IOP | Institute of Physics
In Ireland

NEWSLETTER

December 2009

The deadline for your contributions to the March 2010 issue of this newsletter is

22 January

E-mail your material to

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Merry Christmas from the Institute of Physics

Physics tricks hit Belfast

A diverse group of volunteers manned the stand over the weekend. Caitlin Watson and Alex Cheung represented the Physics in Society team. Iain Robinson, Roger Duthie (postgraduate students from Edinburgh University and Queen's University Belfast) and myself (a postdoctoral researcher from the University of Limerick) came from academia. Deborah Phelps, a physicist, joined us from industry.

Each summer, the Physics in the Field "Busking for Physics" tent goes on tour. Organised by the Institute's Physics in Society team, the tent is staffed by volunteers, and it travels to art and culture events all around Britain. In September, at the Gourmet Garden Festival in Belfast, the tour visited Ireland for the first time.

"What does a food festival have to do with physics?" you might ask. This is one of the reasons why Physics in the Field is so successful – by appearing in unexpected places. We aim to raise awareness of science among unsuspecting children and adults – to capture the imaginations of those who wouldn't normally choose to seek out science.

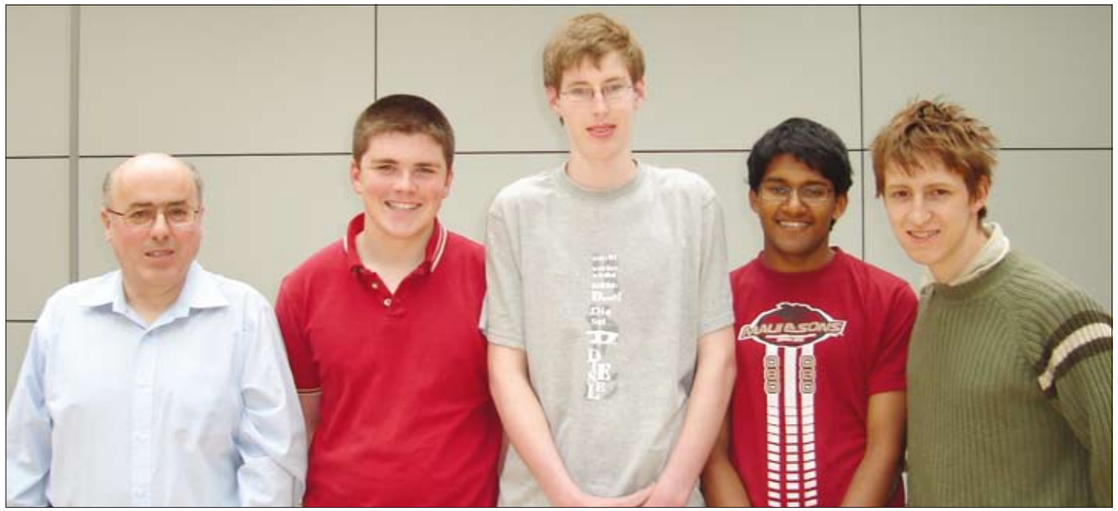
The physics tricks that we performed – and persuaded our visitors to try – ranged from launching rockets (made out of an empty film canister, a crushed Alka Seltzer tablet and some water) to making balloon kebabs (without the balloon bursting). There was something to interest and entertain everyone from all age groups. All of the tricks are designed to illustrate different areas of physics, and they are made out of everyday objects that you can find at home. Often, the best way to engage passers-by was to challenge their perceptions: "Do you think you can lift up an open jar of rice just using a pencil?" Most automatically said no but they were impressed when shown that by repeatedly jabbing the rice with the pencil, the rice will pack so tightly around the pencil that there is sufficient friction to lift the jar. For details of these tricks (and many others) to try at home, visit www.physics.org.

We had more than 1000 visitors to our stand during the weekend, and feedback was overwhelmingly positive. It was an exhausting but really rewarding weekend, and hopefully the first of many Physics in the Field events in Ireland. In fact the Physics in Society team is currently looking for suggestions for events to attend in Ireland next summer. (You can suggest events for Physics in the Field to visit or volunteer to man a stand by e-mailing physics.society@iop.org.)

