Ermysted’s Grammar School in Skipton, North Yorkshire, UK, hosted its first physics summer school. The purpose was to provide an opportunity to challenge and stretch some very able students from across Yorkshire and Lancashire.

A total of 35 year-12 students (17–18 year olds) gave up four days of their summer holidays to attend lectures on topics including classical mechanics and quantum physics. The aim was to cover material in enough depth to allow students to discover the analytical power of physics. Richard Feynman famously said ‘To those who do not know mathematics it is difficult to get across a real feeling as to the beauty, the deepest beauty, of nature.’ This was the philosophy behind the lectures. For example, the quantum-mechanics lectures (three, each lasting for one-and-a-half hours) offered a pragmatic approach to the subject, concluding with the solution to Schrödinger’s equation for the idealized infinite square-well potential. The core aim of the course was to redress the lack of mathematics in current physics specifications. Students gained an insight into the role of differential and integral calculus in mechanics and were shown how to solve first-order and second-order differential equations.

Academic lecturers from Leeds, Liverpool and York Universities gave undergraduate-style lectures on topics such as special relativity and quantum entanglement. Undergraduate students from Oxford and Cambridge Universities provided support throughout the course. They also described the Oxbridge application process in detail and provided personal insights into life at an elite university.

The students were also taken on a day trip to the physics department at Lancaster University, where they were treated to some exciting demonstrations, including playing Oasis through a Rubens tube, firing giant smoke rings across the room and fun with liquid nitrogen. In the afternoon they worked in small groups under close supervision from postgraduate students on apparatus such as Milikan’s oil-drop experiment, the electron diffraction tube, the fine-beam tube, and ultrasonic equipment to perform a number of experiments in the undergraduate labs. This was an opportunity for the students to perform experiments that would normally only be demonstrated or described from a textbook when back at school.

The summer school concluded with the teachers, lecturers and students enjoying a meal at an Italian restaurant in Skipton. One of the highlights was that very able and like-minded students from different schools could come together and share their experiences. They felt at ease with each other as they shared similar interests and aspirations.

The students were positive and constructive in their feedback on the summer school.
The assembled participants at Ermysteds Grammar School’s first physics summer school.

One wrote: ‘This course has whetted my appetite even more... by showing me the breadth, challenge and depth of the subject.’ Another described ‘a very professional learning environment’ and ‘[they] particularly enjoyed being able to talk to professional physicists/physics students’.

As a pilot project, the summer school has been a huge success. The energy and enthusiasm of the students was infectious and the constant barrage of intelligent and well-thought-out questions was particularly pleasing.

The summer school was funded by the Ogden Trust and the Institute of Physics (Yorkshire and Humber branch). It was made possible thanks to the support of staff at Ermysted’s Grammar School. Thanks also to Mr Derek Fry from Leeds Grammar School.

Contact Dr Devinder Gill if you would like details for the 2013 summer schools.

Devinder Gill (e-mail dgill@ermysteds.n-yorks.sch.uk)

Back to school with the IOP and SSERC

The date of the Physics Teachers’ Summer School approached and post-exam-preparation euphoria began to wear off. Did I really want to go back to school? If only I had known what I know now.

The summer school, although technically not in summer, was one of the best physics-CPD events I have been to. It ticked all the boxes—I met up with old colleagues, met new and ‘infamous’ members of the physics community and even learnt a thing or two. The sessions had been carefully tailored to reflect not only the latest changes and initiatives in physics education, with sessions focused on the new Scottish Revised Higher, they had also managed to arrange...
workshops on Tracker (http://www.cabrillo.edu/~dbrown/tracker/) and Audacity (http://audacity.sourceforge.net/). How did they know what had been on my to-do list for ages and that I would now be able to halve my workload?

Care had been taken to vary our activities, starting with the IOP Stirling Physics Meeting followed by a day trip to the University of St Andrews and workshops and talks at SSERC and in the hotel in Dunfermline. I found the laboratory sessions, lectures and field trips to be enlightening, informative, reassuring and even mind boggling, at times. All this combined with stimulating conversation, great company, good food, a trip to the seaside along with free loop-the-loop car sets—what’s not to like?

The next IOP/SSERC Scottish Physics-Teachers’ Summer School is scheduled to take place 22–25 May 2013.

