

Women want a climate change

Heather Pinnell reports on a conference with women and global warming as its focus.

Women involved in science could make a huge contribution to mitigating the impact of global warming, but there first has to be a cultural shift in the workplace. This was a key message emerging from Climate for Change, the third annual conference of the UK Resource Centre for Women in Science, Engineering and Technology (UKRC).

The conference, held on 14 March, was just a week or so after a Channel 4 documentary sought to pour cold water on the widely held consensus that human impact through CO₂ emissions is the main driver of climate change. Opening the conference, the chair, Anna Ford, said that the timing could not be more apposite. "There are sceptics, but in my view they are flat-earthers. They really want to falsify the facts to fit their particular argument. This conference is to explore the contribution made by women scientists and the contribution they might be making if we could entice more of them into SET professions."

In the run-up to the event the UKRC released survey results showing that 86% of women in Britain were "extremely" or "somewhat" concerned about global warming, compared with 76% of men, while two-thirds of respondents thought that climate change and energy use would motivate more women to engage in SET careers. Other studies have shown that women are more likely than men to behave altruistically to combat climate change.

Several speakers, including Minister for Science and Innovation Malcolm Wicks, picked up on the survey results. He said that, while government, industry and individuals must play their part in tackling carbon emissions, there is a need for more scientific research. "We must harness the SET skills base available to us, but tens of thousands of highly qualified women are not working in the fields in which they have qualified. The climate is now right for changes in workplace practices and cultures," he said.

Annette Williams, director of the UKRC, said that the UK economy lost millions of pounds because qualified women did not return to the SET workforce. "In order for women to return effectively, employers need to provide a workplace in which women want to work and which offers flexibility, irrespective of caring responsibilities or gender," she said. "Experts believe that there will soon be massive opportunities in SET as the problems of climate change are considered, but there is a danger of the same thing happening as occurred in the IT



Left to right: Sima Adhya, Prof. Julia King and Averil MacDonald, chosen as outstanding women in SET.

PHOTO EXHIBITION

The Climate for Change Conference included a display of six photographs taken for the touring exhibition Women of Outstanding Achievement in SET. The six, chosen from 66 nominees, included two physicists – the Institute's former chief executive, **Prof. Julia King**, and **Averil MacDonald** of Reading University – and a space scientist, **Sima Adhya** of Qinetiq (pictured above). The exhibition is organised by the UKRC, which launched the collection last year with six other women of outstanding achievement. The specially commissioned photographs are the work of Robert Taylor.

industry. There was a great deal of optimism about opportunities for women, but in fact fewer women are working in IT than 10 years ago."

A number of women who are leaders in their field in research related to climate change addressed the conference, including Prof. Julia Slingo, director of climate research at the National Centre for Atmospheric Research and founding director of the Walker Institute for Climate System Research at Reading University. She described how enlightened employers who had allowed her to work part time at crucial stages in her career had made it possible for her to succeed. Even so, when she first went to Reading after a career break, she had had to start at the bottom again and it had taken her 10 years to gain a professorship. She believes that women are very good at looking at the larger context and taking the multifaceted approach needed to study climate.

Jane Francis, professor of palaeoclimatology at Leeds University, had just returned from Antarctica, where her work on ice cores was showing that there had been periods millions of years ago when all of the Antarctic ice had melted, even when the area was at the pole and not because of continental drift. The South Pole had been extremely sensitive to climate change and could be so in future. Complete melting of the ice would raise sea levels by 50 m, she said. In a panel discussion later she said that women can be their own worst enemies in not putting

themselves forward for promotion. They also prefer to work collaboratively but the university system rewards people who are absolutely focused on their own research.

The conference also heard from Lynda Armstrong, vice-president technical of Shell International Exploration and Production, who joined the oil industry because she had been told that women did not work in it, she said. She had omitted her first name from her job applications in order to get interviews, causing surprise when she turned up.

Other speakers included Jackie Carpenter, a mechanical engineer and renewable energy consultant who is putting her beliefs into practice by joining an "ecovillage", and Prof. Lynne Frostick of Hull University, who chairs the Implementation Group for Women in SET. She believes that it will take another generation to change the culture in the workplace completely.

While most attending want to see more flexibility to enable women to combine caring roles with full- or part-time work, there were some dissenting voices who saw this as keeping women in the workforce while hindering their advancement. They believe that only a more equal balance of household responsibilities would enable women to participate equally with men. Opinion was also divided on whether women should be more active in attempting to "climb the ladder", or whether this was taking on the more negative attributes of a male-dominated culture that is ripe for change.

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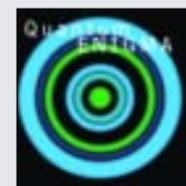
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"Suddenly the sunlight fell on a *Morpho* butterfly. The effect stopped us in our tracks."

Pete Vukusic, p5

"We disappointed Einstein. We did not know what he was talking about."

Bruce Rosenblum, p8

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HIGHLIGHTS

Festival of Physics proves popular in Bristol

The sixth annual Festival of Physics was held in Bristol by the Institute's South West Branch on 3 March. More than 120 people of all ages heard the opening talk from Alice Roberts – a senior teaching fellow at Bristol University more widely known as a presenter on *Time Team*, *Coast* and *Don't Die Young*. Roberts' theme was "The science of *Coast*" and her presentation ranged from Neolithic man on the Gower, through extracting oil from peat, to a rocket research site overlooking the Needles. Peter Kalmus of Queen Mary, University of London, spoke on the fundamental forces of nature from gravity – the most obvious and longest-studied force – to discoveries in electromagnetism, then described present-day developments. He discussed the successful unification of electricity and magnetism by Faraday and Maxwell, the failed attempts of Einstein to unify gravity and electromagnetism, and the electroweak unification in which Einstein played a role. Following lunchtime demonstrations, and a presentation by the Institute's chief executive, Robert Kirby-Harris, Roger Moses of Bristol University spoke about "A thin hard rain from outer space: the story of cosmic rays".