Vincent Cregan, Joanna Mason and Jean Charpin participate in one of the demonstrations, "How to make your own tornado in a bottle", in Limerick.

I liked these physics tricks so much that I borrowed some of them for our departmental open days last week. The above picture shows a race between three tame tornadoes – I'm the one that's winning.

Joanna Mason, University of Limerick



National team leader Eamonn Cunningham, together with the IPhO team: Philip Flahavan, John Collison, Brajith Srigengan and David Cox.

Ireland wins awards in Mexico at International Physics Olympiad

Scientists can determine the distance from the Earth to the Moon with great precision. This is done by reflecting laser light from special mirrors, left on the lunar surface in 1969, and measuring the travel time for the round return trip. Using these results they have discovered that the Moon is slowly receding from the Earth, specifically at a rate of 0.034 m each year, in turn increasing the duration of each day by 19 µs annually. This occurs because the torques due to the tides on Earth constantly transfer angular momentum to the Moon. It was in the historic city of Merida that students on the Irish team faced questions like the above at the 40th International Physics Olympiad (IPhO) competition held last July. On the Irish team were John Collison (Castletroy), David Cox (Portadown), Philip Flahavan (Kilmacthomas) and Brajith Srigengan (Belfast). The Irish team leaders were Dr Eamonn Cunningham from DCU and David Rea from St Colman's College, Fermoy.

The occasion provided a unique opportunity for all of the students to demonstrate their abilities in physics, to exchange ideas and to make new and lasting friendships with peers from all over the world. IPhO participants were able to attend a lecture on binary pulsars by Nobel laureate Joe Taylor, as well as talks on the Chicxulub Impact Crater and on Muon detectors in the search for hidden chambers in the Mayan Pyramids.

The competition consists of two testing five-hour examinations, one theoretical and the other experimental. Around 350 world-class young physicists from up to 80 countries from every continent participated. This year each team comprised a maximum of five second-level students. The national team leaders spend much of their time preparing and grading the competition questions (http://ipho2009.smf.mx). Unlike at the Irish Branch's Spring Weekend table quiz, students in IPhO compete individually. This year's questions ranged from the example given above to developing a simple theory of laser cooling of atoms and then a question using classical and quantum mechanics, thermodynamics and electrostatics to estimate the size of a star. The lab task was to measure the wavelength of laser light (Fresnel diffraction using a razor blade) and then to proceed to find the birefringence of mica.

Congratulations to John Collison, Brajith Srigengan and David Cox, each of whom won an Honourable Mention Award in this extremely challenging competition.

Social programme highlights for the students included visits to El Rancho Tierra Bonita to enjoy the art of charreria, the ancient Yucatan city of Izamal with the largest monastic porticos/cloisters in the Americas, the Merida cathedral (the oldest on the continent), the awesome UNESCO World Heritage Site at Uxmal, viewing the flamingos in the ecotourism paradise at Celestun as well as the most famous of all of the Mayan ruins at Chichen-Itza, complete with the iconic round astronomical observatory and the cenote/sinkhole used for human sacrifices.

Prior to the trip to Mexico, residential training took place in DCU during the spring and early summer, directed by Eamonn Cunningham, Eilish McLoughlin, Paul Van Kampen, David Rea and assisted by Irish Science Olympiad director Michael Cotter and by staff from the DCU School of Physics. The Institute of Physics in Ireland is pleased to have supported the students and, once again this year, it congratulates all involved in this national success in physics.

David G Rea, St Colman's College, Fermoy

Branch is at the frontier of physics

Physics teachers headed to Waterford IT on the last Saturday of September for the annual energy boost that is the Institute of Physics Frontiers of Physics day.

