools the role of leading the training of teachers.

‘We will provide more opportunities for a larger proportion of trainees to learn on the job by improving and expanding the best of the current school-based routes into teaching—school-centred initial teaching training and the graduate teacher programme [...] Our strongest schools will take the lead and trainees will be able to develop their skills, learning from our best teachers.’

The GTP programme was terminated, to be replaced by the School Direct (SD) programmes, and initially the role of HEIs in this new world was unclear, despite the centrality of HEIs in ITE in those global jurisdictions valued highly by the Secretary of State. In the light of the white paper, the government’s education select committee launched an inquiry into the recruitment, training and retention of teachers, and in their wide-ranging report (2012) (<http://ow.ly/nuoTC>) stated that ‘we believe that a diminution of universities role in teacher training could bring considerable demerits, and would caution against it’. The SD programme that was subsequently developed involved partnerships between groups of schools (mainly teaching school

alliances) and HEIs, with schools bidding for places according to their perceived needs, and negotiating with HEIs over how training would be split between them. The HEIs currently still have nationally allocated quotas for PGCE (now called ‘core’ places), but there are no future guarantees of core places, even for ‘outstanding’ (as judged by Ofsted) providers.

The responsibility for recruitment to SD places now lies with schools, frequently working with their HEI partners, and during 2012–3 a great deal of time has been spent on recruitment, with mixed success. The SD programme recruited its first trainees in 2012, and these trainees, at the time of writing, will have just attained QTS. Figures are not yet available, but it is likely that about 500 SD trainees were trained nationally, very few of whom will have been physicists. The system has been considerably expanded for entry in September 2013, although again it is difficult to get any sense of numbers recruited to start in two months’ time. Indications are that about 5000 out of a possible 10000 places have been filled, in the context of about 35000 trained nationally in previous years (primary and secondary). Recently published research indicates that about 25% of the physics SD places available have been filled (<http://ow.ly/nuqIM>). However, allocations for core physics places at HEIs were increased during the year, so hopefully the overall picture is not so grim.

The SD programme is still in its infancy and doubtless the situation regarding recruitment will adapt to the market in future

years, although concerns have been expressed about the uncertainty for physics recruitment numbers, especially after the very encouraging gains made over the last three years. Another concern relates to the possible quality of training in school when SD places will often have been asked for because of a shortage (or even a complete lack) of physics specialists in schools. However, the fact that schools are working in alliances, and also in partnership with HEIs (who are still responsible for overall quality) may allow for creative development of training strategies. One very definite gain is that the conversations between HEIs and their partnership schools have become much more robust, and there is much more understanding of the roles of both partners in the training process. Considerable numbers of partnerships are effectively continuing as before, with schools and universities arranging that their SD trainees will follow the same PGCE programme as the core trainees in university.

The future of SKE programmes is also being reviewed and, at the time of writing, providers are waiting to hear (probably until mid-October) what this will look like in 2013–4. The DfE consultation on their proposal for the future of SKE has recently closed, and their policy should be published soon. The recently published *Evaluation of SKE courses 2010–1* (<http://ow.ly/nunOR>) was very encouraging, and hopefully will also influence the decision-making process.

The future for universities in this new world of ITE has become uncertain, and some providers have already stated

that they intend to close their ITE provision. The major driver in this is the lack of certainty about student numbers, and the consequent impossibility of long-term planning. Some universities, however, have a strong commitment to their involvement in the future training of teachers and are determined to adjust and adapt to changing government

ideologies, in the certain knowledge that for teacher training to remain a high-quality Masters-level teaching and training programme, the universities must continue to have a role to play. This was neatly summed up by this comment in the Education Select Committee (2012) report: 'The evidence has left us in little doubt that partnership between

schools and universities is likely to provide the highest-quality initial teacher education, the content of which will involve significant school experience but include theoretical and research elements as well, as in the best systems internationally and in much provision here.'

Caro Garrett

Forthcoming Events

If you have an upcoming event that you would like to publicize, e-mail clare.thomson@iop.org.

September

2-7 10th Conference of the European Science Education Research Association (ESERA), Nicosia, Cyprus. For information go to www.esera2013.org.cy/

7-12 British Science Festival, Newcastle-upon-Tyne, UK. A celebration of science, engineering and technology, and the role they play in our lives. See www.britishscienceassociation.org/british-science-festival

October

2 12th Annual Welsh Physics Teachers Conference. A free day of presentations and workshops for physics teachers and technicians. Contact cerianangharad@gmail.com for details

4-10

World Space Week. 'Exploring Mars, discovering Earth.' See www.spaceweek.org

24-26

National Science Teachers Association Area Conference in Portland, OR, USA, with the theme 'Bridges to the future'. For more information go to www.nsta.org/conferences

November

7-9

National Science Teachers Association Area Conference in Charlotte, NC, USA, with the theme 'Racing towards science excellence'. For more information go to www.nsta.org/conferences

December

12-13

National Science Teachers Association Area Conference in Denver, CO, USA, with the theme 'Science runs through it'. For more information go to www.nsta.org/conferences

13-15

IOP Autumn Physics Update (Engineering Department, University of Cambridge, UK). A three-day residential course featuring a stimulating programme of talks and

workshops. For details and booking visit www.iop.org/update or contact Manchi Chung (e-mail manchi.chung@iop.org)

January 2014

4-7

American Association of Physics Teachers Winter Meeting, Orlando, FL, USA. For more details see www.aapt.org/conferences

8-11 Association for Science Education Annual Conference, University of Birmingham, UK. The major science education CPD event for all those involved in science education. For details go to www.ase.org.uk/conferences/annual-conference

February 2014

15-18

Physics in Perspective, London, UK. A three-day enrichment course organized by the IOP for sixth-formers and college students. For details and booking visit www.iop.org/pip or contact Manchi Chung (e-mail manchi.chung@iop.org)