Radio tunes in to distant galaxies

In a series of talks in Limerick, Dublin and Cork organised by the Institute of Physics in Ireland, Prof. George Miley of Leiden University, Netherlands, spoke on radio astronomy. His international team probes



optical galaxies associated with distant radio sources, used to study the formation and evolution of the most luminous and largest known galaxies in the early universe. A highlight was his Hubble images of the massive MRC 1138-262, newly named as

the Spiderweb Galaxy, which made headlines last October. The images give dramatic glimpses of its creation. It is 10.6 billion light-years from Earth and is gorging itself with dozens of smaller galaxies spread across more than 100 000 light-years. Miley said the new LOFAR radio telescope, due to come online in 2007, will use phased arrays spread over 100 km in the Netherlands, later extending to 700 km in Germany and the UK. It could locate massive galaxies at redshifts of 8, and even view the reionisation epoch in the early universe.

Institute journal publishes paper on polonium-210

A paper on the effects of polonium-210 (the radioactive substance that killed Alexander Litvinenko in London last year) has been published in the Institute's *Journal of Radiological Protection*. The paper, by Health Protection Agency (HPA) staff and colleagues from research laboratories in the US, concludes that a dose of 1–3 GBq is likely to lead to death from multiple organ failure within about a month, assuming 10% absorption into the blood. Once the poison has been absorbed, treatment is highly unlikely to prevent death, the paper says. The HPA says that, although the death of Litvinenko stimulated the work, the paper does not examine his particular case. Instead it reviews the evidence from animal experiments and data from human victims of accidents and nuclear weapons. An editorial on the measures taken by the HPA following confirmation of Litvinenko's death accompanies the paper.

www.iop.org/EJ

New website on environmental science launched

The Institute has launched a website dedicated to environmental science, *environmentalresearchweb*. It has news, opinion pieces and articles by leading environmental scientists from academia and industry. There is also a link to the Institute's open-access journal, *Environmental Research Letters*, launched last year, an up-to-date



events calendar and a database of organisations in the field. Registration for membership of the site is free and members will gain free access to the content, receive a weekly newsletter and be able to update the site with their comments and events details.

<http://environmentalresearchweb.org>

Young scientists question MPs

By Leila Sattary

More than 200 young scientists, including members from the Institute's student wing, Nexus, met the Science and Technology Select Committee at the House of Commons to ask questions about science policy and current issues. The Voice of the Future event on 13 March also gave young scientists the chance to meet their own constituency MPs.

The new Minister for Science and Innovation, Malcolm Wicks, gave a brief speech that emphasised the need to build a knowledge economy and develop science and engineering in the UK. He took a number of questions and was challenged on the recent controversial closure of Reading University's physics department.

Asked whether anything could

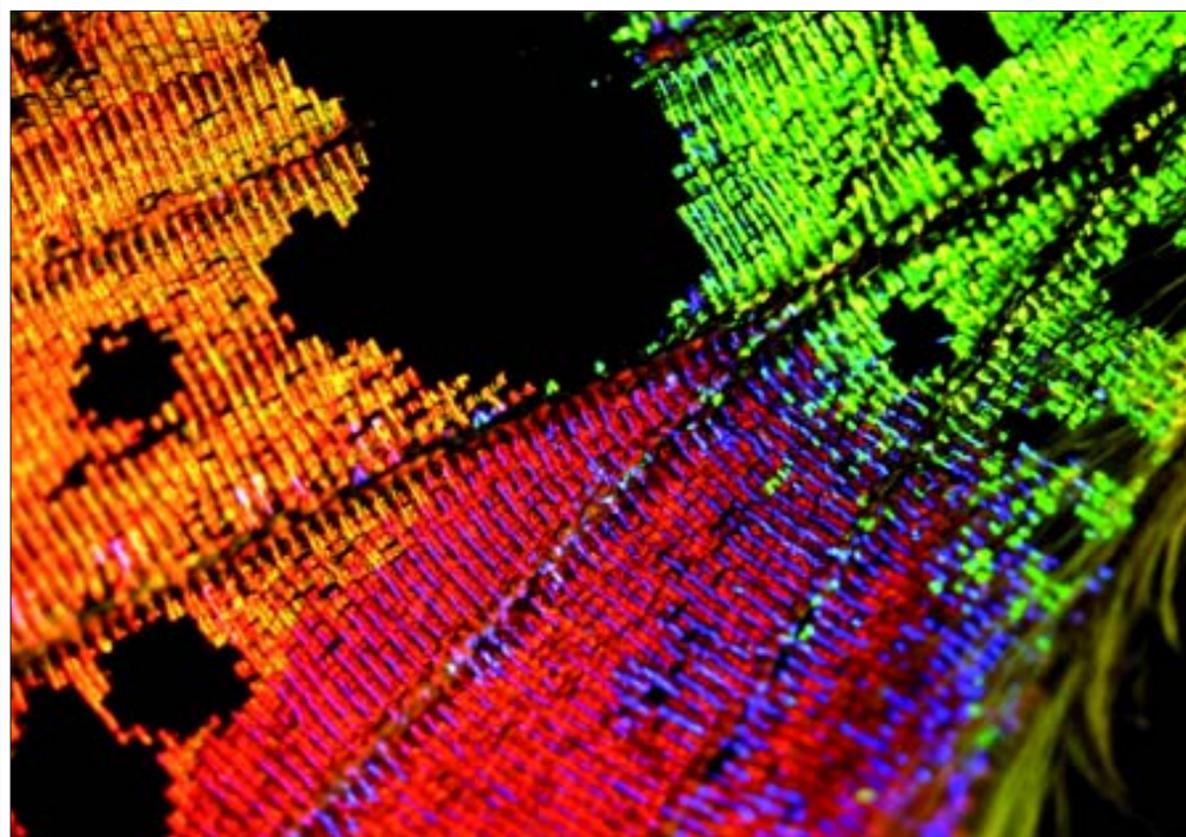
have been done to prevent the closures at Reading or elsewhere in the UK, he said that it was not the government's responsibility to stop such closures and decisions were completely down to the universities involved.

Wicks also defended recent cuts to the research budget, maintaining that the Department for Trade and Industry had to balance its books just like any other organisation. The cuts had been made to compensate for a number of losses such as the collapse of MG Rover, but these were a "blip", he said, pointing to the Labour government's doubling of the science budget since it came to power. He also answered questions about a variety of topics, which ranged from climate change to health care.

In the main event of the day, young

scientists put questions to a panel that included Select Committee chairman Phil Willis MP and three other MPs on the committee – Des Turner, Evan Harris and Brian Iddon – as well as the Royal Society of Chemistry's chief executive, Richard Pike.

