

NEWSLETTER

August 2008

A note from the editor

Once again it has been a very busy and productive time at the Institute of Physics in Scotland. This issue highlights many of the fantastic projects that we sponsor to promote physics to a wider audience. Quite a few of these events concentrate on astronomy, which has been shown to be an inspiring subject to young people in particular.

Next year has been billed as the International Year of Astronomy (IYA), and the Institute of Physics will be fully involved in promoting this. If you have any events that you would like to develop for IYA or anything else, details of how to apply for a grant from the branch are in the adjacent article.

The Institute of Physics also

organises its own activities and the Lab in a Lorry dedicated to Scotland has been especially successful and has attracted a wide audience, including one government minister.

Parliament and policy work has been dominated by the announced changes to the school curriculum and qualifications framework, and I talk about those in more detail on p5. Our careers in physics series continues with an interview with an intellectual property manager on p4.

As always, if you are interested in getting involved in any branch activities, please feel free to contact me (alison.mclure@iop.org).

Alison McLure

IOP grant scheme helps members to reach out

The Institute of Physics in Scotland actively encourages its members and others to communicate exciting aspects and applications of physics to a wide audience. The Institute in Scotland's grant scheme offers up to £2000 to individuals and organisations that are running physics-based events and activities. Examples of such events are highlighted in most branch newsletters.

The scheme aims to support and encourage projects that:

- raise public awareness of, and engagement with, contemporary physics;
- inspire and enthuse young

people, especially those not previously interested in physics;

- help individuals to develop relevant communication skills;
- reach audiences beyond the classroom and workplace.

The branch committee has recently developed guidelines for these grants and would encourage all members to see if their great ideas might attract our funding. Further details and an application form can be found on the IOP Scotland branch website (www.iopscotland.org/activity/Engaging%20the%20Public/page_25699.html) or from alison.mclure@iop.org.

Alison McLure

Primary pupils enjoy stellar event

Pupils from Clackmannanshire primary schools reached for the stars recently when they participated in two evenings of Earth and space activities.

Following a successful pilot activity last year, capacity was doubled to meet the demand from schools to participate. Eight schools took part in the activities that were held on 25 and 26 March.

The event was part-funded by the Institute of Physics and was a partnership between the Forestry Commission, Glasgow Science Centre, Stirling Astronomical Society and Clackmannanshire Council's Determined to Succeed team.

The event was held at David Marshall Lodge in Aberfoyle, chosen specifically because of its location as it provided the

opportunity for pupils to explore the night sky in an area with low levels of light pollution. It was a beautiful setting.

The activities were partly weather dependent, but once we realised that it was not going to be a clear evening the astronomers swiftly moved to a "plan B" of activities that were still interactive for the pupils. Unfortunately the weather was the one aspect of the events over which we had no control.

Forty pupils from four primary schools took part each evening and the aim was to reinforce what they have learned at school through their Earth and space topic work. Pupils witnessed a practical demonstration from the Glasgow Science Centre on how comets are made, and everyone



Primary pupils discover there's a lot to learn about the night sky.

took part in a forces and motion workshop where the children constructed rockets and then launched them outside.

Despite the weather, pupils also had the opportunity to work with enthusiastic local amateur astronomers from the Stirling Astronomical Society. Pupils were given a brief tour of the solar system and then worked

in smaller groups, learning about what equipment you can use for stargazing and how the telescopes on display work, as well as other practical activities.

Every pupil had the opportunity to ask questions, and all received an information pack with materials from the Institute of Physics and NASA as a reminder of their visit.

Many thanks to all who were involved in the project, particularly the Stirling Astronomical Society who gave their expertise and time and the Forestry Commission who provided the venue, both for no charge. The Institute of Physics provided a valuable grant that covered the transport and catering costs.

Lynsey Davidson,
Clackmannanshire Council

Check out our website at www.iopscotland.org

Lab in a Lorry keeps on trucking

Since receiving its Lab in a Lorry last year, the Institute of Physics in Scotland has been playing its part in enthusing children from all over Scotland about physics. By visiting every corner of Scotland, Lab in a Lorry has highlighted the work that the Institute does for teachers, students, businesses and policy makers, raising the Institute's profile significantly.

Lab in a Lorry is a hands-on working lab, staffed by practising physicists and engineers with the aim of enthusing the next generation of physicists. The lab is aimed at S1 and S2 students, and is a partnership between the Institute of Physics, the Schlumberger Foundation, the Offshore Training Foundation and the Scottish Government. All of the partners share a common concern for the future supply of skilled scientists and engineers in Scotland, hence their involvement.

Lab in a Lorry was launched in May 2005. After the original funding expired early last year, the programme changed due to regional funding, leading to one lab in Scotland, one in the East Midlands and one in the north-west of England.

In total Lab in a Lorry has had more than 12 000 visitors from 74 schools in Scotland, which is approximately 20% of all Scottish secondary schools. From the Western Isles to Aberdeenshire, Caithness to the Borders, Lab in a Lorry has been all over Scotland with only a few areas not yet visited.

Lab in a Lorry is always warmly received by schools, who are grateful to have this resource at no charge. From a recent evaluation, one teacher commented that: "This sort of high-quality science experience is great at motivating pupils to



Putting physics to the test: pupils from all over Scotland have the opportunity to carry out experiments on-board the Lab in a Lorry.

do better in any subject. The bureaucratic issues, health and safety risks and transport costs in taking pupils off-site frequently mean that additional opportunities elsewhere are impractical. The Lab in a Lorry removes all of these restrictions and gives pupils a great experience too. We need more of this in schools."

Student comments have also been positive, for example one S1 student said that "it taught me a lot in a fun way", which confirms our objective that they leave the lab having had a good time and that they associate this with science. It won't come as a surprise to readers to learn that grabbing students' attention early on is crucial for involving them in science.