Dawn Pirie

Tasker Milward School in Haverfordwest, Wales, has launched a ‘point and click’ camera, tied to a meteorological (‘weather’) balloon high into the stratosphere into the region classified as ‘near space’. The camera captured images throughout the ascent as the balloon climbed, while electronic sensors captured data to profile the temperature throughout the atmosphere. A GPS module relayed information on the balloon’s position throughout the flight, which was received by a radio receiver on the ground. This allowed the team to track the balloon as it climbed, and subsequent analysis of the data will provide information on the wind speed, ascent and descent rate of the payload. The balloon climbed to a maximum height of 32.7 km, reaching temperatures as low as −40 °C. The images captured at maximum altitude showed the curvature of the Earth, the blue glow of the atmosphere and the blackness of space. Weather systems could be seen as the camera captured images from this maximum altitude, before the payload started to plummet back to Earth. The initial descent rate was around 90 mph and the payload took 32 min to fall to its eventual landing point in a field of cows near St Clears.

Flight-summary data
● The balloon climbed at a rate of 2.77 m s⁻¹ and reached

Measuring the temperature of the sun using radio waves.

Up and away ... camera climbs to heights by balloon
a maximum altitude of 32.722 km.

- The balloon took off at 11.30 a.m. and the ascent took 3 h and 14 min. The balloon burst at 2.44 p.m.
- The balloon had an initial descent rate of 40.17 m s\(^{-1}\) (89.5 mph, more than 140 km h\(^{-1}\) and significantly faster than a speeding car on a motorway).
- The descent took 32 min. (A typical skydive lasts notably less than 10 mins.)
- The balloon had a final descent rate of 9.94 m s\(^{-1}\) (approximately 20 mph).
- The lowest temperature reached was –40.7 °C (–41.3 °F).

The idea of launching a payload into space was the brainchild of Connor Goddard after he came across the Spacebits website (www.spacebits.eu) while researching for A-level coursework. Connor then discussed the idea with friends Tom Morgan, Kristian Skoczek and Tom Llewellyn, and the group asked their physics teacher about the viability of the project and for support. Tomos Griffiths then joined and played a vital role in designing, developing and building the electronics for the payload. When Connor Goddard left for university, the work was carried on by the rest of the group, including students from year 9, Albert Ugwudike and Tom Evans, and other members of staff.

‘We couldn’t understand when it landed why it was still moving...we found a field full of young heifers...trying to play football with it,’ said Connor Goddard, ex-sixth-former. For Tomos Griffiths, joint project leader, ‘Seeing the pictures for the first time was incredible. The realization that all the hard work had paid off made it all worthwhile.’ Albert Ugwudike, year 9, found the project equally engaging: ‘I have a strong interest in astronomy and I was fascinated by the stunning images that were captured.’

The team can be contacted for additional information. There is also an ITN news report that can be viewed at http://www.itv.com/news/wales/2012-07-11/a-view-of-pembrokeshire-from-space/. A TalkPhysics group for discussion on how to send a balloon into space can be found at http://www.talkphysics.org/groups/3435, and more information is available on the schools’ website: http://physics.taskermilward.org.uk/high_altitude_balloon.htm.

Dorian Pascoe project leader (e-mail dorian.pascoe@hotmail.co.uk), Connor Goddard lead student (e-mail connor.goddard@gmail.com) and Tomos Griffiths joint project leader (e-mail tomos.j.griffiths@btinternet.com)

EXAMS

The ‘last ring’ before Poland’s matura exam

Among many exams that conclude particular educational levels, the most important in Poland is the matura exam. It is taken at the end of high-school and its results determine students’ enrolment into university. However, most students delay their preparation for the matura exam until the last moment and then usually look for some help with their exam preparations. The workshop, titled ‘The last ring before matura exam in physics and astronomy’, was intended to meet such expectations of assistance with exam preparation.

The workshop was organized at the Department of Physics, Astronomy and Applied Computer Science, Jagiellonian University.
University in Cracow, Poland, by a group of students. Their aim was to help by providing revision of the most important areas of physics and to give students an opportunity to ask questions that they may not consider asking at school. An equally important aspect of the workshop for high-school students was to gain practical advice from people who had just passed the matura exam. The workshop was attended by 53 graduates from south Poland, which is a significant proportion of the student population taking the matura exam in physics.

The workshop started with a lecture titled ‘The most common mistakes and pitfalls during the matura exam’, which was given by MSc W Zawadzki, where students learned how to deal with some tricky matura questions. At the end of the talk students received a ‘matura briefcase’, containing a personalized timetable and exercises prepared for each student. There were also leaflets encouraging them to study physics at Jagiellonian University. Next, every student took part in three successive workshop groups. Parallel groups were organized in six fields of physics: mechanics, thermodynamics, vibration, waves and optics, electricity and magnetism, gravity and astronomy, and particle physics and the structure of matter, which covered all the topics of the respective part of the matura exam. Students had to choose the workshops they wanted to attend by registering at the dedicated website two days before the event, at the latest. Workshop groups were led by 14 university students from four scientific circles. Five additional students were responsible for technicalities such as coffee breaks and registration.