The topics covered included clean coal, nuclear power, science education and creationism. Much of the discussion focused on halting the decline in numbers of people taking physics and chemistry at A-level and studying them at university. Harris commented: "We need science in schools to be taught by science teachers and not generalists doing their best. Scientists are sought after by the City for their high level of numeracy and we need to make teaching more attractive to reverse this trend."



Kaleidoscope of colour: Pete Vukusic's research into colours in butterfly wings is being exploited by industry.

Pupils see light shed on colour

By Joanne Page

Pupils from schools in Colchester had their eyes opened to the science of colour by the Institute's 2007 Schools Lecture when it visited Colchester County High School for Girls on 20 February. Some 400 students went along to see the presentation "Light fantastic: the science of colour" by Pete Vukusic of Exeter University.

Vukusic brought the subject to life with demonstrations and images. Beginning with the visible and its place in the electromagnetic spectrum, he went on to explain how the eye works. The audience had fun trying out tests for anomalous colour vision. Pupils also helped to set up standing waves on a flexible spring to demonstrate both constructive and destructive interference, their excite-

ment increasing with the frequency of the oscillations and the number of standing waves achieved.

Using coloured lights and food dyes, Vukusic showed the difference between additive and subtractive primaries and explained why the primary colours and the results of mixing them differ when mixing paint or blending light.

He explained some of his research into how the structure of tiny scales on butterfly wings produce iridescent colour by refracting light, and how different parts of the scales reflect different colours. Focusing a microscope onto a fragment of butterfly wing and projecting the image onto a screen, he gradually revealed a pattern of coloured rings. Structural colour, as can be seen in soap bubbles and butterfly

wings, can be far brighter than pigimentary colour and the students saw examples of how industry is exploiting this property to develop materials, paints and cosmetics.

The annual Schools and Colleges Lecture, which is organised by the Institute and usually given by a practising physicist, is aimed at enthusing 14–16-year-old students by linking classroom physics to the latest research. The tour began on 29 January. Details of the 35 venues that the lecture will visit in 2007 are in the schools and colleges section of the Institute website at www.iop.org/activity/education/index.html.

Searching for 2008's lecturer begins soon. We are particularly interested in people who can talk about work at the Large Hadron Collider. For more details, contact joanne.page@iop.org.

Successful physicists tell their stories to inspire women

Heather Pinnell reports on a careers event for women, which included a prize-giving.

Young physicist Liz Ainsbury was presented with a prize to recognise both her achievement in research and her significant contribution to physics outreach during a seminar for students on careers for women physicists at the Institute on 28 February.

The new Very Early Career Woman Physicist of the Year Award, given by the Institute's Women in Physics Group (WIPG) and sponsored by HSBC, was presented by Dame Mary Richardson, chief executive of the HSBC Global Education Trust. Accepting a certificate and a cheque for £1000, Ainsbury said that she was very honoured to receive the award. Dame Mary said that groups such as the WIPG do much to interest young women in physics, but more needed to be done, particularly to recruit more specialist physics teachers.

The winner of the second prize was Elaine Baxter of Qinetiq Space Division and the third prize went to Andrea Ma of the Cambridge Cavendish Laboratory. Both were presented with books. All three prizewinners gave brief presentations to the seminar audience. Ainsbury, who had just completed a PhD at Bristol University and begun working for the Health Protection Agency, described her

postgraduate work on the physics of extremely low-frequency magnetic fields. The research was funded by the charity Children With Leukaemia. It looked at the health effects of the magnetic fields around power lines and the physics behind these. She also described her outreach work as a "researcher in residence" at St Mary Redcliffe and Temple School in Bristol. The schoolchildren whom she worked with frequently commented that physics was "hard and really boring" she said, but she believes their attitude could be changed if they could be shown what a career in physics was really like.

Elaine Baxter, who joined Qinetiq after a physics masters at Oxford, said that she was immediately involved in writing ground station software for an optical imager, which was one of the instruments carried on board a satellite launched some nine months later. She was responsible for operating the imager from the ground, effectively having her own satellite to play with, she said. In her work with schoolchildren, she told them if they worked hard and did their homework, they might do the same one day.

Andrea Ma, who did a BSc at Imperial College London then a PhD at the



Liz Ainsbury gives a presentation after receiving a prize at the Institute.

Cavendish Laboratory, described her work with computer simulations to fill the gap between experiment and theory, in particular looking at how electrons behave in structures.

WIPG committee member Ann Marks said that one reason for establishing the prize was to celebrate good role models for young women physicists. While women having marvellous careers at a very high level provide one sort of role model, not all young physicists can identify with them, she said. Students in schools and universities needed to see women physicists involved in work that they could imagine themselves doing in a few years' time. Other speakers at the seminar included Caroline Crawford, an astrophysicist at Cambridge University who also worked part-time for

the Royal Society. She described how her career had progressed through a number of short-term fellowships. She now saw such variety and openness as a positive opportunity. Gillian Butcher, a space researcher at Leicester University, also emphasised an element of "leaving things to fate" in her career, while Amalia Patanè, who was awarded the Institute's Boys Medal and Prize, said one had to be prepared to take risks in one's career. A panel discussion covered career breaks, balancing having children and a career, and networking. The Institute's chief executive, Robert Kirby-Harris, said the Institute had a very strong commitment to encouraging women to study physics and to pursue careers in physics, in the context of its diversity programme.

Crucible to fire up talented scientists

The Crucible programme, which brings together talented early-career researchers to develop ideas and explore the potential of their work, is now under way. Run by the National Endowment for Science, Technology and the Arts (NESTA), it involves 30 successful applicants spending three residential "lab weekends" together.

NESTA trustee Kathy Sykes, who is professor of science and society at Bristol University and won the Institute's 2006 Kelvin Medal, said: "For science, technology and innovation to flourish, researchers need to talk with – and listen to – the public more. It's great that Crucible reinforces the importance of public engagement in our most talented researchers."

For details, see www.nesta.org.uk/crucible. The closing date is 30 April.

New communications director

The Institute has appointed Beth Taylor as its director of communications and external relations. Taking up the post on 16 April, she'll be responsible for raising the profile of the Institute as the voice of physics in the UK and Ireland with the public, media, government and industry.

Beth Taylor comes to the Institute from the UK Atomic Energy Authority (UKAEA) where, as director of communications, she led a team across the UKAEA's decommissioning sites during a time of significant change. Both at the UKAEA and the UK Department of Energy she held a number of senior roles. She has a BSc in natural sciences and a PhD in earth sciences from Cambridge University.