At the heart of Lab in a Lorry is its volunteer base, and there have been 346 volunteers involved with Lab in a Lorry across Scotland to date. Without these volunteers the programme just wouldn't work, and Lab in a Lorry has been fortunate with the amount of individuals

and businesses who have been involved across Scotland.

Many large businesses support tours in their respective areas, with companies such as SELEX UK (Edinburgh and Lothians), UKAEA (Caithness), GlaxoSmithKline (Angus), Rolls-Royce (Renfrewshire), QinetiQ (Scotland-wide) and Scottish and Southern Energy (Perthshire) being some examples. Businesses tend to get involved for three reasons. First, they share a common concern about the future supply of scientists and engineers. Second, Lab in a Lorry contributes towards their corporate social responsibility strategy, and third it gives them great continuing professional development opportunities for their young graduates. We also get great support from small- and medium-sized businesses, and also from individuals who offer their own time to contribute to the programme.

Lab in a Lorry has also proven to be a good platform

and a good reason to invite local politicians on board. This has the benefit of raising the profile of the Institute in the Scottish Parliament, while emphasising the importance of science and technology to the Scottish economy. Around eight Members of the Scottish Parliament (MSPs) have visited Lab in a Lorry, including Roseanna Cunningham, who visited when the Lab was in Crieff, Perthshire, and the minister for schools and skills Maureen Watt MSP, who visited the Lab in Oldmeldrum, Aberdeenshire.

Looking ahead to the next school year, Lab in a Lorry will house two new experiments. The first is related to the application of lenses and optoelectronics in the form of a camera optics experiment. Students will make their own camera – starting with a pinhole and moving up to a digital one. The second is a Scottish Government-funded experiment relating to climate change, which will probably take the form of renewable energy and energy efficiency.

While emphasising the importance of climate change, this experiment also aims to educate students about the general problems of and solutions to the energy debate.

The Lab also has funding for a two-week tour of Argyll and Bute (including some islands), visiting around eight schools, which will take place in late August/early September. Visits to Dumfries and Galloway and Inverness are also planned as these are areas that haven't been visited yet.

If you would like to get involved with Lab in a Lorry as a volunteer then please contact Ian Cuthbert at the Institute (ian.cuthbert@iop.org).

Would you like to contribute to the next issue of this newsletter?

Senior members congregate for more lunchtime meetings

A Lunchtime Rendezvous at the University of Glasgow on 22 January was attended by 22 senior members of the Institute, which was close to the specified capacity of 24 for the university's Melville Room. The lecture "Low Power Satellite Communications and Positioning", given by David Meldrum, head of technology development at the Scottish Association for Marine Science, gave an interesting overview of the various satellite systems used to monitor the oceans and our climate.

Dr Peter Waddell, formerly a reader in the mechanical engineering department at the University of Strathclyde, presented a lecture entitled "Who Really Invented the Multi Cavity Magnetron?", which offered fresh insight into the complex history of radar development during the Second World War. A brief tour of the Hunterian Museum was then followed by a four-course lunch of the usual high standard.

A second Lunchtime Rendezvous, attended by 18 members and guests, was held at the Clubhouse, Daniel Stewart's and Melville College, Edinburgh, on 19 March. A lecture entitled "Fair Trade or Sharp Practice: Understanding the Units of Scotland's Early Trade" was given by Dr Allen D C Simpson, Hon Fellow in Scottish History at the University of Edinburgh. It gave excellent examples of how practical trade considerations gave rise to a variety of units and standards.

John Butler, principal computing officer at the School of Informatics,



(From left to right) Dr Allen Simpsen, Dr Peter Dryburgh, Mr Renton Mein and Mr Christopher Fentiman having discussions over lunch.

University of Edinburgh, then gave the lecture "Hidden Traps within the PC", and Dr Dick Dougal presented several thought-provoking demonstrations of exhibits taken from Edinburgh University's SCI-FUN Touring Exhibition for Scottish Schools. These demonstrations were again followed by an excellent four-course in the spacious dining room of the clubhouse.

In addition, the first Lunchtime Rendezvous to be held in Aberdeen will be at the Aberdeen Maritime Museum on Friday 17 October.

The programme for this meeting is as follows:
10.50 a.m. Arrival and coffee/tea in the education room.

11.05 a.m. Welcome from the Seniors Group coordinator.

11.06 a.m. Introduction by David MacLennan.

11.10 a.m. Lecture on "What does a Marine Scientist do?" given by John Dunn.

Midday Tour of the Aberdeen Maritime Museum.

12.30 p.m. Lunch in the education room.

3.00 p.m. Tour of RV Scotia.

4.00 p.m. Finish.

Bookings have already been made for two social events for members and partners in 2009, namely a Lunchtime Rendezvous in the Melville room, Gilbert Scott Building, University of Glasgow on Tuesday 27 January, and a Lunchtime Rendezvous at the clubhouse, Daniel Stewart's and Melville College, Inverleith Playing Fields, 525 Ferry Road, Edinburgh, on Wednesday 18 March.

Full details, including booking forms, menus and prices, will be published on our website (www.iopscotland.org) and will also be sent to senior members in the Aberdeen, Dundee, Edinburgh and Glasgow areas.

Suggestions for lecture topics and speakers for the Lunchtime Rendezvous, as well as other



Professor Arthur Cracknell examining the explanation of the two-lane racetrack SCI-FUN exhibit, in which the ball bearing with the longer path has the shorter trajectory time.



Mr David Meldrum presenting his lecture in the Melville room.

activities for the Seniors Group are always welcome.

