Continued from page 7

The interface problem between physics in school and physics at university is recognised as an issue across Europe. *The European University Physics Educational Network,* EUPEN, through its operation of the STEPS project funded by the European Commission, is looking at a number of issues affecting Europe's physics departments. One of these is the interface between schools and university physics. This is recognised as a problem throughout Europe although causes and severity vary from country to country. What seems to be widely felt is that it is the ability of first year university students of physics to use mathematics that is the main problem. Also it seems this might be a bigger problem in the UK than elsewhere even though our physics degree courses are less mathematical than those in continental Europe. As part of this study I have been visiting a few schools in the UK and also in Portugal to talk to practising physics teachers and to get their perspective. This has been illuminating.

The overall picture which emerges from Smithers is that the science education of large numbers of pupils has been impoverished by the severe shortage of physics teachers in schools and that the knock-on effects of this are not only harming university physics departments but also harming the general level of scientific literacy in society and the ability of UK companies to recruit a technically and scientifically advanced workforce.

The Smithers report ends with the questions "*What importance should be attached nationally to identifying and developing students capable of taking physics to a high level, what role should physics play in general education, and how best to achieve the desired ends?*". These are questions with which the university physics community should engage and indeed lead the discussion.

Gareth Jones
(Imperial College London)

Dates for your Diary

16th May, 2007; University of Leicester; joint meeting of the HEG and the IoP Education Group; *"The Training of Teachers"* (http://www.iop.org/activity/groups/subject/hed/Events/page_8067.html)

17th - 20th June, 2007; University of Keele; Higher Education Academy; *"Science Learning and Teaching Conference 2007"* (http://www.physsci.ltsn.ac.uk/Events/EventList.aspx)

21st June, 2007; University of Keele; Higher Education Academy Physical Science Centre (on behalf of all STEM Centres); *"Recent Changes to 16-19 Science Qualifications"* (http://www.physsci.ltsn.ac.uk/Events/EventList.aspx)

28th July – 1st August 2007; Greensboro, NC USA; 131st National Meeting of the *American Association of Physics Teachers (AAPT)*. (http://www.aapt.org/)

2nd August 2007; Greensboro, NC USA; AAPT *Physics Education Research Meeting.* (http://www.aapt.org/)

21st August – 25th August 2007; University of Malmo, Sweden; *"2007 Conference of the European Science Education Research Association"* (ESERA) (http://www.mna.hkr.se/~ll/eseraconf/)

26th -31st August 2007; Opatija, Croatia, International Group for Research in Physics Teaching and the European Physical Society; GIREP-EPEC Conference 2007; *"Frontiers of Physics Education"* (http://www.ffri.hr/GE2/)

6th – 7th September 2007; Dublin Institute of Technology, Ireland; Higher Education Academy Physical Science Centre and Physics Innovations Centre for Excellence in Teaching and Learning; *"Physics Higher Education Conference"* (http://www.physsci.ltsn.ac.uk/Events/EventList.aspx)

6th - 8th September 2007; Sant Feliu de Guixol, Costa Brava, Spain; European Physics Education Network (EUPEN) 9th General Forum; *"The Physicist in the European Knowledge Society"* (http://www.eupen.ugent.be/conf/egf2007.php)

13th - 15th September 2007; University of Wroclaw, Poland; *"12th Workshop on Multimedia in Physics Teaching and Learning", MPTL 10.* (http://www.eps.org/conferences/europhysics_conferences/mptl-12/)

16th September 2007; Institute of Physics, London; talk by David Mills (Monash University) as part of his UK tour jointly sponsored by the HEA Physical Sciences Centre and piCETL; *"Students' Investigative Skills and the Physics Laboratory - research and good practice seen from 'Down Under'"* (Details to appear at http://www.physsci.ltsn.ac.uk/Events/EventList.aspx)

11th-16th November 2007; Marrakech, Morocco; International Commission on Physics Education (ICPE); International Conference on Physics Education *"2007 Building Careers with Physics"* (http://www.ucam.ac.ma/icpe2007/Html/Important%20Dates.html)

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Items for the Newsletter

The Newsletter aims to provide a platform for the exchange of news, information, activities and ideas between those active in the Higher Education and those who have an active interest in the subject. The Newsletter is published twice per year. This is the fourth edition covering the period between October 2006 and April 2007. If you would like to make a contribution (news, activities, conference reports, articles, diary dates, letters, book reviews, etc.) to the second edition of the Newsletter, please send it to the Newsletter Editor:

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Institute of **Physics**

THE HIGHER EDUCATION GROUP

NEWSLETTER No 4 • May 2007

A Welcome Note

A warm welcome to all members of the Higher Education Group and a welcome also to this, the fourth Newsletter of the Group. The AGM last December saw some changes in the management of the Higher Education Group with Bob Lambourne stepping down as the Group's inaugural Chair and *Ray Jones* taking over as Chair. *Eamonn Cunningham* takes over from Ray Jones as Secretary and *Lowry McComb* takes over from Eamonn as Treasurer. Several new members have now joined the Committee and hail from a number of different Universities around the UK. You will find the details elsewhere in this Newsletter. The first three years of the group's operation have seen a vigorous programme of activity spearheaded by *Bob Lambourne*, and we owe a great deal to his inspirational leadership and hard work in getting the group off to such a good start. We are delighted that he remains on the Committee to help steer the group from the backbenches. Our warmest thanks for everything he has done.

The group's final meeting this academic year is on the 16th May 2007 at the University of Leicester and offers an opportunity for members of both the Higher Education Group and of the Education Group to get together and discuss *The Training of Physics Teachers* at a meeting planned by *Ian Lawrence* and *Brenda Jennison*. We were reminded at our AGM in December 2004 that such a meeting was long overdue and the importance of the topic for the continuing health of Physics at all levels cannot be overemphasised and it must be hoped that the meeting will be as well supported as the topic deserves. In the meanwhile the new Committee has met to plan the outline programme of meetings for the academic year 2007-8. A number of topics were mooted as likely to be of significant interest. It is hoped to organise a joint meeting with the Education Group, and there is interest in mounting a meeting looking at the general issue of E-learning. It has become the practice of the *HEG* to include one meeting devoted to the promotion of some area of Physics which has been poorly represented in the traditional undergraduate curriculum and the suggestion has been made that a meeting devoted to the teaching of *Soft Condensed Matter Physics* would fit the bill. We are also exploring plans to run a meeting devoted to the issue of First Year Skills. These ideas are, at present, only provisional and if you have any suggestions for future meetings, we should be very glad to hear from you.

We intend to continue the policy of spreading the Higher Education Group's activities around the UK and the Committee was very pleased to note the success of the meeting on *The Postgraduate Experience* at Durham a little earlier in the year. If you have any ideas for other ways in which the group might develop, please do contact either of us (or any Committee Member) to talk things over. We should welcome your views. In the meanwhile we hope to meet you in the near future at one of our meetings.

Raymund C. Jones
(University of Birmingham)
HEG Chair

Eamonn Cunningham
(Dublin City University)
HEG Secretary

Ray Jones – the Chair of HEG - in Scotland

3rd HEG AGM

The 3rd Annual General Meeting of the Higher Education Group was held on Wednesday, 13th December 2006, at IoP, London. It took place on the same day as the joint meeting on *"Investing in the Future of Physics: New degrees in Physical Science"* organised by the HEG and the Education Group. After the annual reports from the Chair, the Secretary and the Treasurer had been presented, the election of the committee took place.

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The Postgraduate Experience, 7th February 2007, Durham University

On 7th February, the Physics Department of Durham University hosted the most northern meeting of the Higher Education Group so far. The meeting, our first to focus on postgraduates, was overshadowed by the death the previous day of *Sir Gareth Roberts*, FRS. Among his many achievements, Sir Gareth was instrumental in the development of the recent changes in postgraduate education, especially the provision of ear-marked money for the development of early-stage researchers. He also had strong connections with Durham, having been Head of the Department of Applied Physics and Electronics here earlier in his career. Friends and colleagues stood in silent tribute to his memory.

The morning session of the meeting was devoted to a discussion of national issues in postgraduate education. The first speaker was *Kate Reading* of the *Research Careers and Diversity Unit of Research Councils* UK. Kate summarised the policy background to the recent changes in postgraduate education in the UK and the Research Councils' strategy in achieving their goals regarding research careers and diversity. She then presented an outline of the current national picture of career development for postgraduate researchers as revealed by the annual monitoring of Roberts expenditure and mentioned some plans for future activities.

Dr Janet Metcalf, Director of the *UK GRAD Programme*, followed Kate's theme by focusing on a doctoral research programme as a preparation for a career. She reported on recent surveys of employers' and researchers' views of essential employment skills and attributes in early stage researchers and on the career paths of PhD graduates, particularly those in the physical sciences. She then surveyed the work that UK GRAD in particular is doing to enhance the personal and professional skills of early stage researchers.