The Institute's chief executive, Robert Kirby-Harris, said: "The post

of director of communications is vital if the Institute is to fulfil one of the key aims of its recent strategic review: improving communications with stakeholders and influencers in the wider world. Beth is well equipped to help us to do this as she brings a unique combination of skills and experience to the Institute. Her ability to analyse situations, and to present concepts and ideas clearly and persuasively, together with her wide-ranging experience in a physics-based sector, makes her an ideal person to take forward the Institute's communications strategy".

Beth Taylor commented: "This is an exciting time to be joining the Insti-



Beth Taylor.

tute. I'm really looking forward to getting to know the members, and learning more about their priorities and the issues they would like me to promote on their behalf. I'll be working across the organisation to communicate better the excellent work carried out by the Institute and to build its voice and influence in the wider community. I'll also be looking to build and enhance partnerships with external organisations to improve our delivery of key projects.

"As a parent I'm particularly enthusiastic about taking forward the Institute's campaign to support and promote physics teaching in our schools."

IN BRIEF

• The Institute has expressed concern over the implications of a High Court decision in February requiring the government to start its consultation on building new nuclear power stations all over again, as a judge ruled that the first consultation process was "misleading", "seriously flawed" and "procedurally unfair".

The Institute's manager (science policy) Tajinder Panesar said: "This is worrying news. We were all looking forward to the Energy White Paper, expected in March, which would hopefully pave the way for new nuclear build. It is bad enough that the issue of dealing with legacy radioactive waste, among others, has prevented the government from embarking on a new build programme; now it is possible that this could delay matters further.

"In the light of the Stern review on climate change, the fact that the UK is now a net importer of gas, and the many R&D challenges still facing renewables, a new build programme is vital if we are to ensure that the UK becomes self-sufficient in electricity, that we replace our aging fleet of reactors, and that we don't become over-reliant on imported natural gas, increasing our CO₂ emissions."

NEWSMAKERS

Wendy Sadler, the Institute's Young Professional Physicist of the Year in 2005, has been awarded the Descartes Prize for Excellence in Science Communication by the European Commission. The Descartes awards have been called the Nobel Prizes of the European Union, and the honour brings



with it a share in the €250 000 prize fund, which Sadler received at a ceremony in Brussels on 8 March. The Institute

nominated Sadler for the prize in the Innovation Action category. She was the founder of the science communication company Science Made Simple, started in 2002 as a spin-out from Cardiff University's school of physics and astronomy. The company's three staff use innovative methods to convey the message that science is for everyone. They have produced spectacular shows for schools, such as *Cartoon Science* and *Bubbles and Balloons*, contributed to science television and radio programmes and children's books, provided training for scientists and acted as consultants for the UK research councils.

Sadler, whose work has previously been featured in *Interactions*, said: "To be following in the footsteps of inspirational communicators, such as Sir David Attenborough and Bill Bryson, [previous prizewinners] is incredibly exciting and an acknowledgement of what we have achieved as a small business over the last few years."

Your views on solving the teacher shortage

In the February issue we asked you to send in ideas for solving the physics teacher shortage. Some common themes emerged from those who contributed: higher salaries and stimulating syllabuses are for many the priorities. Thanks to all who responded – the debate will go on and we'll continue to listen to your views.

I am two months into my PGCE course for post-compulsory education. I am a first-class physics graduate, surrounded by friends who have gone to work in the City as investment bankers, traders and accountants. It pains me to think that, although I graduated with the highest overall exam percentage in the final year of my masters degree, many of my peers have entered careers where they will earn double in their first year what I will in mine (and I have paid £3000 top-up fees just to train).

Friends who aren't earning this salary have jobs that don't require the out-of-hours work and preparation that teaching entails.

I must add that the PGCE training is not typically suited to the skills and ideas of scientists as it involves reflective writing assignments and studies in psychology, which to us is foreign territory. I can't help but understand why there are not more physicists entering this profession.

Donna Carroll
Coventry

Reversing the decline of the single GCSE physics in state schools could lead to an increase in physics graduates opting to teach. Those who wish to enter state schools are put off because they're forced to teach biology and chemistry, which many have no background in, as part of the combined science PGCE and dual award science GCSE, when they may prefer to do a PGCE in physics, or maths and physics combined.

Single-science GCSE would allow students in the critical 11–16 age range to be taught by physics specialists, and also reintroduce a more rigorous and stimulating course than the new science communication GCSEs. This would also encourage physicists to enter the classroom. If we were to have "real" physicists teaching "real" physics at GCSE, more students would be equipped for A-level and degrees in the subject, leading to more potential physics teachers.

George Dean
Research assistant
The Ogden Trust

We live in a market economy where you pay to get the calibre of person that you want to do a job.

The BBC reports that a teacher's salary is too low to enter the housing market by a factor of two and there's a shortfall of physics teachers so their value goes up. The market answer is simple: just triple the salaries.

Martyn Gardiner

I am disturbed at just how difficult the problem of solving the shortfall of physics teachers is being cast as when it is so obviously simple.

First we perform an experiment: we ask all of those graduates who can teach, why they don't. I expect the answers to be, in order of diminishing importance:

- poor pay;
- discipline problems in schools;
- too much bureaucracy.

These are readily addressed with well directed expenditure but require the political will to do so.

The solution has been known for decades, but there has been no political will to say that teachers are some of the most important people in society, ahead of doctors, lawyers and politicians, and should be remunerated accordingly. The real problem is how to convince society that this is true.

Igor Bray
Professor of physics
Australian Research Council and deputy director, ARC Centre for Antimatter-Matter Studies

Most of what is taught in schools is relatively simple though it gets more difficult the nearer it comes to A-level. However, every physics undergraduate can cope with most of it. So why not send physics students into schools, where there is a severe lack of physics teachers?

The pupils would learn physics taught by someone who has a real interest in it and the knowledge to cope with school-level physics. The undergraduates would deepen their understanding of physics and not forget the simple stuff, thus helping them to cope better at university.

A science teacher not specialised in physics could then do most of the teaching and undergraduate physics students could teach some lessons or just support them. They would also learn from the very beginning what teaching at a school is like.