● For further information please contact Dr John Higinbotham, Seniors Group coordinator, The Institute of Physics in Scotland, 12 (1F2) Bruntsfield Gardens, Edinburgh, Scotland EH10 4EA; e-mail john.higinbotham@physics.org.

Send your materials to Alison McLure by Monday 27 October

Physics career interview: the i

Name: Beth Vokurka

Job: Intellectual property manager and innovation consultant

What got you interested in physics?

I became interested in physics at high school. Fermilab was close to where I lived and I volunteered to attend Saturday-morning physics talks at the lab. As an undergraduate at the University of Illinois at Urbana-Campaign, I was offered a job helping to build a detector for Fermilab, which involved working at height and doing lots of hammering and operating heavy machinery. I also gained a fellowship to work at Stanford Linear Accelerator near San Francisco one summer. This got me interested in particle physics in particular. It is a great subject because you can travel to interesting places and get to play with big shiny machines!

What did you study at school and university?

During my physics degree at Illinois I spent a year as an exchange student at the University of Manchester. I returned to Manchester to do my PhD at their high-energy physics department, paid for by a Marshall Scholarship. I did my PhD research at CERN a couple of years before the Large Electron

Positron Collider shut down, and it was at this time that I became interested in medical imaging. I gained a post-doctoral research post specialising in magnetic resonance imaging and algorithmic development at the University of Manchester, after some persistent badgering. This was in the renowned Division of Imaging Science and Biomedical Engineering; the division that developed the underlying technology for car-registration recognition.

What was your career progression?

Before setting up as a freelance consultant I worked for a small Edinburgh-based company called Voxar, which was founded by a computer-science graduate from Edinburgh University and specialised in medical imaging software. Following my post-doc I wanted to move north and noticed that Voxar were offering free fruit, which persuaded me to apply to join them. One of my projects was to help design, manage and build a virtual colonoscopy application to analyse computerised tomography and magnetic resonance imaging scans.

While I was working at Voxar one of my jobs was to help invalidate another company's patent. I found that I enjoyed



Ecoday's 2008 is a hit with pupils

Ecoday events are run on behalf of the Glasgow STEM (science, technology, engineering and mathematics) Group, and this year's events were sponsored by the Institute of Physics, Scottish Power and Glasgow City Council.

The Ecoday's aim to raise awareness of the importance of:

- saving energy and water;
- reducing waste and pollution;
- using environmentally friendly transport;
- learning about the natural world around us;
- learning about environmental issues and how to live more sustainably.

Schools across Glasgow were invited to send a class of P6-S2

pupils to Ecoday; a limited number of spaces were also offered to West Dunbartonshire and Inverclyde schools. The events took place at the Glasgow Science Centre.

The Ecoday events were held over three days and were attended by 1813 pupils from 68 schools. Sixty-six schools from Glasgow were offered places on a first-come first-served basis from the 120 schools that applied.

The pupils attending were given a chance to learn about environmental issues by taking part in two structured activities and through following the Eco-Trail. They were allocated a packed-lunch slot and their Eco-Trail activity sheet also contained a feedback section.

The structured Eco-Activities

were provided by the Glasgow Science Centre, The WISE Group, Glasgow College of Nautical Studies, Glasgow City Council, STOW College, SETPoint and the University of Strathclyde.

Pupil feedback

"It was absolutely brilliant!"

Anthony (St Francis Primary).

"It was fun. I wish we had more time to do it all. I feel much more firm about the environment now. I want to do it again!"

Emily (Jordanhill Primary).

"I thoroughly enjoyed the activities."

Saira (Merrylee Primary).

"I liked it and I learned lots of new things."

Kirsten (St Vincent's Primary).

"It was good fun and made me think about how much waste we use and how we could reduce it."

Reagan (Scotstoun Primary).

"IT ROCKS (this paper had better be recycled!)"

Courtney (school not specified). The paper WAS recycled!

"I feel it was a very good convincing lesson."

Nathan (St Ambrose Primary).

Teacher feedback

Teacher feedback concurred with that from pupils, with 95% rating pupil enjoyment as good or excellent and 91% rating suitability for the age group as good or excellent. 88% rated the activities as good or excellent for relevance to the curriculum.

The feedback and comments from both teachers and pupils confirms that the Ecoday's were enjoyable and effective in their aim to inform and inspire pupils about environmental issues.

Gillian McNicholas

Intellectual property manager



the work and was good at it. I started to move into intellectual property management, helping to protect intangible things like inventions and trade secrets within the company. During my seven years at Voxar I was also involved in market analysis, corporate espionage, technical research and funding acquisition. The experience I gained as an academic researcher helped for most of my work in industry. I decided to move on after Voxar was taken over by another company.

What job do you do now?

I became a freelance intellectual property management consultant in 2007. There are about 30 consultants in Scotland, including a couple of physicists.

What does the work involve?

Most of my work is with small and medium enterprises who are involved in high-tech software and electronics. I help them to set up policies and processes that identify and protect the company's intellectual property. I also work with the Intellectual Assets Centre, which provides free intellectual asset management advice and information to businesses across Scotland,

and I perform due diligence for investors – which includes technology and IP audits and technical viability reviews. Much of my work with companies involves helping to identify inventions, keep trade secrets secret, prepare patents and trademarks, develop brands and manage relationships.

What benefits does the job provide?

I enjoyed particle physics because it involves asking fundamental questions in such spectacular ways. I enjoyed medical imaging particularly because it helps people out. I've now moved to helping businesses out, and each of those businesses contribute to and benefit society in their own way. The ultimate goal of my work is to educate and empower businesses to protect what makes them special and use what they've got wisely.

What personal skills or aptitudes do you need for the job?

I am an Associate Member of the Chartered Institute of Patent Attorneys. While I'm not a patent or trademark attorney, I keep a close eye on legislation and trends in intellectual property. I also have to know a good deal about how businesses are

run successfully. In most cases it is helpful that I have some knowledge about the technology that the companies are marketing. I need to be able to communicate effectively with both technical and non-technical people.