After a welcome from the Institute's Dr Eilish McLoughlin, we had an outstanding presentation from David Hughes of Sheffield University on the history of telescopes. With a dry, northern wit, Prof. Hughes entertained us with tales of how telescopes as "light buckets" have doubled their light-collecting power every 50 years so far. He explained the amazing discoveries that each improvement brought, starting with Galileo's first views of the Moon and Jupiter's satellites. One spectacular example that he gave was the Hooker 100 inch telescope built at Mt Wilson in 1917. Hubble used this to look at the formerly "blurry" galactic nebulae and saw that in fact they were other "star cities" (or galaxies, like our own Milky Way). Prof. Hughes described how this meant that scientists had to make a "slight" numerical correction in their results: "You know how we thought the number of galaxies in the universe was one? Well, now we think it's closer to 100 billion."

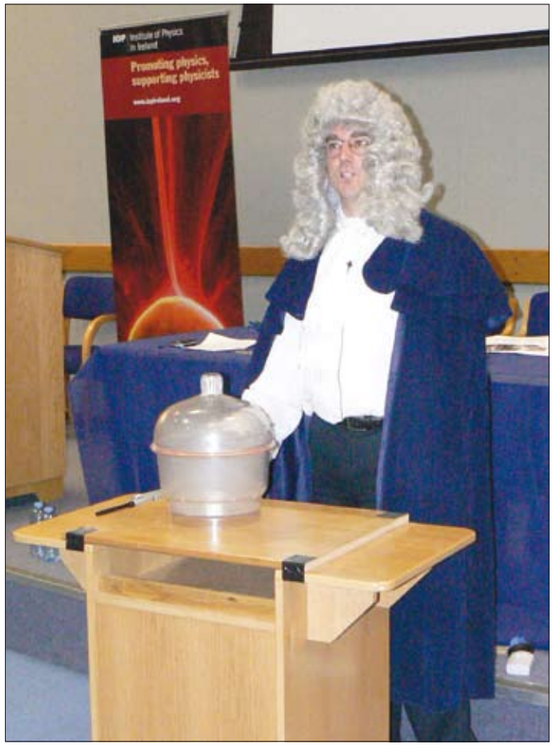
He described the proposed next generation of telescopes, such as the James Webb Space telescope (JWST) and concluded that although, as they say in Yorkshire, astronomy may not affect "the price of fish", there are great discoveries still waiting to be made. Seeing fainter and further objects could enable us to see back in time to the edge of the universe.

Irish Science Teachers' Association members will be familiar with the great work being done by Sheila Donegan and Eoin Gill of the Centre for the Advancement of Learning of Maths, Science and Technology (CALMAST), based in the Waterford Institute of Technology (WIT). Eoin, resplendent in a 17th-century wig, talked about "local hero" Robert Boyle from Lismore. He described how Boyle's education and travels in Europe may have influenced his developing interest in scientific ideas. Physicists present learned some interesting things about his work in chemistry, including his use of "syrup of violets" as the first acid-base indicator. Eoin went on to show us some demonstrations that he uses when giving his interactive show about Boyle to school students. This included some nifty variations on how to show Boyle's law. With a sealed syringe of air with different weights placed on it, he explained how to help students to "get their head around" Boyle's law without getting bogged down in complicated experimental details often present in Leaving Certificate physics versions.

Dr Cormac O Raifeartaigh of WIT talked about "From Walton to the LHC". He took us through the development of the Standard Model of particle physics and explained how this model will remain incomplete until (or unless) the Higgs boson is discovered. He showed how the higher energy density available with the Large Hadron Collider allows us to reproduce conditions (in a small space) close to those of the Big Bang. This "looking back in time" connects with the use of the best telescopes to see as far as we can in the universe, which of course is also seeing back in time to the early universe. His Antimatter blog has more on this and other topics.

Cormac also forcefully pointed out how Walton made his discovery when working, under Rutherford, with the best scientists and equipment available internationally in the 1920s. He argued strongly that Ireland should now be involved in international projects like CERN and the European Southern Observatory (ESO) to achieve this best level of co-operation for Irish scientists.

After a great lunch and some time to catch up with colleagues, there were two workshops. Jonathan Sanderson, of the Planet SciCast competition, showed how students can make a 2½ minute film illustrating a scientific idea. He got some "volunteer" teachers to do the demonstrating, camera and sound and within minutes we had a (basic) video, showing how "do-able" this could be with the right preparation. Previous participant Declan Doherty of St Joseph's in Lucan also shared the positive experience of his students with us. Visit the SciCast website for some sample films and more details at www.planet-scicast.com.