Joerg Robin
Germany

More physics teachers? Less paperwork, more discipline. Better behaviour, pay, and prospects. Real labs, real experiments, some risk – exclude dangerous disruptive pupils: their "entitlement" spoils things for the rest. Real physics, with maths – doing it, not just projects writing about it. Understanding, not just "naming of parts". Get rid of science teachers – instead have physicists, chemists, biologists. Physicists should have the training and career option to teach maths or technology

The newspaper of the physics community February 2007

interactio

IOP Institute of Physics

Physicist shortfall continues

Heather Pinnell looks at what can be done to ensure that more of those who can, teach.



The severe shortage of physics teachers in schools is now common ground between the government and all of those with an interest in science education. Agreement on what the solutions are is more elusive, however.

The scale of the problem is massive – recent reports suggest that there is a shortage of roughly 10 000 physics teachers. About a quarter of 11–16 schools in the state sector in England and Wales have no physics specialists teaching science, and only 19% of science teachers are physicists. Though data on trainee teachers' qualifications is poor, it is known that about 2500 people graduate in physics each year, but only about 200 of these go into teaching. Some 100 graduates from related disciplines, such as engineering, also go into teaching each year.

The picture is not uniform throughout the UK, however. There is not generally a shortage of physics teachers in Scotland, though local variations exist. Alison McLure, the Institute's national officer (Scotland), says that pay and conditions for teachers in Scotland are slightly better than in England and Wales, though the Institute has some concerns about the future career progression of teachers, as heads of department for the three separate sciences are tending to be replaced by science faculty heads.

Though Northern Ireland has recently had virtually no teacher recruitment problems, a Department of Education Northern Ireland study last year found some pockets of difficulty, particularly in inner-city and non-grammar schools.

To correct the shortfall in England

HAVE YOUR SAY
Do you have any suggestions for solving the shortfall in physics teachers? Send in your ideas (in no more than 200 words) by 2 March and your suggestion could be published in *Interactions*. Write to *Interactions*, 76 Portland Place, London W1B 1NF or e-mail interactions@iop.org, including your contact details. Comments or letters on the issue of physics teacher shortages can be sent to the same address.

tives, though it believes that there is scope for doing more, such as writing off student loans or tuition fees, or offering larger incentives tied to the number of years that new teachers stay in the profession.

More controversially, some suggest that the incentives should extend to permanent differential pay for teachers in shortage subjects, arguing that market forces would improve recruitment if this were introduced. There is bitter opposition from many in the education sector, however, not least from headteachers who would have to implement such a plan, and from

won't meet this target without retraining or developing non-specialist physics teachers. Its publication *Science and Innovation Investment Framework 2004–14: Next Steps*, includes a proposal for an accredited and nationally recognised diploma for science teachers without a physics or chemistry specialism who gain the knowledge and skills to teach these subjects.

The Institute is involved in a working party that aims to set up a pilot for such a diploma to qualify non-specialists to teach both GCSE and A-level. The government also intends to ask the School Teachers' Review Body

The February issue invited you to have your say on the teacher shortage.

rather than biology. Budding scientists should study separate subjects, with strict corequisites – the rest can do "general science".

David Kimber
St Neots, Cambridgeshire

Why would a young person with some talent and enthusiasm enter a profession deprived of real challenges, a fair income and the prospect of bright career development? Physics teachers should have an opportunity to improve further and advance professionally.

They should have an opportunity for affirmation and financial reward. A part of the teacher's effort (say 30% of their normal load) could go if they wish to an alternative activity, such as: a university research project; a pure educational research project; an industry or community project.

The government must subsidise this activity or secure other sources of funding. This would raise the teacher's standing in society and would attract more candidates.

Prof. Miroslav Furic
Zagreb, Croatia

Physics is losing the public relations battle and needs to fight back. The traditional image of physicists – white-coated boffins with poor people skills working in particle labs and nuclear reactors – needs to be changed. It puts many youngsters off.

I propose an article at the front of

the Institute's magazine/website in a "five-minute-interview" or "day-in-the-life-of" format, with different people every issue (perhaps even celebrities). It would explore why physics graduates studied the topic, what line of work they are in now, how physics has contributed to their work and life, and so on. It would perhaps dispel a few myths.

Philip Smith
Haywards Heath, Sussex

Your recent articles on the shortage of physics teachers cause me no surprise. In 1958, when I was a sixth-former at Hanley High School, Stoke on Trent, we lost a physics teacher and no replacement was in prospect.

As I had finished my A-level work and done the usual scholarship exams by Christmas, I was left with "nothing to do". The school employed me as a "temporary, unqualified assistant teacher". I was paid £365 per annum to teach physics to my fellow pupils up to the penultimate O-level year.

I learned a lot about teaching and how to keep a class under control and, more importantly, interested in the subject. I only hope I taught them something about physics. Is this an experiment worth repeating or building on? Sadly, a few years after I left, the system went comprehensive, spreading this scarce resource of specialist teachers over the whole city. Can you wonder at the results? The problem of scarcity of physics

teachers is not new. We should have been tackling it 40 years ago, not seeming to wake up to it today. But I commend the Institute for its encouragement to teachers in schools.

Bob Adams
Emeritus professor of applied mechanics,
University of Bristol

In February the Qualifications and Curriculum Authority suggested a radical approach to the school timetable for 11- to 14-year-olds, with entire weeks or days turned over to single topics or subjects. Extending and elaborating this approach could see physicists outside teaching, in industry and the like, being trained for co-option into schools so that their expertise could be intensively used in chunks of time that are feasible and manageable in the context of their normal jobs.

And/or, physics teachers could become "flying teachers", dropping in on different schools for intensive periods of expert instruction to students, backed up in a more permanent way by teachers not originally educated as physicists. Could a pilot scheme be started?

Roger Woodham

The answer is so simple: if you wish to do a degree course in physics, engineering, chemistry, modern languages or whatever the UK badly needs, you get an annual grant of, say, £15 000 and pay no fees. As it would be irrespective of income, or background, it would be fair, easy and cheap to run. If you want to take sports science or media studies, you pay £20 000 fees, irrespective of your personal circumstances.

There could be a sliding scale and the government could adjust the numbers (well in advance) every few years to reflect the changing needs of society. If ever the economy were put at risk by an acute shortage of English literature graduates, for example, their fees could be reduced.

P D Hodson

Unfortunately, I'm just about to leave teaching after six years and go back into the nuclear power industry. I'm doing this for self-survival and with great regret, since I became a teacher to "make a positive difference". I teach at a very good school in Gloucester where discipline issues are minor – it's just the workload and preparation time – average 70 hours per week for £32 000.