What has been the highlight of your career?

Always doing what I want to do. I have only ever worked in areas I enjoy. Also, that I enjoy getting recognition for a job well done, whether it's a stranger at a conference complimenting me on a paper I had written years before, or getting an unsolicited testimonial from a client about how I have genuinely helped their business.

How does your physics training help you in that work?

In my work you need to be meticulous and have good attention to detail, skills that are essential to gaining a physics degree.

Anything else you'd like to add?

In my spare time I verify and write questions for the BBC's *University Challenge* programme. A chance opportunity arose seven years ago and I've been doing it ever since.

Hopes for new science baccalaureate

There have been several announcements on education in the Scottish Parliament recently. Learning and Teaching Scotland have issued *Building the Curriculum 3: A Framework for Learning and Teaching*. This seeks to build on previous publications and help schools plan for the new curriculum. The draft experiences and outcomes for science were put out for consultation earlier in the year. The Institute in Scotland collated the feedback from more than 100 teachers and used this to reply to the consultation.

The education secretary Fiona Hyslop also announced plans to phase out the Standard Grade, Intermediate 1 and 2

qualifications and replace them with general SVQ qualifications. Access 3 will be maintained. Higher and Advanced Highers are to be overhauled, although Hyslop emphasised that the Highers are regarded as "gold standard" qualifications.

Of particular interest to the science community is the proposed introduction of a Scottish Science Baccalaureate. Hyslop said: "The new baccalaureates are designed to stretch our most able young people and the first awards will be made in 2010." The structure for the baccalaureate is:

- interdisciplinary project at Advanced Higher;
- maths at Higher;

- two science at Higher;
- one science at Advanced Higher.

It is hoped the baccalaureate will encourage more young people to study science and will raise the status of a sixth year at secondary school.

The government launched a consultation on these proposals on 10 June and hopes that a future qualifications framework will reflect the developments in *A Curriculum for Excellence*. The Institute will of course contribute to this consultation and your views are welcome. More information can be found at www.scotland.gov.uk/Publications/2008/06/09084232/0.

Alison McLure

Do you have any ideas for branch events?

If so, e-mail them to
alan.walker@ed.ac.uk

Book review: James Clerk Maxwell 150 years on

James Clerk Maxwell 150 years on, compiled and edited by John S Reid, Charles H-T Wang and J Michael T Thompson. Published May 2008, special offer price £47.50 (usual price £58).

James Clerk Maxwell has proved to be the physicists' physicist, the engineers' physicist, the historian and philosopher's physicist and even the artists' physicist.

Maxwell has frequently been coupled with Newton and Einstein for his fundamental insights into the physical world, but in truth his breadth of interest and influence has been even wider. This book celebrates 150 years since Maxwell came to his first professorial post. The articles provide new insights into his life, intelligible overviews of areas of modern science that are underpinned by his works, and some technical articles on modern developments in

fields that have grown from Maxwell's initial work.

Such was Maxwell's range of interests, the articles are of necessity only a sample of what could have been written. Nonetheless, the reviews cover such fields as Maxwell's teaching (downplayed in all his biographies), the foundations of colour science, molecular science, the stability of astrophysical disks, the magnetic Sun, electromagnetic machinery, electromagnetism and the foundations of relativity.

Research papers give an insight into future developments in subjects as diverse as digital holography, plasma-based accelerators, modelling composite materials on a micro- and nano-scale, and applying gauge theory (introduced by Maxwell though he seldom gets credit) to quantise the gravitational field. There are good examples



of the cross-fertilisation of ideas (for example, Maxwell's ideas on the stability of Saturn's rings being applied to other astrophysical disks and extended to electrical and quantum phenomena).

This book will appeal to physicists and engineers working in all areas of electromagnetism, to those in holography, material modelling, Maxwell scholars and others interested in the history of science.

Subscribers to *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* can access it online at publishing.royalsociety.org/maxwell. Non-subscribers can purchase the print issues at the special reduced price shown above. To place an order at the discounted price, please send payment either by cheque (made payable to Portland Customer Services) or by Visa or MasterCard (quoting reference TA 1871) to: Portland Customer Services, Commerce Way, Colchester CO2 8HP; tel +44 (0)1206 796351; e-mail sales@portland-services.com.

Philosophical Transactions of the Royal Society has been published continuously since 1665. For subscription details, please contact sales@royalsociety.org or visit the website <http://publishing.royalsociety.org/philtransa>.

Skills Committee looks to boost future economy

The Skills Committee of the Scottish Funding Council (SFC) were asked to investigate potential areas for improvement in the contribution that colleges and universities make to skills development in the financial services, energy and textiles sectors. These sectors are key to the Scottish economy and, as a result, SFC set up discussions with key stakeholders to look at ways that higher- and further-education institutions could continue to complement industry needs in these sectors.

The main aims of the forums were:

- to identify areas for collaboration, sharing ideas for curriculum development and strategic change as well as discussing employability and work readiness;
- to discuss current and prospective skills needs taking into account the complexity of the energy sector.

Alison McLure, IOP national officer for Scotland, attended the forum on the nuclear energy industry. Dr Janet Lowe, chair of the SFC skills committee, opened the forum

by laying out the Scottish context for skills development. She outlined the commitments given in the government's skills strategy and looked at how modern apprenticeships might help in providing a workforce for the nuclear industry. The focus was, inevitably, on decommissioning, given the current government's "no new nuclear" stance.