Eoin Gill as Robert Boyle at the Frontiers meeting at Waterford IT.

Robert Hill of the Northern Ireland Space Office and the International Year of Astronomy took us on an energetic tour of astronomy IT resources (all free of charge) including some spectacular 3D trips through the solar system and beyond. I have since downloaded and used one called "Celestia" and it is impressive. He also showed how the "Underneath the stars" theme (ages 11–14) on the Northern Ireland curriculum links spiritual awareness, science, maths and English as an example of their thematic approach.

There was also a number of stands present, among them Discover Sensors and SciFest with Sheila Porter. I learned from her that almost 2000 students took part last year as SciFest goes from strength to strength.

Thanks to PharmaChemical Ireland, the presentations will be available to view over again. Keep an eye on http://iopireland.org for more news.

Thanks to all at WIT for the welcome and the venue and also the Institute's Teacher Network co-ordinators Paul Nugent and Dave Keenehan. The day was well worth the trip from Dublin and I am looking forward to us getting together again next year in Maynooth.

Seosamh Ó Braonain, Wesley College

Science review acknowledges the importance of STEM to the Northern Ireland economy

The long-awaited report on Northern Ireland's (NI) science, technology, engineering and mathematics (STEM) was finally published and launched on 30 September. It was commissioned jointly by the NI Department of Education and Department of Employment and Learning in spring 2007 to examine the issues related to STEM and to make recommendations to ensure the future success of STEM education in the region.

The review, chaired by well known Belfast physicist Dr Hugh Cormican, provides a detailed analysis of the state of STEM including precise information about student and teacher numbers at all levels, noting in particular the decline in uptake of physical sciences at GCE A-level at a time when the other UK regions are responding to the recommendations of the Sainsbury Review for an increase.

The report highlights the drop-out rate of between 10 and 18% of STEM students at the local universities coupled with the migration loss of around 26% of NI-domiciled students who graduate in STEM courses in the UK each year choosing not to live and work in NI after graduation. Other areas of concern are gender imbalance at all levels and the decreasing number of physics teachers.

Against these issues about the supply of a suitably qualified workforce considered vital to the growth of the economy, the review sets out a clear set of 20 recommendations. These fall into four broad areas:

- business to take the lead in promoting STEM;
- alleviating key constraints in the STEM artery;
- increased flexibility in the provision of STEM education;
- improved government co-ordination in its support for STEM.

Considerable detail is provided in the report on these areas with particular emphasis on the provision of clear careers advice, the introduction of prestigious third-level STEM scholarships, improved planning of the interface between primary and secondary education and the provision of enhanced professional development for STEM teachers.

The Institute of Physics has particularly welcomed the recommendation for the appointment of a chief STEM adviser to ensure a cross-departmental structure to support STEM.

Speaking at the launch of the report, the ministers and senior civil servants in both government departments made clear that they accept the importance of STEM to the NI economy. It is to be hoped that they will act with speed and determination to implement the review's findings.

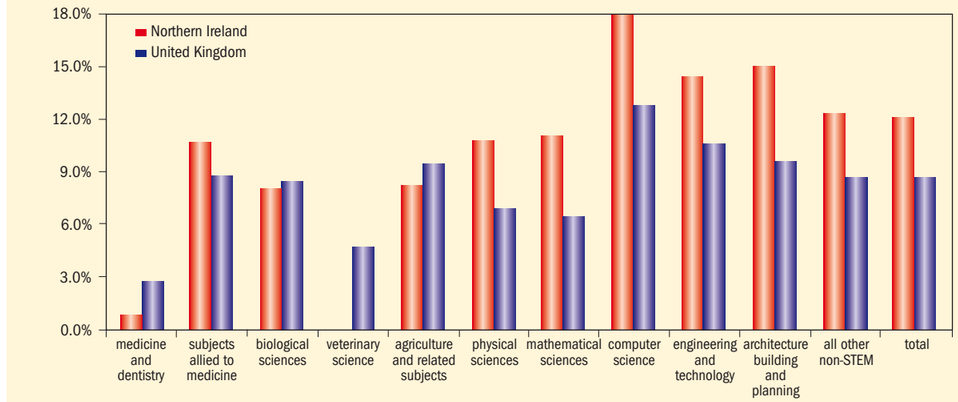
The full report is available for dowload at www.deni.gov.uk/report_of_the_stem_2009_review.pdf.