Name and location supplied

Contributors' views do not necessarily reflect the policy of the Institute of Physics.

profile: Pete Vukusic

Colour vision to share

Sharon-Ann Holgate discovers the many facets of this year's schools lecturer.

Pete Vukusic is still on a high from delivering the first of the Institute's 2007 Schools and Colleges Lecture series. "I'm not sure I'd still be a researcher if I couldn't combine it with public lectures and teaching," he says. "Amazing as discovery is, it's transferring my knowledge to others that really excites me. I get a big kick out of seeing that moment of clarity on a person's face when they realise they understand a concept."

The school environment is familiar to Vukusic, who taught at the public school Marlborough College for four years before becoming an academic at Exeter University. As well as lecturing, an average week also sees him talking in several local schools as part of his department's outreach activities, and researching how nature manipulates the flow of light and colour using nanostructures. He has studied the iridescence that is produced by butterfly wings, and he has investigated why the white colour of *Cyphochilus* – a species of beetle – is so white.

Science published a paper about the beetle work in January, and offers of financial support have been coming in ever since from large companies that are hoping to ape the network of protein filaments responsible for the beetle's colour. Meanwhile the butterfly research has appeared in *Nature*, and in 2004 it won Vukusic the prestigious L'Oreal Prize for the Art and Science of Colour, worth \$25 000.

The win led to him advising L'Oreal's cosmetics division, which is now developing a range of make-up that, instead of containing pigments, relies on the interaction of light with a nanoengineered white powder to appear coloured. For a man who claims to have "drifted into physics", he doesn't appear to be doing badly.

"Dad was a physicist at Imperial and I guess this unconsciously steered me as it made me more open to the odder concepts in physics," he says. He followed his undergraduate degree at Exeter with a masters in semiconductor physics at Imperial in 1988, then he returned to Exeter for a PhD – a CASE studentship for British Gas investigating whether surface plasmon resonance could be used for gas detection. While writing it up he took a PGCE at Exeter in 1993.

After a six-month stint as a postdoc at the Commonwealth Scientific and Industrial Research Organisation, in Australia, he went into teaching. He



Pete Vukusic uses butterflies to help people see the world in a new light.

has a strong interest in the learning process and says that the way his teachers and parents explained things to him using analogies and simple language shaped the way that he interacts with his own children and with wider audiences. "Good teachers slowly introduce higher-level words to give access to higher-level concepts. A gradual approach lets scientific thinking mature as a child matures."

Vukusic, whose mother was a primary schoolteacher, says that it's a shame that teaching gets such a bad press. "I know from going around schools that the vast majority of teachers are enthusiastic and know their subject. At the heart of their delivery is a desire to teach physics correctly and bring the children on as young people and scientists. Their contribution is underrated."

So if he feels this strongly, why did he leave the profession? "Teaching was challenging and extremely rewarding, but I felt that something was missing. One day the seed sown during my PhD sprouted and I contacted Roy Sambles [his old PhD supervisor] and asked to have a chat about doing research again," he says.

The resulting visit to Exeter was pivotal. "We were sitting in Roy's office with the sun streaming in through the

window having a really good discussion about the things we didn't understand in physics. Suddenly the sunlight fell on the *Morpho* butterfly that Roy had mounted in a case on his office wall and the wings lit up. The effect was so amazing that it stopped us in our tracks, and we took it down off the wall and started to talk about the physics involved," he recalls.

Vukusic resigned from Marlborough and started unpaid work at Exeter in 1998, writing a review about iridescence in butterfly wings. After carrying out experiments in his old lab on *Morpho*, he produced results that were encouraging enough for Sambles to assemble a grant proposal. The resulting funding from the Biotechnology and Biological Sciences Research Council (BBSRC) allowed him to work on the physics of iridescence in butterflies in 1998–2001, leading to two papers in *Nature* and the award of a five-year David Philips BBSRC fellowship.

His work provides some colourful examples for his current audiences (see p2). "I've been using a microscope to show the kids the structure of a butterfly wing," he says. "I want them to see that there's much more beneath nature's surface in terms of colour and light than we'd ever realised. I stress how close we are to a big breakthrough in applying this knowledge to cosmetics, light displays, paints, fabrics, signal processing and optical computing."

Vukusic is thinking about further outreach work and has a burning desire to write a popular science book for children, but the keen researcher lives on. "The thrill of seeing something on a microscope that no one else in history has ever seen is a pretty major event. I wouldn't say there's as much adrenalin involved as in my other great passion – surfing – but there's definitely a real rush to it, and I find it just as addictive."

"I want them to see that there's more beneath nature's surface in terms of colour than we'd ever realised."

OBSERVATIONS



Holly Batchelor, who's off to Edinburgh University this autumn, describes how a holiday project drew her into particle physics.

During the Edinburgh International Science Festival last Easter I helped as a presenter for the Particle Physics for Scottish Schools project's (PP4SS) exhibition. This was a great opportunity to work alongside PhD students and senior lecturers, and to learn more about how physics is studied at university. It also helped to increase the little understanding of particle physics that I had and convinced me that I'd enjoy studying for a physics degree.

I happened to be working alongside a student who'd recently undertaken a science project with PP4SS, aided by a Nuffield Foundation Science Bursary. I realised that I could do the same and, although time was tight, I got in touch with the regional Nuffield coordinator, Frances Chapman, who assured me that there were still a few places left for the summer.

Having my application accepted was exciting because it allowed me to do (and get paid for) a six-week project – "Cosmic rain: investigating particles from space". Alan Walker and Peter Reid at Edinburgh University's School of Physics were my supervisors. Over the summer holidays I investigated different aspects of cosmic rays, gaining an insight into the satisfactions and frustrations of experimental physics. I never imagined the number of hours I would spend gnashing my teeth redoing calculations, rewiring circuits or rerunning experiments. But when it went well it was great.

My project consisted of three experiments. The first was to investigate the angular distribution of cosmic rays at sea level by constructing a cosmic-ray hodoscope to detect and count cosmic-ray flux. I adapted this apparatus to make a cosmic-ray "telescope" to allow me to investigate cosmic-ray flux at specific angles. A second investigation was to determine the energy spectrum of muons. The third task was to design and construct a diffusion cloud chamber to look at the tracks left by the particles that I was investigating. I wanted the cloud chamber to be cheap, easy to build and use, and reliable, so that it could be copied by schools and allow pupils to experience the excitement of seeing tracks left by particles travelling close to the speed of light.