The final speaker before lunch was *Prof. Lynn McAlpine*, Professor of Education at *McGill University* and presently on secondment to the University of Oxford as Director of the CELT Preparing for Academic Practice. Lynn's presentation focused on *"Preparing the next generation of scientists: What are the issues?"*. In a wide ranging survey of recent research, she summarised doctoral students' views of academic practice and how that might translate into our doctoral programmes.

The afternoon session was devoted more closely to good practice in physics departments. *Avril Manners*, Director *SUPA Graduate School*, described the exciting work of the *Scottish Universities Physical Alliance* in collaborative doctoral provision. SUPA is designed to bring together physics research in Scottish Universities and so to reach the critical mass needed to address the big scientific problems of the new century. Avril described how the Graduate School provides Alliance-wide development for physics early-stage researchers, both in the provision of technical and transferable skills and how technology – both video conferencing and web-based activities – are used to deliver the programme.

Dr Ray Jones, of the *School of Physics and Astronomy, University of Birmingham*, described the programme which is running at Birmingham to support early-stage researchers in their teaching. In common with other Physics Departments, Birmingham depends heavily on postgraduate researchers in delivering the undergraduate teaching programme. Ray described an innovative programme of postgraduate teaching assistants who are given more responsible teaching duties such as supervising undergraduate projects in return for an additional honorarium and an extra term's support for writing up. These PGTAs, as well as ordinary postgraduates and postdocs, are required to undergo a comprehensive departmentally-based teaching induction programme which is accompanied by follow-up sessions later in the year.

The final speaker – and very relevant to the day – was Léon Gaillard, a postgraduate research student and PGTA from the School of Physics and Astronomy, University of Birmingham. Léon gave a fascinating presentation which covered his expectations of a doctoral programme and how the opportunities provided at Birmingham and the skills he developed met these expectations. This provided an extremely useful view from the student's perspective and gave many useful suggestions as to how doctoral programmes could be adapted to further meet researchers' needs.

Leon Gaillard, University of Birmingham

Both morning and afternoon sessions conclude with panel discussions which produced a lively discussion involving the audience and presenters. My co-organiser, *Eamonn Cunningham*, and I would like to thank all the speakers and participants for making this meeting so successful.

Lowry McComb
(Durham University)

Eamonn Cunningham
(Dublin City University)

Some Comments on the Smithers Report

In August 2006, *Alan Smithers* and *Pamela Robinson* of the University of Buckingham published their report "*Physics in Schools and Universities – II. Patterns and Policies*" (downloadable from www.buckingham.ac.uk/news/newsarchive2006/ceer-physics-2.html). This attracted quite a lot of press attention provoking headlines such as *"Physics in Terminal Decline?"*. The sad tale there documented of the decline of physics as a subject in schools and universities was keenly felt by those engaged in physics teaching in higher education as well as by physics teachers in schools. In many ways the Smithers Report covers similar ground to the IOP's own report published in 2001 *"Physics- building a flourishing future"* but is more recent and takes a more detailed look at the statistics and their interpretation. It also comes up with a more worrying conclusion and prognosis. At least it has drawn the attention of politicians to a serious situation which could adversely affect the future economic competitiveness of the country.

So what are the alarming facts emphasised by Smithers and Robinson? Perhaps the most dramatic is that the uptake of A level physics has shrunk from 6% of 16-year-olds in 1990 to 3.8% in 2004. Also, since 1994, the number of home students on first-degree physics courses has decreased by more than 28% while the number of universities teaching undergraduate degree courses in physics has decreased by more than a quarter (from 57 to 42).

The kind of statistics it examines principally relate to exam entries/results and university admissions/degree results. It looks carefully at the changes that followed the introduction of GCSE replacing O-levels, combined science largely replacing separate sciences, AS levels and modular A Levels replacing the integrated two year Physics A-level. It also looked at the role of gender differences and school types. It thus could examine long term trends and changes which we have been aware of for some time but which perhaps have not been subject to analysis backed by comprehensive statistical data.

As an example of long term trends, the report shows that A level physics entries in 2005 were, at 30,000, approximately the same as they were in 1960. The difference is that in 1960 the numbers were rising quite strongly whereas for the last 15 years they have been falling steadily, having peaked in 1983 at about 50,000. Meanwhile total A level entries have risen steadily and are now four times what they were in 1960. The study of physics thus represents a significantly smaller part of school teaching in the age ranges 16 – 18 than it used to. The same is true of the age ranges 14 – 16 where physics as a separate subject has been subsumed in combined science GCSE and occupies a smaller part of the curriculum.