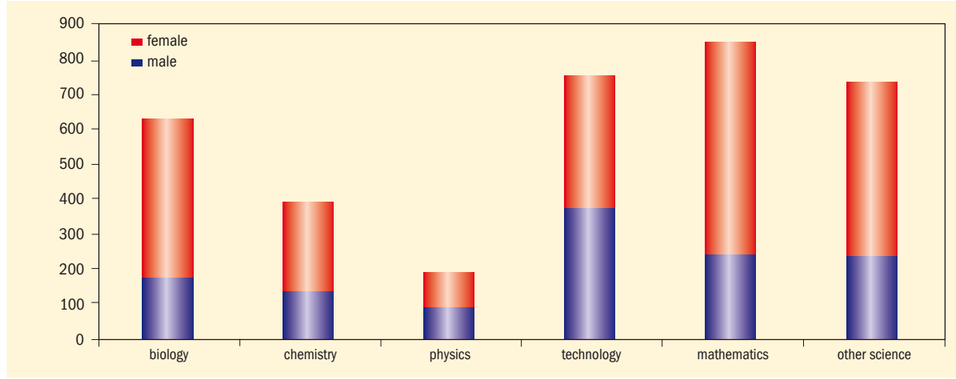
Sheila Gilheany, policy officer

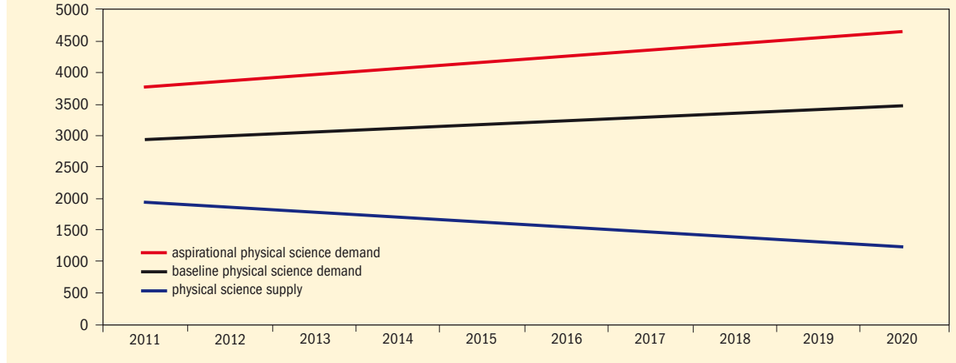
Figure 1 (top): First-year drop-out rates from first degree courses in Northern Ireland and the United Kingdom.

Figure 2 (centre): Numbers of STEM teachers by subject and gender.

Figure 3 (bottom): Projected physical science STEM supply and demand.







Irish physics teacher wins top award

Dr Catherine Donnelly of Ballymena Academy (County Antrim) receives her 2009 Institute of Physics Teacher of Physics Award from the Institute of Physics president Prof. Dame Jocelyn Bell Burnell.

37th Annual Conference for Physics Teachers is a source of inspiration for class demonstrations

The vast array of demonstrations used at this year's annual conference for physics teachers at QUB.

The conference, held at the end of June, was opened by Ian Williams who is professor of physics and the new head of teaching for the Department of Physics and Astronomy at Queen's University (QUB).

In his new role as the chair of physics outreach and recruitment at QUB, Prof. Alan Fitzsimmons had the responsibility of organising the conference. His introductory speech gave an extremely interesting and entertaining insight to his past and present studies and duties. He is an astronomer in the QUB Astrophysics Research Centre whose primary research interests are in performing observations of minor bodies in our solar system, such as comets and asteroids. These studies are generally based on observations performed on the UK-supported telescopes in Australia (AAT), the Canary Islands (ING), Hawaii (Gemini) and Chile (Gemini, ESO).