I managed to investigate the angular distribution of cosmic rays, comparing with experiments that were undertaken in the 1970s. The measured flux of low-energy muons agreed with published data. The cloud chamber was constructed for less than £40 (a fraction of the price of commercially available kit) and worked pretty much every time. One of the hodoscopes that I constructed is now being used in exhibits by PP4SS and SCI-FUN (a science and technology roadshow run by the University of Edinburgh). Another ended up on top of a "Cosmic Ray Doorway" that I later worked on – an exhibit that allows bystanders to "experience" cosmic rays piercing through them. The hodoscope sits directly above someone standing in the doorway. When a cosmic ray is detected, strips of LEDs flash down either side, showing that if a cosmic ray passed through the hodoscope it must have gone through the person, too.

I received a BA Gold CREST Award for my project and applied for a place at the national BA CREST Science Fair at the Royal Society. Thrilled to be invited to attend, I travelled to London in February, taking my hodoscope, cosmic-ray telescope, many posters and my enthusiasm on the train. (Assuring airport security that I wasn't carrying a bomb might have been tricky.) After seeing everyone's work and meeting the society's president, I never imagined that I would win – I was sure that they'd called my name out by accident.

Winning the overall prize means that the computer company Intel is sending me to represent the UK in the International Science and Engineering Fair in Albuquerque, US, this May. Who'd have thought that my wee holiday job would lead to this?

If you would like to contribute to **OBSERVATIONS**, please send an e-mail with your idea to interactions@iop.org.

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interactions

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Girls and physics

We were shocked by *Interactions'* deliberate decision to stir up controversy by publishing prominently Alan Smithers' article entitled "Do girls just want to avoid physics?" (February). We were disappointed that the Institute's own newsletter should consider it reasonable to target minority members for attack just to provoke a reaction. We expect that the editor will give equal space for a counter article, restating the Institute's commitment to increase the numbers of girls studying physics.

It is Institute policy to encourage more girls and women to take up and pursue physics courses at school, in

universities and in the workplace, and many Institute members and dedicated staff are working hard to help to promote physics to these groups and to retain them. Giving out the message that this is a waste of time is counterproductive and demoralising. We are particularly disappointed that such a criticism came from a prominent educator.

More fundamentally, it flies in the face of evidence. Girls do study physics in greater numbers in other countries, including Italy and Greece, and reaching parity in China and Russia, suggesting that cultural pressures are at play. In the UK, girls are as capable as boys of achieving high grades in A-level physics. Yet, despite their ability, research shows

that they are being put off from continuing with physics in education and as a career. Even once qualified, women physicists drop out at a higher rate than men.

As a discipline, physics cannot afford to lose this talent pool. Rather than the onus being on us to prove that women and girls are as interested as boys, in a climate of obvious discrimination, we suggest that Prof. Smithers holds off making his own assumptions about appropriate ratios until there really are equal chances for women in physics. Girls do like physics but they do not yet have an equal chance.

A decade ago some still believed that girls were inherently not as good at physics and maths as boys. Now

that this has clearly been proved wrong it seems that the new argument is that girls do not "want" to do physics. Perhaps Prof. Smithers could look to other countries, where plenty of female students enjoy learning about the science of the physical world, and ask instead why British girls are dissuaded. Whether they feel welcome in physics as an area in which to pursue a career in the longer term is another matter.

Joanne Baker, Philippa Browning, Gillian Butcher, Dimitra Darambara, Gillian Gehring, Paula Knee, Averil MacDonald, Ann Marks, Carla Molteni, Carol Thompson, Nicola Wilkin

The acting editor replies:

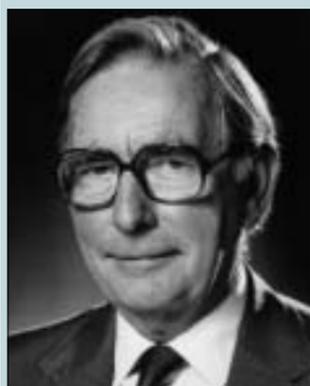
Alan Smithers' views expressed in

"Reflections" were his own, not those of the Institute or of *Interactions*. While it is part of the remit of this publication to be "occasionally provocative" and to "encourage debate", it was not our intention to "target minority members" or to publish the article "just to provoke a reaction". Views such as those expressed in the article are in circulation, and it is a matter of debate as to whether it is best to discuss these openly or to allow them to go unchallenged. *Interactions* has carried a number of articles relating to Institute policy in this area and will continue to do so.

Write to interactions@iop.org or the address above. Letters may be edited for length.

OBITUARY

Roger Blin-Stoyle (1924–2007)



Roger Blin-Stoyle, who died on 31 January, was born in Leicester, the son of a shopfloor worker. He went to Alderman Newton's Boys' School and won a scholarship to Wadham College, Oxford, serving as lieutenant in the Royal Signals (1943–1946) before returning to Oxford to gain a DPhil in theoretical nuclear physics.

Blin-Stoyle made substantial advances in the understanding of the weak interaction and the properties and transformations of complex nuclei, as well as in the contribution of transitory "virtual" particles to nuclear properties. His books included *Theories of Magnetic Moments*, *Fundamental Interactions and the Nucleus*, and *Nuclear and Particle Physics*.

He was a research fellow, then senior research officer in theoretical physics at Oxford until 1962, with three brief periods elsewhere: as lecturer in mathematical physics at Birmingham University (1953–1954); visiting

associate professor at the Massachusetts Institute of Technology (1959–1960); and visiting professor of physics at the University of California (1960). In 1962 he became the founding dean of the school of mathematical and physical sciences at Sussex University – an institution that was just being set up. He went on to become its pro vice-chancellor and deputy vice-chancellor, and he was made a fellow of the Royal Society in 1976. He took a broad interest in education, being seconded to be part-time chair of the School Curriculum Development Committee (1983–1988), and he served on several boards and committees, including that of the Royal Greenwich Observatory, the nuclear physics board of the Science Research Council, the University Grants Committee and the council of the Royal Society. He was president of the Institute (1990–1992) and of the Association for Science Education (1993–1994). He is survived by his wife, a son and a daughter.