To improve the quality of future workshops, an evaluation questionnaire was prepared and posted on the workshops’ website. The 31 answer sheets containing students’ suggestions that were received from participants enabled organizers to come up with some proposals for future improvements to the workshop. Considering the fact that 97% of respondents would like to participate in such a workshop not only once but regularly during the school year and would recommend it to their younger friends, we believe that the workshop was a great success.

We are grateful to Dr Zenon Rajfur for careful reading of the report.

Daniel Dziob and Urszula Górska
Institute of Physics, Jagiellonian University, Cracow, Poland
Students

The International Physics Olympiad 2012

The UK once again celebrated success at the International Physics Olympiad (IPhO) with all five team members returning home wearing medals.

Adam Brown (Alcester Grammar School, Warwickshire) was ‘happy and surprised’ at achieving a silver medal but like his team mates, Eric Wieser (Hills Road Sixth Form College, Cambridgeshire), Frank Bloomfield (Colchester Royal Grammar School, Essex), Peter Budden (King Edward VI School Southampton, Hampshire) and Richard Thorburn (Lingfield Notre Dame School, Surrey), he felt the competition was ‘much more challenging than expected’.

The team was selected from 1700 students from over 300 schools who participated initially in the British Physics Olympiad (BPhO) competition in November 2011. They undertook a number of theoretical papers, practical problems and training camps in the lead up to IPhO to ensure their place on the team. Their hard work paid off when the team competed against 80 countries to achieve two silver and three bronze medals for their results in two demanding five-hour exams in theoretical and experimental physics.

One of the practicals in the competition investigated the diamagnetism of water, in which the magnetic field of a neodymium magnet placed under water created an observable dip in the millimetre depth of water above. The students measured the resulting change in the shape of the surface of the water with a laser. However, it was the second experiment the team enjoyed the most because it was a ‘fun challenge’. Here they did a series of tests to identify the properties of a nonlinear electrical component (a tunnel diode) in a black box.

Paul Nicholls, physics teacher and team coach, was also pleased with the practical results and felt that this had a lot to do with the ‘hands-on approach underpinning physics teaching in the UK’. Paul believes that we should ‘continue to build upon this strength in future Olympiads’.

This year the competition took place in Estonia in July 2012. During their stay the students had some free time to relax and...
sightsee, and Peter spoke for the group when he said ‘we were all looked after so well, everyone was so friendly’. The students also played in the IPhO football tournament and afterwards Eric joked, ‘not only did we win medals in physics but we also won two international football matches’.

Visit www.bpho.org.uk for more information about the competitions and for access to past papers and resources.

Sian Owen

**Optoelectronics**

Experiments illustrate union of light and electricity

Optoelectronics is the marriage of light with electricity, and is a powerful tool for attracting the interest of students. It is the basis for television, medical imaging, communications, mobile phones, digital cameras, CD players, computer screens, and much else that we use regularly in our daily lives.

The Rank Prize Fund has designed three sets of hands-on experiments illustrating facets of the subject of optoelectronics, and is introducing them into schools throughout the UK.

Local teachers spent a day in the Spring term at Holland Park School trying out the kit for each of the experiments, and were taken through the ways it can be used in the classroom. Teachers enjoyed the activities, which included a competition between teams involving solar-panel cars. Participants also received the kit free of charge.

For more information see http://www.opto.org.uk/.

Niloufar Wijetunge
New Technology
Day of new and future technologies inspires teachers

As part of the Stimulating Physics support programme, Dr Simon Foster (Outreach, Imperial College) and Niloufar Wijetunge (Physics Network Co-ordinator, London) organized a physics experience day for teachers of physics, which was held at Imperial College in July.

The aim of the day was to inspire and encourage teachers to include the application of new and future technologies in their teaching.

PhD students gave talks about the current research taking place in the three new Centres for Doctoral Training, a new initiative to train PhD students in the UK. These centres work on controlled quantum dynamics, theory and simulation of materials, and plastic electronics. Teachers learnt how these areas are applied to real-life technologies. The lab tours at the end of the day allowed teachers to meet and speak to other researchers who demonstrated the daily work they carry out.