Another "newbie" was Nicola Byrne, the new chair of the physics teachers' panel. She gave a brief overview of the panel's work, after which I introduced myself as Vida Given's replacement as the Northen Ireland Teacher Network co-ordinator. The conference was preceded by two days of interactive demonstrations and workshops for year 11 (15-year-olds), at which I had delivered a "Magnetic electric show", so I used my introduction spot to share briefly some of the demonstations used. This led very nicely to the introduction given by David Keenahan and Paul Nugent, the region's network co-ordinators, who presented a fabulous range of demonstrations that can be used in the classroom. The huge number of demonstrations took them more than four hours to set up the night before the event.

The conference then broke for lunch, which was served in the Great Hall. A feast to behold was consumed, so I am not sure how the teachers managed to stay focused for the two workshops delivered in the afternoon session. Nicola Byrne chaired a panel session looking at curriculum matters and I introduced a new workshop, to be delivered by network co-ordinators, "Reasons for seasons". This was received with great enthusiasm and it has been added to the programme of study for 2009–2010 of at least one of the teachers present.

Susan McGrath, Teacher Network co-ordinator, Northern Ireland

Physics question cards get moving

One of the four cards that appeared on public transport in the Republic of Ireland during Science Week.

A set of four colourful cards with intriguing multiple-choice physics questions, to which answers can be texted to a mobile phone, was designed by the Institute for physics students earlier this year. The Institute of Physics in Ireland has adapted these to use at outreach events and teachers' conferences, and a few weeks ago, during Science Week, they were advertised on the DART and buses in Dublin, Cork, Limerick, Galway, Waterford and Louth. They will also feature on public transport during Northern Ireland's Science Week in March. Visit http://iopireland.org/questioncards to see the four questions, multiple-choice answers, hints and solutions.

The cards will be handed out at the Institute's stand at the BT Young Scientist Exhibition in January. They are also being distributed in physics classes, lectures and Science Society events throughout Ireland.

Alison Hackett, IOP representative in Ireland

Members of the Santa Sabina team: Siobhán McGovern, Emma Carter, Iryna Mykbaleoska and Sinéad McCann, together with space correspondent Leo Enright, IOP teachers co-ordinator (and Santa Sabina) Paul Nugent and Robert Hill (Northern Ireland Space Office).

European night-sky symposium awards team of Irish students for presentation on light pollution

New computer games to raise awareness of light pollution were created by four teams of four students from Belvedere, De La Salle Churchtown, Gonzaga and Santa Sabina. The 16 students and another eight from Northern Ireland presented their work in Armagh on Saturday 16 September at the ninth European Symposium for the Protection of the Night Sky. The inspiration came from Rob Hill, director of the Northern Ireland Space Office.

"Three weeks? Forget it. Can't be done," I said – and it's great to have been proven wrong. This project had all of the ingredients to get students going like an express train. The students from the four Dublin schools grasped the challenge. They created a new resource, researched and campaigned on the major issue of light pollution and enjoyed each other's company in Armagh, as well as meeting the professionals. What more could you ask for from an educational experience?

Rob Hill's enthusiasm is so infectious that it could start a pandemic. He and Andy McPherson took over the IT suite in Belvedere College SJ, invited by the headmaster Gerry Foley who recognises 21st-century learning opportunities when he sees them.

In three hours the students became remarkably comfortable with a powerful authoring tool called Thinking Worlds software. (Ask someone younger than me.) They produced early drafts of four new 3D computer games and, as Rob and Andy noted, they never asked if there was a manual – only adults need a manual. It was a pleasure to witness their passion, involvement and fun while discovering what they could do with this software. It was a perfect illustration that, unlike most teachers, "students are digital natives".

The students were also guests at the Royal Irish Academy in Dawson Street on Wednesday 6 September when the proceedings of the ninth European Symposium for the Protection of the Night Sky were opened with an address by the Minister for the Environment, John Gormley TD, and a lecture titled "What is light?" by science broadcaster Leo Enright.