Several factors which might lie behind these trends are examined. Changes in the national curriculum have resulted in very large falls in the numbers taking single award physics at GCSE (which is now practically the preserve of independent schools) and double award science at GCSE has a physics component which is much reduced and is mostly taught be teachers who do not have a degree in the subject. Relatively few physics graduates enter teaching and the retention rate of those who do is not very good. Physics graduates now comprise only one in eight of science trainee teachers and combined science in schools is now increasingly being taught by biologists. GCSE double award science does not give a good foundation for A level physics so pupils perceive A level physics as more difficult than most other subjects, so fewer choose it. This is particularly so in the many schools where none of the science up to age 16 has been taught by a physics graduate. These things have all been known or at least suspected for some time but it is helpful to have them all brought together and backed by statistics. They lay behind various government initiatives to encourage physics graduates to become teachers. On the London underground I frequently see advertisements showing a youngster inspired by his physics teacher carrying the caption "*That's gravity that's making his jaw drop*". The add goes on to quote the financial incentives of becoming a physics teacher as well as communicating the non-financial rewards of helping young people to understand physics. I applaud this and hope that it will make a difference. The government has finally woken up to the problem and is trying to do something about it.

One of the factors that has not received much attention (just a little from Smithers and Robinson) is the effect of the division which has grown between physics and maths in school. This division has occurred partly because physics has been subsumed within science at GCSE without regard to its special characteristics and perhaps also because it has been felt that the use of even very elementary mathematics creates a barrier and a disincentive. There is almost no use of maths in GCSE combined science and not much maths in A level physics. This is a shame as in fact there is a close synergy between physics and maths. Physics acquires much of its power through the use of mathematics. Without it, much of physics teaching is more like telling pupils things rather than explaining them. Twenty years ago this was apparent (in both O level and A level) but this is no longer so and many first year university physics students are very surprised to discover how important maths is for physics. It needs good physics teachers to bring it out and to show that far from making physics more difficult it actually makes it more understandable - assuming they have acquired competence at school mathematics. One effect of this is that physics graduates who want to become school teachers find that they can train either to become science teachers (with physics as the main subject but also able to teach another science as well as physics) or to become maths teachers. We might get more physics graduates going into teaching if they could train to become physics teachers who also could be called on to teach maths.

However, not all is gloom and doom since one important statistic emerges (although not emphasised by Smithers and Robinson) which is that the number of students gaining a grade A pass in A level physics has actually increased by about 27% since 1990 and has been fairly steady for the last seven years. This confirms that physics is recognised as a difficult and challenging subject in schools and that those that choose it at A level are amongst the more able and they do well at it. University physics departments of course want to admit these A grade students and the good news is that the supply does not seem to be decreasing. Of course, it can be argued that an A grade in physics now is not what it was in 1990. This is undoubtedly true as A levels have changed and physics departments recognise that there is an interface problem between school and university studies in physics. Whether it has actually become easier to get an A grade is a difficult and controversial question; exam boards and government ministers deny it while the distinct impression of admissions tutors and those teaching first year physics at university is that it has in fact got easier. Physics degree courses have had to be adjusted downwards even for those students with A grades in both physics and maths.

Continued on page 8

Physics and Public Engagement with Science, 11th October 2006, IoP London

Engaging the public in scientific matters is generally regarded as a good thing. Some see it as an essential part of developing an informed citizenry, others as an indirect route to increased support and improved funding for science. Taking a more parochial view, it can also contribute to the public perception of a subject, an institution or a department, and thereby contribute to student recruitment. However, effective public engagement is no easy matter; for many professional scientists the first challenge is simply to find the time to participate in public engagement activities but beyond that are the challenges of devising activities that will reach a sufficiently large or sufficiently focussed audience to be worthwhile and, of course, communicating with that audience. In the specific context of physics, the HEG's Public Engagement discussion meeting addressed all of these issues and many more besides.