Ken Nicol followed on and, as Scottish regional manager of the National Skills Academy for Nuclear, set the scene with an overview of the nuclear industry in Scotland. He also looked at some of the challenges facing the industry in the future. He estimated that there will be a need for some 7000 graduates and 3500 skilled trades over the next 10 years. The current workforce will also need to "upskill". Nicol pointed out that there is a shortage of high-quality engineers, radiation safety specialists and environmental specialists. In the current political climate in Scotland it is pretty difficult to attract talent to the industry, but as

someone from the IOP, I am always heartened to know that there are still plenty of good-quality jobs available for physicists.

The forum then broke out into three different workshops to look at:

- Do we need "nuclear qualifications"? What skills and qualifications are needed and how can colleges and universities best respond to this? Do we have the right frameworks in place?
- Science and technology in schools – too hard to do? How can we encourage greater numbers of young people into STEM subjects in school? How can colleges, universities and employers help influence the school curriculum?
- How can colleges and universities collaborate better across Scotland and with employers? What models work and how?

The workshops were followed by perspectives from higher education, further education, employees and industry. There was a remarkable amount of

agreement and optimism about the future of the nuclear industry. Even if the industry was run down in about 20 years' time, it was felt that the workforce would have sufficient transferable skills to move seamlessly into the upsurging renewables sector. There was a call for an intelligent, informed debate in Scotland on the future of the nuclear industry. Perhaps a "national conversation" might steer the government towards a different policy.

Energy forums were also held on oil and gas, microrenewables and renewable energy. A note summarising the discussions is on the Skills Committee website. All three forum events that the SFC have organised on energy have been useful and will inform the Skills Committee's future discussions on where our focus should be in relation to the energy industry. Further information on these can be found at www.sfc.ac.uk/about/about_us_committees_skills.htm.

Alison McLure

Scottish physics teachers take a trip to CERN

A group of 16 physics teachers from schools across Scotland travelled to Geneva, Switzerland, in February to gain first-hand experience of the work going on at CERN – home of the world's largest particle accelerator. The visit was sponsored jointly by the Institute of Physics and the Science Technology and Facilities Council. Twenty-six physics teachers from England also attended the three-day programme, which was hosted by CERN's education coordinator Mick Storr.

The intensive schedule consisted of site visits together with a series of lectures describing the development of our understanding of the structure of matter. Starting with the humble atom, the group followed the exciting and sometimes complex story of the discovery of the electron, proton, neutron and quarks. The story culminated with the development of the Standard Model, consisting of just 12 fundamental particles and four force particles through which the universe (apart from gravity) can be described.

But that's not the end of the story and it certainly does not explain the sheer excitement and buzz of the scientists at CERN as summer 2008



The physics teachers on their three-day visit to CERN in Switzerland.

approaches. Why? Because then the Large Hadron Collider (LHC), the world's largest particle accelerator, is due to enter full operation.

Buried some 100 m underground and spanning the Swiss/French border, the LHC will accelerate bunches of protons to close to the speed of light. Travelling in opposite directions, and guided by superconducting magnets operating at 1.8 K (colder than outer space), these bunches will collide, resulting in energies in excess of 100 GeV (equivalent to temperatures of the order of 10^{16} K). Under these extreme conditions, not seen since fractions of a second after the Big Bang almost 15 billion years ago, it is hoped that new particles will be created and, in particular,

the elusive Higgs boson, which is believed to be responsible for giving matter its mass.

Detection and identification of these particles is no easy task, as the teachers themselves discovered. Enormous detectors, such as ATLAS with a diameter in excess of the height of a house, have been constructed like a giant jigsaw in huge cathedral-like caverns deep underground. Despite their size and complexity, these detectors have to be aligned to within fractions of a millimetre.

With collisions expected every 25 nanoseconds (25×10^{-9} s), the amount of data produced will be vast – a full DVD each second or around 1% of the world's total data output! To cope, huge computing power is required –

this is achieved by connecting 7000 PCs together at CERN to form the GRID, which is in turn linked to computers around the world.

In addition to seeing the LHC and ATLAS, the group also visited the antimatter decelerator. Here, very small quantities of antimatter are produced and research into new medical physics applications (such as hadron beams for the treatment of tumours) is undertaken, building on the original work that resulted in imaging techniques such as positron emission tomography.

At the end of the three-day visit the teachers left CERN with a deeper understanding of particle physics and its links to the creation of the universe. More importantly though, each teacher was enthused and motivated to inspire their pupils to take an active interest in science and the world around them, and perhaps even become the particle physicists of tomorrow.

More information about CERN and educational visits (including the presentations given on the UK teachers programme) can be found at www.cern.ch.

Keith Gilroy, Department of Physics, Edinburgh Academy

A diary of the visit to CERN

Monday

I'm not good at 5 a.m., and I have to worry about collecting other people and getting to Edinburgh airport on time. How bad will the traffic be? Can I manage not to get lost? Have I packed everything? And are there any other worries I haven't even thought of yet?

As it happens it all went fine. Sixteen teachers from various parts of Scotland were to travel from Edinburgh, and I was a bit disappointed that before leaving e-mails went back and forth with people identifying themselves to make it easier for all of us to meet at the airport.

I was disappointed because I'd hoped to test my theory that by some undetectable field or force of attraction, 16 physics teachers would just naturally drift together and find each other. Well maybe that was a long shot!

After installing ourselves in our rooms at CERN, some of us were given a short tour of some of the attractions.

- The library: "Hi Jack," said Mick Storr, CERN's educational officer and our host, then *sotto voce* to us: "That's Jack Steinberger – Nobel prize winner."

- The office where Tim Berners-Lee invented the World Wide Web: Mick was working in the same office at the time. His contribution apparently was that when Tim said: "Hey

Mick, what do you think of the name 'World Wide Web'?" Mick replied: "Yeah – it's OK".

- The main auditorium: where breakthroughs have been announced and the famous have spoken.