In the remaining two weeks these games were developed, improved, edited and fine-tuned by their authors. Indeed, by 19 September in Armagh all of the students were relaxed and confident about facing some of the best astrophysicists in the galaxy – and their work was superb. They were warmly appreciated at the symposium and they were presented with awards and certificates. It was such a busy day that there is talk of a repeat trip to Armagh in November to visit both the historic observatory and the planetarium, and to enjoy each other's company.

A huge debt of gratitude is due to Rob Hill, Andy McPherson, Albert White and Paul Nugent from the Institute of Physics (teachers co-ordinator) and Santa Sabina, teachers Brian Masterson, De La Salle, and Joe O'Briain, Gonzaga, for this wonderful opportunity that provided at least three levels of benefit to a lucky group of 24 students from both sides of the border.

Michael Grehan, Belvedere College SJ

Winners of the Photonics Ireland 2009 student poster competition proudly receive their award certificates at one of Ireland's major physics events. Left to right: Aurora Panzera, Barbara Korzeniowska, Laura Russell, Nitesh Pandey, Anna Baldycheva and Jaroslaw Pulka.

Event celebrates Irish photonics

275 students, scientists and industrialists converged on Acton's Hotel in Kinsale in September to highlight Ireland's growing investment in photonics. The three-day Photonics Ireland event, organised by a consortium of researchers across Ireland followed on from an initial event in Galway two years ago.

With almost 200 papers presented, the sessions covered most aspects of photonics research in Irish universities and institutes of technology, including: photonic materials, photonic devices, nanophotonics and plasmonics, biophotonics, imaging, laser-material interactions, quantum optics, and optical communication systems. The conference also included a session on "Entrepreneurship in optics and photonics", chaired by Eoin O'Driscoll (chair of Forfás).

The conference participants were representative of all of the photonics research groups in the Republic of Ireland and Northern Ireland, and many research students and postdocs in photonics – as well as senior researchers – participated. International speakers from Germany, Switzerland, Israel, the UK and the US also featured prominently. In addition, there were several high-level representatives from industry and funding agencies.

Just some of the major research areas that were covered included:

- photonic materials – growth of site-controlled quantum dots with record properties;
- photonic systems – development of a new type of fibre-to-the-home network designed to replace the separate metro and access portions of today's networks, demonstrated by Tyndall in collaboration with partners in the EU PIEMAN (Photonic Integrated Extended Metro and Access Network) project;
- materials design – description of a generalised photo-polymerisation-driven diffusion model, in work part-funded by Bayer and now finding wider application, including in holographic materials design by Sony.

As the conference chair, David Cotter of the Tyndall National Institute noted: "Photonics is a key driver for technological innovation and it has become one of the most important sectors for future products and markets in the 21st century. It has tremendous leverage for creating products in a broad range of industrial sectors that multiply the value of initial photonic components and technologies many times over."

Certainly, this is a message that Irish government-funding agencies have taken on board with recent key investments in Ireland by Science Foundation Ireland, the HEA (through the Programme for Research in Third-Level Institutions PRTLI) and the European Union (through Framework programmes). These have resulted in an emerging critical mass of photonics R&D in Ireland. Several groups now work on key aspects of photonics, ranging from the theory of quantum processes and materials at the atomic level, through optoelectronic and optical components and sub-systems, to the demonstration of advanced applications, such as high-speed telecommunications.

Within the industry forum many of the speakers, such as Daniel Neal, founder and CEO of Wavefront Sciences, and Carl Jackson, founder and CEO of SensL, highlighted the opportunities that are available for enterprise in this area. They stressed the critical need for a flow between the laboratory and the marketplace with innovation being driven primarily by understanding the customers and their needs.

Photonics Ireland 2009 was sponsored by the Institute of Physics in Ireland, Science Foundation Ireland, INSPIRE – Integrated Nanoscience Platform for Ireland (a PRTLI-funded collaborative research initiative) – the Tyndall National Institute, Thorlabs and IMEX Test and Measurement.

Sheila Gilheany, policy officer