After some brief introductory comments, the meeting opened with a scene-setting talk by *Darren Bhattachary*, the Royal Society's Science and Society Manager. Darren concentrated on a major study, funded by the *Royal Society, Research Councils UK* and the *Wellcome Trust*, of the factors affecting science communication by scientists and engineers. The study was intended to provide factual data about current attitudes and activities, and also to contribute to efforts to create a workable system of recognition and reward for science communication activity. One part of the study was a survey involving a sample of 1485 researchers, 8% of whom were physicists. Darren went to some trouble to isolate the responses from physicist and to compare them with the overall response from the sample. The picture that emerged was one of a surprisingly high level of activity, with about 75% of respondents having been involved in one or more activities in the past year (excluding departmental open days), and 10% involved in more than 10 activities. 43% of the general respondents said they would like to spend more time on science communication activities while 44% of physicists gave the same response. Only 5% of the physics respondents said they did not want to get involved and only 1% wanted to spend less time on such activities. Not surprisingly, the main barrier to involvement was lack of time and the factors most likely to increase science communication activity involved money (for departments rather than individuals) career recognition and support from departmental heads. Follow up interviews provided further insight into some of these issues, including the perception that involvement in science communication activity could be positively damaging to a scientific career, that it was a low priority compared with research, and that the *Research Assessment Exercise* had the effect of displacing a certain amount of communication activity. The full report can be downloaded from the internet at http://www.royalsoc.ac.uk/page.asp?id=3180

In my own presentation I examined some of the potential links between public engagement and student recruitment. Coming from the *Open University*, where there are now several relatively young students, some of them effectively full-time, but where the average student is around 30 and definitely part-time, a wide range of engagement activities have the potential of assisting the recruitment of students. I started by listing some of the projects that had been funded under the *IoP Public Engagement grant scheme*, and then went on to examine in detail three areas of activity in which I have personal experience. The first of these was the use of TV broadcasts to attract students, particularly the steps that could be taken to convert a vague interest aroused by a science TV programme into a real enthusiasm that might even be converted into a student enrolment. My second topic was the role of science festivals, as exemplified by the *Edinburgh International Science Festival*, and my third the role of outreach lectures and continuing education. In the latter case, I concentrated on the work of the *Oxford University Department for Continuing Education,* where I have been involved in organising and presenting a rich programme of physical science activities for many years.

After lunch, particle physicist *Brian Cox*, from the University of Manchester, gave a talk on the pros and cons of being a media scientist. Brian spoke very amusingly about some of his experiences of trying to communicate science to the public and gave some interesting illustrations of the care that is sometimes needed to avoid giving the wrong impression about the true nature of scientific work. Brian's talk ranged across radio, TV and live public lectures, but the main emphasis was on television, where the potential impact is greatest due to the size of the audiences. Some of the issues that Brian raised were also explored by the forth speaker, writer and broadcaster *David Whitehouse*, a former BBC science correspondent. David, who has a background that includes research in radio astronomy, gave an insider's view of the role of the media (potential and actual) in the creation of the public image of scientists. His thoughtful and at times quite provocative talk emphasised the agendas to which journalists had to attend and the ways in which they often differed from those of scientist interviewees.

The day ended with a presentation on the *Scientist in the Classroom* by astrophysicist *Shomak Raychaudury* of the University of Birmingham. Shomak based his talk on his outreach and engagement activities in India and the US as well as his more recent experiences in the UK. He expressed the view that the best target to aim for was the 11 to 13 year-old who would not yet have made a definite decision about future studies, and went on to survey a range of appropriate activities in addition to lectures and visits. Shomak's talk had a very practical flavour, though it was clear that his work on a science park that youngsters could explore had benefited from the Indian climate and would not work so well in the UK! One of his projects that had achieved remarkable success in India that might be replicated here concerned a *'Big Quiz'* in which a high proportion of the schoolchildren from a town or city might be involved, initially as participants and subsequently as spectators. His other approaches included workshops, master-classes and a range of internet based activities.

This HEG meeting was sponsored by the Physics Innovations *Centre for Excellence in Teaching and Learning* (piCETL), thanks to which it was possible to waive the usual charge to participants. All the presentations were recorded on video by piCETL and will be soon be available to view from the new piCETL website (http://cetl.open.ac.uk/picetl/).

Robert Lambourne
(The Open University)

The School of Physics and Astronomy in the (new) University of Manchester

Background

In 2004 the *Victoria University of Manchester* (VUM) and *UMIST* formally merged to form the new University of Manchester. There were a small number of "overlapping" departments, mainly in science and engineering, of which physics is one. Most members of the predecessor departments joined the new *School of Physics and Astronomy;* the exceptions were the atmospheric physics group and some condensed matter physicists. The new School has two large research groups working on Astronomy/Astrophysics and Particle Physics, as well as groups in Condensed Matter Physics, Photon Physics, Biological Physics, Nonlinear Dynamics and Liquid Crystals, Nuclear Physics and Theoretical Physics.