- And when physicists need a break from working through the equations in their offices and nip off to the coffee room, what else would they do but use the blackboards that line the walls there to continue working on them.

Tuesday

This was a packed day. After being welcomed by the secretary-general of CERN Maximilian Metzger, we were treated to an introduction to what happens at CERN. We were already impressed and

wanted to know more. The task of supplying that information was immediately undertaken by Dr Rolf Landua (the real Leonardo Vetra, if you've read *Angels And Demons!*), whose passion for his subject showed clearly, and whose lectures on particle physics were not only informative but enjoyable and much appreciated.

Among the 40 of us (which included 24 teachers from England), conversations at lunchtime buzzed with superlatives and more questions, and anticipation of the afternoon's visit – by special arrangement – to the Large Hadron Collider (LHC).

We were probably the last group lucky enough to have this chance, as the LHC will soon be operational and so out

Star gazing at the science festival

For more than 50 years Edinburgh has hosted what is widely regarded as the greatest arts festival in the world. For a month in late summer the city hums to the varied beats of the artistic community. Some 20 years ago, perhaps in an effort to redress the balance in the home of Scottish enlightenment, one of the world's first science festivals, the Edinburgh International Science Festival (www.edinburgh-festivals.com/science), was established.

Each spring the city now hums to a different beat – that of young and old enthused by science, mathematics, engineering and technology. In this the festival's anniversary year, the Stars 'r' Us! team delivered their message of how chemistry controls the cosmos and is attempting to answer the questions of the origin of life and its existence elsewhere in our cosmos.

Stars 'r' Us! (www.chem.ucl.ac.uk/cosmicdust/starsus.html) began life as an exhibit at the 2004 Royal Society Summer Exhibition. Involving a consortium of university-based researchers from Heriot-Watt University, UCL, the University of Nottingham, the Open University and Strathclyde University, with colleagues from the National Maritime Museum and the



Stars 'r' Us! on the road at the Edinburgh International Science Festival.

Royal Observatory, Greenwich, the team's goal is to reach out beyond the telescope and lab to explain the varied and important roles of chemistry in our cosmos – introducing children, their parents and educators to the young and rapidly moving science of astrochemistry.

Since its genesis, Stars 'r' Us! has regularly gone on tour. It was popularly received at the Royal Greenwich Observatory during the National Science, Engineering and Technology weeks in 2005 and 2006. The team were also participants in the Royal Society of Chemistry's National Chemistry Week Shopping Mall Tour in 2005.

Stars 'r' Us! has also gone international with the help of the

British Council, who supported us for an event in Athens, Greece, in May 2005 and at the Village des Sciences in Paris in October 2005 to celebrate French Science Week. This April, over the final weekend of the science festival, Stars 'r' Us! was resident in Our Dynamic Earth (www.dynamicearth.co.uk), the Edinburgh science centre located a stone's throw from Holyrood Park and Palace.

Our Dynamic Earth is a modern, well lit venue that proved ideal for Stars 'r' Us!. Manned by a team of academics from across the consortium – early stage and experienced researchers at the forefront of astrochemistry and science outreach specialists from



The "Seeing Stars" exhibit shows how visible spectroscopy allows us to remotely detect atoms and molecules in stars.

Scotland and England – Stars 'r' Us! delivered its message to a wide ranging audience of more than 300 during its three-day sojourn. The team were enthused by the willingness of the audience to interact and believe that many went away with more understanding of how our cosmos works.

Stars 'r' Us! would like to thank the team at Our Dynamic Earth for their patience and support during the visit, and the Institute of Physics in Scotland and the Royal Society of Chemistry for their vital financial support.

Prof. Martin McCoustra, chair of chemical physics, Heriot-Watt University, and Stars 'r' Us! team member

of bounds to visitors.

It's difficult to describe my reaction to a visit to the LHC and to the ATLAS detector, but my lasting impression is of excitement and scale.

The staff are excited because 25 years of work are about to come to fruition and data will start pouring in. (A perfect example was Troels Petersen, who gave us a presentation on the ATLAS detector and whose enthusiasm was infectious.)

And as for the scale, well parts of the 27 km ring will be the coldest spots in the universe, at 1.9K. Others will carry up to 20000 A. A volume of 6500 m³ has to be evacuated to 10⁻¹³ atm – a pressure 10 times lower than on the Moon. Bunches of 10¹³ protons are accelerated to 99.99% of the speed of

light, gaining momentum like a high-speed train. 600 million collisions will take place each second, to be picked up by the various detectors – such as the 7000 tonne ATLAS detector, which is 25 m in diameter and 46 m long. After a run, the excess protons (with an energy of about 350 MJ) are "dumped" into a block of carbon 2 m in diameter and 40 m long, melting a few metres of it in the process. The data that will need to be processed will amount to 1% of the information in the world – enough to fill around 100 000 DVDs every year. Who could fail to be impressed?

Wednesday

A day of lectures by several presenters – Elena Wildner introduced us to the inner

workings of accelerators; Manjit Dosaanj explained the medical applications of particle physics; and Rolf Landua told us all about antimatter and the antiproton decelerator, or antimatter factory. All the speakers managed to be very patient about answering our almost endless flow of questions!

We visited the antimatter factory in the afternoon and were amused to see benches covered in wires, and things wrapped in tinfoil and held together with duct-tape. Very much cutting edge! Work in progress rather than the finished article.

We finished the day off with a trip to a hotel in Geneva for dinner. This was accompanied by live music from traditional

musicians, and there was a chance for some brave physics teachers to try their prowess on the alpenhorn!