Meeting
Physics educators gather at 1st SEEMPE

Research into physics education and its quality development is increasingly important. At the same time there is a growing need to share research experiences, new achievements and ideas that can make physics more attractive to pupils from kindergarten or primary school as well as for university students. The aim of the 1st South Eastern European Meeting on Physics Education (SEEMPE) 2012 was to bring together teachers, researchers and scientists from neighbouring countries in the south-eastern region of Europe who work in physics education. The meeting took place at the Faculty of Education, University of Ljubljana, Slovenia, on 11 and 12 September. Close to 40 participants, mostly from Slovenia, Bosnia and Herzegovina, Croatia and Serbia attended the meeting, but there were also attendees from Poland, Austria, the United States and Mexico.

The goals of the meeting were to exchange educational experiences, bring together people engaged in teaching physics and in physics-education research and to give them the opportunity to discuss various problems and start new initiatives or projects. Participants reported the results of their research in 24 talks, two workshops and 10 posters, indicating that this part of Europe is active within this field. The meeting was organized as a single session, allowing all of the participants to attend all of the presentations.

Talks allowed participants to become familiar with the research topics of various groups from neighbouring countries. They can be divided into three main categories: modern technology in physics education, pedagogical issues, and projects in...
In May 2012 a memorandum of understanding was signed between the Institute of Physics (IOP), the South-Sudan Ministry of Education and the Juba Diocese, to train physics teachers in practical skills and establish a resource centre where physics apparatus is constructed and distributed to schools.

Thanks to the amazing support of many individuals and organizations—David Richardson of Clifton College, IOP for Africa, the Salisbury Diocese, LabAid, Rapid Electronics, Mission Aviation Fellowship and Avient Aero—the team was able to take over 400 kg of equipment to South Sudan this summer.

In the first week 17 teachers from five out of the 10 South-Sudan states were trained and instructed in how to use apparatus at school. All the poster sessions were combined with coffee breaks, which stimulated discussion between participants.

Based on the feedback of participants, the meeting was considered to be very successful. Bringing neighbouring research groups together and giving them a unique opportunity to present their research was a good idea, which should become a tradition. The participants therefore decided at the closing session that the SEEMPE meeting should become a biennial event in this region of Europe.

Daniel Dziob, Institute of Physics, Jagiellonian University, Cracow, Poland, Urszula Górska, Institute of Physics, Jagiellonian University, Cracow, Poland and Katarina Susman, Faculty of Education, University of Ljubljana, Ljubljana, Slovenia

South Sudan on the globe.
tus in their physics teaching. This included sessions on Newton’s laws, energy, electric circuits, optics and vibrations, and undertaking investigations. At the end of the week each teacher was able to take a kit bag of apparatus back to their school.

We observed the teachers undertaking practical physics lessons with groups of students from the Juba Diocesan Model Secondary School (JDMSS). Nelson wrote in his evaluation: ‘These practical ideas will make our students love the subject very much.’ Noel commented: ‘I am particularly happy because I have acquired enough teaching skills to make physics a reality.’ Matthias, a science teacher for 25 years, said: ‘It is the first time in my life I have used apparatus. I would like to encourage this type of training.’ Michael summed up everyone’s feelings: ‘It will help me teach my students about physics practically rather than theoretically.’ Archangelo realized: ‘I have learnt to teach students in less time with maximum understanding by linking the practical and theoretical simultaneously.’

A key aspect of our time in Juba during the second week was to train two school leavers as science technicians to work at JDMSS and establish a resource centre where apparatus is constructed. Cleopas and Noel also attended the earlier teacher training. Cleopas worked with the parallel biology/chemistry team, while Noel was trained as a physics technician, able to construct apparatus using the tools we had imported in a 180 kg crate.

A concern was whether a week’s training in the practical skills of using tools such as a pillar drill and soldering iron would be sufficient, but we met Louis, a retired South-Sudanese Moravian missionary, who learnt technical skills in Germany during the Troubles. He will work alongside Noel and Cleopas, ensuring that the work is sustained.

In the third week we travelled 100 miles south-west to Yei on a six-hour journey to appraise the impact of the training from 2011. Martin, an outstanding physics teacher from last year’s training, works at Kinji Secondary, a very poor school in Yei. We invited other local physics teachers to a day’s physics training and used some of the apparatus that Martin received last year, which he stores in a suitcase and brings to school each day on his motorbike.

By chance we met Agoyi, the dean of students and head of science at Yei Teacher Training College, whose aim is to raise the scientific literacy of primary teachers. Martin and Agoyi have now set up a Stimulating Physics Network that will meet regularly in the lab at the college, bringing local science teachers together to share practical ideas for teaching physics. Amazing!

Gerry Blake  IOP for Africa,
South-Sudan co-ordinator