The History

The two departments started their collaboration substantially before the merger; advanced options, typically at 4th year MPhys level were open to students from the other department. This probably helped us in reaching the decision to start joint teaching a year before the official merger—and thus in 2003 all applicants were directed to the VUM programmes. In order to bring the teaching in line, a review of the VUM first year was undertaken, so that students having taken the first year at either institution could take almost all courses on offer in the second year—thus making substantial savings on class-room teaching. In the new university we continued with this new first year, and slowly built on it. Its most distinctive feature is a core course in astronomy and astrophysics for all Physics students—the remaining material covered in our first year core is similar to that in many other universities in the UK.

The Intake

Clearly the UMIST department was the smaller partner in this merger—bringing in about 60 students a year, whereas VUM brought in over 200, and for that reason many of the techniques to deal with such numbers were taken over from the VUM side. The highest intake reached was about 260 (which is the size of our largest lecture theatre in physics), and has slowly been reduced to about 230, where it has been for the past couple of years.

The Transition

Our courses had, at both our predecessors, and still have, a strong experimental flavour. They also use a large amount of small group (tutorial and workshop) teaching. Staff spend most of their teaching time on small-group and laboratory-based activities.

Managing the merger was quite difficult, because we were refurbishing the *Schuster Building* at the same time; we had also decided that all teaching would be concentrated there, and staff would have to travel. This worked very well for the new intake of students, but some of the former UMIST students felt rather homeless, notwithstanding all our efforts to alleviate the difficulties.

One of the interesting aspects of the new University was of course all the new structures and regulations, administrative procedures and management information systems that come with its establishment. Whereas many of the latter probably temporarily stifled innovation—since staff was busy "filling in the blanks", there has been a substantial push for change. All Schools in our Faculty have a *"Learning Enhancement Officer"* (in our case the author) who is partially responsible for driving innovation, and funds are available both in faculties and the centre for innovative projects.

The university has set itself a development target, called the *"2015 agenda"*. On the teaching side this requires us amongst other targets to *"enhance the Manchester experience"* and *"Enrich face-to-face teaching and learning through the provision of highly interactive on-line learning environments drawing on international best practice in e-learning."* This clearly guides our innovations, while keeping the Manchester style, with its emphasis on experiments, and depth and width of pure science as well as applications.

Our Innovations

We have a number of innovation projects, which are mainly ongoing. We have had a review of second year teaching, the outcome of which has been a small realignment of a few courses, but no major changes.

Some of the projects we are involved with are:

- We have run our first blended learning course for first year dynamics. The effect achieved (in terms of results) was quite good, but there was substantial resistance amongst the students to some of the on-line formative assessments used. We are currently deciding what we want to do next year.
- We are trying out a newly developed set of visualisation web pages in our first year, second semester, *maths* course.
- We have just appointed a learning technologist in a joint project with *Chemistry;* he is working on the application of e-learning in the undergraduate laboratories. We are targeting pre-labs; Chemistry is looking at the whole laboratory environment. The goal is to prepare students more efficiently for the time spent in laboratory.
- We are investigating the use of *LabVIEW* in our undergraduate labs, to reflect more closely a real research environment.
- We have been funded by the Faculty to develop e-learning in our first year *Astronomy* course.
- We are part of a joint project between Maths/Engineering/Physics to study the use of "*algebraic answers*" in on-line assessment (mainly formative, but also summative).
- We are developing a *Biological Physics* set of courses—this goes in parallel with the growth of our Biological Physics group.
- First year laboratories are under active review.
- A revamp of our *Physics with Technology* course (which will probably become *Physics with Photon Science*) is in progress.

The list above excludes projects specifically targeted at MSc students—which are driven by links with the University's research institutes such as the *Photon Science Institute* (Lasers, Optoelectronics) and the *Dalton Nuclear* Institute (Nuclear Science/Engineering).

This year the School launched its *"Photon Science"* taught MSc in association with the PSI, replacing the previously offered courses in Laser Photonics and Holography. The launch was supported by a CTA grant which will pay the salary of a Teaching Fellow for the next 2-3 years and funds start-up bursaries for home students (five bursaries this year, reducing to zero within five years). One of the aims of the programme is to improve links with industry, and we plan to offer an increasing number of students the opportunity for industrial placements as part of their programme.

School academics also provide a core module in *Radiation and Radiological Protection* to the NTEC consortium which is coordinated by the Dalton Nuclear Institute. In the first year 45 students were registered on the programme. Although this is a UK-wide consortium covering predominantly engineering areas, most successful applicants for the CTA-funded places have come from our own undergraduate Physics programmes. The module is being converted to distance-learning format for delivery from Sept 2007. It will include a residential element and will use our undergraduate nuclear laboratory for practical work.