Thursday

By Thursday we were all very aware that our time was almost up and that we still had lots of questions. Luckily, before our taxis arrived to return us to the airport there was a chance to have a lot of them answered, though I'm sure the session could have gone on and on if only there had been time. Mick also gave us lots of information about CERN's teacher support programme, and about bringing pupils to visit – so I'm pretty sure a few of the group left thinking: "Maybe I could come back!"

Mae Thomson, Bearsden Academy

Dark Sky Scotland report

Dark Sky Scotland (DSS) was a 15 month Scotland-wide programme of some 35 public and educational astronomy events that ran from November 2006 to March 2008, mainly in rural and remote communities, which exploited some of the largest areas of dark sky in western Europe.

The innovative DSS partnership provided a range of complementary resources for the programme and included Careers Scotland, the Forestry Commission Scotland, the Glasgow Science Centre, the Institute of Physics in Scotland, the Royal Observatory Edinburgh Visitor Centre and the University of Glasgow. The main funders were the Highlands and Islands Enterprise, the Scottish Government and the UK Science and Technology Facilities Council.

Objectives

The aims of the DSS programme were to:

- inspire the public, pupils, teachers and parents through the night sky, astronomy and space science;
- encourage positive attitudes towards science and technology subjects and careers;
- develop “dark-sky tourism” to engage people with astronomy and space science;
- develop a network of people able to run events through the project and independently;
- create partnerships of organisations that will support future activities.

Reaching out

The events programme formed the central component of the project. Activities were run at more than 40 venues, many in rural and remote parts of Scotland. A key concept of the programme was to reach teachers and other mediators, as well as the wider public. Figure 1 shows a map of all the areas visited by the programme.

The main activities at the events programme were stargazing, starlab shows, comet-making demonstrations, rocket launching and talks.

A strong feature of the

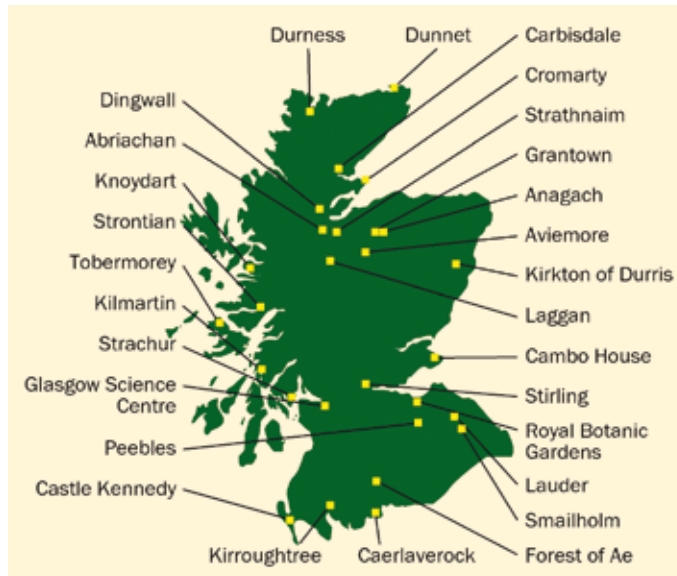


Fig. 1. The areas of Scotland visited by the DSS events programme.

programme was the diversity of events and how these combined sessions for different audiences. For example, the programme included 17 DSS weekends, each typically combining sessions for families and schools alongside training workshops. We ran sessions at three outdoor festivals, most notably the Outsider Festival near Aviemore, and ran family events at three historic gardens as part of VisitScotland’s winter festival. Other outputs included:

- Five portable display stands, which were used at all the events and at other public venues, such as the Glasgow Science Centre, the Scottish Parliament and Inverness Museum, on an ongoing basis and were seen by around 25 000 people.
- 200 night-sky training packs, which were distributed.
- More than 100 000 DSS stargazing charts, which were distributed via newspapers and events.
- The DSS website, which directed people to the events and provided supporting information about dark-sky activities.
- The Highland constellation project, which was inspired and supported by the DSS team and led by the Highland council. Three artists-in-residence worked with eight schools, who identified a new Highland constellation in the northern

sky, through which the history of the region can be told by linking the distance to the stars (measured in light years) to historical events. The artists produced original written work, a unique bound book and an art installation at Genuig.

- Our launch event, which attracted national TV and radio news and feature coverage. Press coverage during the project reached a readership of up to 1.9 million. Dark skies now features in several tourism guides to Scotland.

A great learning experience

Examples of feedback from the participants included: “*Brilliant learning experience.*”; “*Really great family event – comet was fab!*”; “*Very useful practical advice that I will be looking forward to using with my pupils.*”; “*A great session that has taught me a great deal. Thank you.*”; “*Lively and not too technical – just right!*”; “*The knowledge and enthusiasm from all staff was exceptional.*”

Funding is currently being sought to continue the project into the International Year of Astronomy in 2009. Dark Sky Scotland will be used as a template for UK-wide activities, which will be run under the banner Dark Sky Inspiration. **Dan Hillier**, Royal Observatory Edinburgh

Events calendar

Tuesday 2 – Friday 5 September

Schools Lecture Series 2008 – Rock in 11 Dimensions: Where Physics and Guitars Collide

Heriot-Watt University, contact Deryck Reid (tel 0131 451 3652); University of St Andrews, contact Lesley Aitken (tel 01334 463 100); University of Dundee, contact Linda Rannie (e-mail l.c.rannie@dundee.ac.uk); University of Glasgow, contact Lucy Murray (tel 0141 330 4707).

Talk by Dr Mark Lewney.

Friday 17 October

First Seniors Group Lunchtime Rendezvous in Aberdeen

Aberdeen Maritime Museum, 10.50 a.m. to 4.00 p.m.

Programme:

10.50 a.m. Arrival and coffee/tea.

11.05 a.m. Welcome and introduction by the Seniors Group coordinator.

11.10 a.m. “What does a Marine Scientist do?” by Mr John Dunn.