Conclusion

We have probably only just started on the path to innovate our courses; it seems likely that changes will be incremental rather than revolutionary, partially due to the substantial student satisfaction with the way we teach at the moment, but also due to the costs associated with implementing changes for a large group of students.

Niels Walet
(The University of Manchester)

INVESTING IN THE FUTURE OF PHYSICS: NEW DEGREES IN PHYSICAL SCIENCE, 13th December 2006, IoP London

A meeting jointly organised by the *Higher Education Group and the Education Group*

At a lively and crowded meeting in the Institute of Physics' Phillips room, progress in the implementation of new degree courses was reported and debated. Derek Raine started the discussion by analysing the difficult situation facing many physics departments. He had no need to sound alarm bells: his audience was all too well aware of the recent announcement of the closure of the department at Reading. As a pioneer of *Integrated Science* at the University of Leicester, he is particularly well-placed to explain how integration has been achieved there using *'problem-based-learning'*. This method emphasises a series of open-ended problems, for example: *"Could a replica Stonehenge serve as a valid tourist attraction?"*. This would include questions of astronomical alignment, the physics of dating and building methods, the geology of the stones and so on. Students are encouraged to look at methods of addressing the question from the viewpoint of a variety of sciences, and to produce a report. Appreciation of physics as a discipline which can provide quantitative answers to problems is thereby fostered, in addition to other scientific ways of looking at the archaeological context in which the problem is framed.

Derek's introduction was followed by *Peter Main,* Director of Education and Science at the IoP. He pointed out that although physics as a discipline is thriving, and shows no decline in its contribution to economic and intellectual life, it has become vulnerable because of the progressive reduction in the number of institutions of higher education offering it as an undergraduate degree. It is one of a number of *'SIVS': Strategically Important Vulnerable Subjects*. As a result, the *Higher Education Funding Council of England and Wales* (HEFCE) has awarded a grant to the IoP to help find a strategy aimed at increasing the number of physics students. Before winning the grant the IoP held a series of seminars at which was revealed the enormous conservatism of university departments: the implication being perhaps that those departments not in fear of closure had everything to gain from the closure of other, smaller neighbours. The grant over a period of two years enables a programme called *'The Stimulating Physics Project'*. There are two strands. One is to improve access at universities by repackaging existing degrees, as well as trying out new degrees. The second strand of activity concerns schools and institutions of further education, in particular making staff and students aware of physics and the opportunities it affords by e-mentoring, industrial visits, and enterprise simulation, all with the aim of encouraging the interest and enhancing the career prospects of non-specialist teachers.

The first strand, the *New Degree*, is what mainly concerned the meeting. Peter explained that market research examining reasons for student choice will be carried out by professionals, targeting those students who have done A-level maths and physics. In addition, in co-operation with partner departments, new degrees will be tried out, to provide physics-based courses for students who wish to live near home, but who do not have access to a physics department, and who do not have traditional A-level preparation. The new degrees should have an appropriate identity and coherence, one which can be understood by potential students, their parents, and by employers. They must provide a possible route into more traditional courses, and they must be recognised by the IoP through its Accreditation Committee. The departments partnering the IoP are at the moment those at University of East Anglia, located in a large 'physics desert', University of Leicester, London South Bank University, and the University of Surrey. This last has for many years offered well-known 'sandwich' courses in which students acquire industrial experience as they progress through their undergraduate career. These seem particularly well-suited to current developments in *'21st Century Science'*. The new degrees will all be marketed under the banner of *'Integrated Sciences'* – market research having discovered that the former brand of 'i-science' does not produce the right associations in the public mind.

After this progress report on the exciting new initiatives, *Sir Peter Williams* invited us to consider the *'Sterling Value of Physics'* from an industrialist's point of view. He pointed out that the City of London doesn't really invest in technology as such: most of the publicly listed companies combine goods and services in such a way that it's impossible to discern where the physics comes in. Nevertheless, if you look at the directors of highly successful giants, such as BP, you find physicists in the driving seat. The sterling value of such men is indeed high! Moreover, as it becomes ever more apparent that climate change brought on by carbon dioxide production presents us with a multi-trillion pound challenge, the role of physics becomes ever more crucial in meeting it. Surely this is potentially our strongest card: without science, and particularly without physics, our society will literally drown. In implementing and improving nuclear power, photovoltaics, battery technology, etc., physics plays a crucial role. Undoubtedly young people will more and more come to realise this. In a remarkable power-point presentation, Sir Peter showed us the consequences of failing to meet the challenge, and the value of physics in finding ways to surmount it.

Following on from the lunchtime Annual General Meeting of the Higher Education Group, *Mark Dixon* from the OCR examination board explained to us how GCSE has changed with the introduction of new programmes of study, particularly *21st Century Science and Gateway Science*. These place more emphasis on scientific literacy and applicable science. They will also give more scope for coursework and school-based assessment. Mark emphasised the great success of *Advancing Physics*, the IoP-sponsored programme, now taken by more than 7,000 students at AS level, and 5,000 at A2 level, more-or-less equal to the traditional subject. He also indicated that although the numbers are by comparison small, there is a dramatic increase in numbers of students taking *Environmental Science* at AS level – up 30% this year, compared with last year. This may be the start of a trend to integrated science in which the environment plays a central unifying theme.

We then heard from *Sarah Howls* of HEFCE. She indicated that the aforementioned SIVS includes, in addition to *STEM subjects* (Science, Technology, Engineering, and Medicine) such subjects as *Modern Languages* and *Area Studies*. Overall support of £250M is pledged, and £75M to support these subjects while demand is grown. She declared that we are entering the era of *'marketisation'*, consonant with the IoP's attempts to enlist professionals to help brand or rebrand physical science. She also hoped that ways would be found to get direct employer participation in the development of new curricula.

Karen Heywood from the University of East Anglia and *Alex Mack* from Leicester then explained briefly their progress so far in implementing new courses. For example, at UEA, there is a successful topic on *'Sound and Music'* which is aimed at young people who can combine their musical interest with the relevant physics of sound – presenting something similar to a series of problem-based learning challenges. In this way, at both institutions, one can follow a route through natural sciences, based on integrated science, not the sequential study of separate specialisms.

Needless to say, at the close of the meeting, there was a lot of discussion. The effectiveness of the environmental banner was questioned by some, welcomed by others. Problems in getting direct interaction from entrepreneurial physicists were encountered, but real benefits seem likely to accrue to the courses of those who manage to do it. What about problems of respectability and accreditation? The bench-mark statements for physics seem to allow considerable flexibility and scope for recognition from the IoP. Finally, the question arises: is £75M enough to stave off closure of departments until demand rises? At least it provides a platform for the flexible and creative thinking that is needed if we are to survive the bumpy road ahead of us.

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πCETL in Singapore

The International PBL Symposium 2007, with the theme of re-inventing *Problem-Based Learning* (PBL), was held in Singapore in March at Republic Polytechnic, an institution which, when at full strength, will teach 13000 students across the curriculum solely by PBL. Staff from *πCETL- Leicester* were there to give a pre-conference workshop looking at re-engaging with PBL as a mature methodology, but also to learn from the collective research experience of an approach to learning that is now around 50 years old.

It is unsurprising that after this length of time PBL has spawned many variants, but its central theme remains unchanged: it attempts to engage students in a group approach to 'real world' problems. Some of the initial ideas of how PBL should be done have been made to look eccentric by the research findings garnered over the years. The idea that groups can be effectively facilitated by staff who know nothing about the subject or the problem at hand, and the concept of divisibility of core learning objectives amongst the group are no longer tenable.

The Singapore educational system is interesting: we were told that over 90 per cent of the population go on to higher education, but only 15 per cent in the University sector, the remainder in polytechnics. This means not only that resources can be concentrated on areas of economic relevance, but that there is scope, and perhaps a need, for educational experiment.

The approach of *Republic Polytechnic* to re-inventing PBL is unique. It's most fascinating feature is that it is the brainchild of one man, Director of Academic Affairs, *Dr Alwis*, and centrally controlled through the Staff Development Unit. Teaching across the Institution follows a single pattern, summarised as *'one problem per day'* (not the same problem, of course). In this system, all students in their various groups get a problem in the morning and present their solutions in the afternoon, with a significant amount of guidance along the way, by staff trained to follow the Polytechnic's methods. It is a huge educational experiment without a control group. Republic Polytechnic being new, it is too early to pronounce on its success, but the Polytechnic has stuck to its system in the face of its critics and is now attracting world-wide interest.

The most exciting aspect of our visit was the earthquake that occurred mid way through our workshop. We carried on blithely, but the locals who obviously knew a thing or two, turned white and ran for the fire escapes. I have to say I felt safer swaying at the top of the building than standing on the ground in its shadow, but, to put it briefly, nothing happened. So clearly not a metaphor for the impact of PBL in Singapore!

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Derek Raine in πCETL in Singapore