12.00 p.m. Four-course lunch.
2.30 p.m. Tour of RV Scotia.
4.00 p.m. Finish.

Programme for the Royal Meteorological Society at the Scottish Centre

Friday 10 October

“A century of numerical weather prediction.”

Peter Lynch, professor of meteorology, University College, Dublin.

Friday 14 November

“Phenology and the advance of spring.” Tim Sparks, Centre for Ecology and Hydrology, Monks Wood.

Friday 12 December

“The future of the Royal Meteorological Society and our role in influencing public policy.” Paul Hardaker, chief executive, Royal Meteorological Society.

An up-to-date listing of the Institute of Physics in Scotland meetings can be found at whatson.iop.org. Type the keyword “Scotland” into the search box.

What the Institute can do for you

At the Institute of Physics we are constantly looking for new ways to support our members, but I think we sometimes forget to remind our members of the benefits already available to them. I have outlined many of the benefits below, and for further details the IOP website (www.iop.org) is a good place to find out more.

So, a reminder that available to you as a member are:

- *Physics World* – the highly respected monthly magazine, reporting the latest news and developments in the world of physics.
- *Interactions* – the member newspaper of the Institute of Physics.
- Dedicated websites – for members, students, graduates, teachers and children.
- Conferences – in all areas of physics, from half-day briefings

to large international events.

- Technical and professional groups and divisions – specialist subject groups provide a forum for discussion on progress in research and development, in pure and applied physics. Several groups working together form divisions, which promote an interdisciplinary approach.
- Journals – a range of more than 50 journals covering most areas of physics. Members can subscribe to up to three journals per year at discounted rates.
- Surveys and policy representation – an opportunity to express your views through periodic surveys for aggregation in IOP policy representation.
- Dedicated careers information – one-to-one support, as well as online and printed careers resources.
- Short courses – access to a

range of general short courses for physics graduates.

- Chartered status – represents the highest standards of professionalism.
- Regional branch events – activities in your local area.
- Discounts and bursaries – discounted registration fees for conferences, journals and software. Travel bursaries for young members.
- PhysMail – a full web-based e-mail facility for members, including a forwarding service.
- 76 Portland Place – access to the Institute's members' room, as well as the opportunity to hire the professional meeting and conference facilities.
- Member diary – a 16-month diary and address book containing useful scientific data.
- Online services – convenient renewals and amendments of your member records.

Conference and 2008 AGM looks to the energy gap

At the 2008 Scottish Conference and AGM, which was held at the University of Glasgow in June, around 40 members and partners enjoyed a day of talks on the subject "Physics and the Energy Gap".

Professor Maxwell Irvine of the University of Manchester kicked off the day with an

excellent overview of the wide-ranging issues surrounding energy in the UK, including the policy background, the recent history of energy generation and consumption, the energy market, the resources remaining and some of the technologies available.

Gordon Proven, from Proven Energy, then talked about his vision for Scotland of reaching 100% electricity production from renewables. This was based on his 25 years' experience of installing wind

turbines across the world and his investment in other renewable technologies.

After lunch the recent chair of the IOP Energy Group, Terri Jackson, took us through the "Pivotal Points of the Power Programme", which was nicely balanced by Ian Arbon's presentation on how technology can help address the issues discussed during the day. A lively question and answer session followed, where the subject was discussed with some passion.

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The Institute of Physics, 76 Portland Place, London W1B 1NT, UK.

Tel 020 7470 4800.
Fax 020 7470 4848.

Correction

Our apologies to Leila Sattary. The article "Science hots up in the Highlands" on page 5 of the April newsletter should have been credited to her. She wrote the article about the Moray Science Festival and also took the accompanying photograph.

Following a quick and efficient AGM, Ken Skeldon gave a short introduction to the life and work of Lord Kelvin as a precursor to the drinks reception and tour of the Lord Kelvin exhibition in the Hunterian Museum. An enjoyable and fascinating day was rounded off by an excellent meal in the stunning surroundings of the Melville Room. Thanks to all the speakers and to the staff of the University of Glasgow for making the conference such a success.

Alison McLure

INSTITUTE OF PHYSICS IN SCOTLAND COMMITTEE MEMBERS 2008

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Prof. Julian Jones
Heriot-Watt University
E-mail j.jones@hw.ac.uk

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E-mail a.long@physics.gla.ac.uk

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University of Dundee
E-mail d.j.keeble@dundee.ac.uk

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Stephen McGeoch
E-mail stephen.mcgeoch@uk.thalesgroup.com

Seniors Group coordinator

Dr John Higinbotham
E-mail john.higinbotham@physics.org

Outreach coordinator

Dr Gillian Lang
E-mail gillian.lang@ntlworld.com

Ordinary members

Prof. Alan Walker

Iain Glennie
Biggar High School
E-mail iglennie@uddingston.ac.uk

s-lanark.sch.uk

Prof. Duncan Hand
Heriot-Watt University
E-mail d.p.hand@hw.ac.uk
Stuart Farmer

Dr Carol Trager-Cowan
University of Strathclyde
E-mail cacs19@strath.ac.uk

Grampian local-area coordinator

Dr Charles Wang

Dr Bill MacPherson

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Dr Graham Turnbull

Co-opted members
Edinburgh local-area coordinator

Prof. Derryck Reid
University of St Andrews
E-mail d.t.reid@hw.ac.uk

Bob Kibble

Stirling local-area contact

Michael McVey
Lourdes Secondary School
E-mail mpjmvey@ntlworld.com

IOP national officer for Scotland

Alison McLure
E-mail alison.mclure@iop.org

NEXUS representative

Szymon Daraszewicz

Scottish education manager

Tom Dickson
E-mail tom.dickson@fife.gov.uk