Alun Jones writes:

Roger Blin-Stoyle was the first president of the Institute with whom I worked as chief executive. I had known him since he lectured to me in Oxford, but we had lost touch for many years until our paths crossed again at the Institute. He was essentially unchanged

in appearance since the late 1950s. He had a formidable intellect combined with politeness and charm. His lectures were a model of clarity and his incisive mind was invaluable in our many discussions on the future of physics and the Institute.

We learned the art of managing a learned society and professional body together. These were the early days in Belgrave Square before the move to Portland Place, and one of my abiding memories of Roger is sharing a glass of champagne with him when we had disposed of the site of the Fulmer Contract Research Organisation for a seven-figure sum.

Roger's abiding interest was education at all levels. He was a man with well thought-out ideas, which did not always chime with those of the establishment, and one of his strengths was that he stood his ground in committee and stuck to his beliefs. He believed that there should be honourable exit points from university at all levels – an excellent concept that many would still find attractive.

The past few years have been difficult for him and his wife, Audrey, with Roger suffering from a degenerative condition. I will remember him with fondness. I owe him a great deal for help and support in those early years, and advice throughout my period as chief executive.

OBITUARY

Sir Gareth Roberts (1940–2007)



Gareth Roberts, who died on 6 February, was born in North Wales and raised in a Welsh-speaking home. He learned English at school and went to a grammar school in Llandudno, going on to gain a first in physics and a PhD in semiconductor physics at the University College of North Wales at Bangor, where he became a lecturer.

After two years as a research physicist for the Xerox Corporation, Roberts became a senior lecturer, then reader, then professor of physics at the New University of Ulster, holding the chair in physics by the age of 34. In 1976–1985 he headed the department of applied physics and electronics at Durham University. In 1985 he went to Thorn-EMI as chief scientist, then became its head of research.

He developed an international reputation for his work on the physics of semiconductors and molecular electronics. He was elected a fellow of the Royal

Society in 1984, received the Holweck Medal in 1986, was vice-chancellor of Sheffield University in 1991–2000 and was knighted in 1997.

Roberts played a key role in establishing the Russell Group of universities and the World Universities Network. In 1995 he became chairman of the Committee of Vice-Chancellors and Principals (now Universities UK), leading a joint campaign with the campus unions on funding. He then joined the board of the Higher Education Funding Council for England. He was president of the Institute in 1998–2000 and president of Wolfson College Oxford in 2001–2007.

Gordon Brown asked him to review the supply of skilled scientists. His advice on how to overcome the serious problems in the supply of scientists, engineers and mathematicians in his report in 2002, *SET for Success*, was accepted by the government. He was made president of the Association of Science Education and the Engineering and Technology Board shortly before he died. He had two sons, a daughter and two stepdaughters.

Alun Jones writes:

Gareth Roberts was a man of stature who contributed immensely to education and science. A Welshman through and through, he delighted in applying his

energy, intellect and management skills to organisations that were lucky enough to have him as their vice-chancellor, president or chairman. I was fortunate enough to be the chief executive of the Institute when Gareth was president.

Nothing was too much effort for him to further the interests and status of physicists and the standing of the Institute. To say that it was difficult to keep up with him is an understatement. I remember the way that he took control of the international committee set up in 1997 to assess the state of physics in the UK, when he was vice-chancellor at Sheffield. His hospitality and the events that he organised in Yorkshire paved the way for UK physics to be seen in its true light as highly effective and of international standard.

My wife Ann and I fondly remember travelling with Gareth and his wife Carolyn to many countries to laud the virtues of British physics. Gareth and Carolyn were model travelling companions – easygoing, always cheerful and with a wonderful sense of humour. Gareth was a true ambassador, delivering lecture after lecture, speech after speech – always relevant and always aware of what was needed for each audience. I will miss him. The scientific community will miss him. His was an untimely death.

Visit whatson.iop.org for full details of all Institute of Physics events.

APRIL 2007

Microscopy of Semiconducting Materials XV

Conference sessions about recent advances and an exhibition.

EMAG Group
Churchill College, Cambridge
2-5 April

www.iop.org/Conferences
Registration required

34th IOP Annual Conference on Plasma Physics

Event aimed at postgraduate students.

Plasma Physics Group
Regency Airport Hotel, Whitehall, Dublin
2-5 April

www.dcu.ie/iop_pp
Registration required

Nuclear and Particle Physics Divisional Conference

First joint meeting of four Institute of Physics groups, plus a workshop on next-generation isomers.

Nuclear and Particle Physics Division
University of Surrey

3-5 April
www.iop.org/Conferences
Booking required

CONFERENCE

Dynamic Nuclear Polarisation Symposium

A conference to bring together scientists across the nuclear magnetic resonance community to discuss progress in NMR research involving dynamic nuclear polarisation.

BRS Group
University of Nottingham
29-31 August
www.iop.org/Conferences

Condensed Matter and Materials Physics (CMMP07)

Annual conference with speakers and poster sessions.

Condensed Matter and Materials Physics Division
University of Leicester
11-13 April

www.cmmp.org.uk
Registration required

Exploring the High Energy Universe: GLAST Mission and Science

Talk by Julie McEnery of the Goddard Space Flight Centre, USA.

Institute of Physics in Ireland
University College Cork, Queen's University Belfast, University College Dublin, Ireland
16, 18 & 19 April
<http://ireland.iop.org/program.html>

The Physics of Life

Talk by Prof. Peter Weightman of the University of Liverpool.

Yorkshire Branch
Department of Physics and Astronomy, University of Sheffield
17 April
www.iop.org/activity/branches/Yorkshire/index.html

A Scientist's Approach to Religion

Talk by Revd John Polkinghorne of the University of Cambridge.

Merseyside Branch
Chadwick Lecture Theatre, University of Liverpool
19 April

www.iop.org/Our_Activities/Local_Branches/Merseyside/index.html

Severe Weather: Origins and Predictions

Talk by Ross Reynolds of the University of Bristol.

North Eastern Branch
Innovation Centre, University of Teesside
24 April
<http://iop.ncl.ac.uk>

MAY 2007

Bridging the Gap between Theory and Experiment

Seminar on hybrid and inverse methods in experimental mechanics.

Stress and Vibration Group
Brunel University, London
2 May
www.iop.org/activity/groups/subject/sv/index.html

CONFERENCE

QuAMP 2007

Internationally leading speakers will present the latest ideas and results at the forefront of research. Abstract submission deadline: 28 June.

Atomic, Molecular, Optical and Plasma Physics Division
University College London
10-13 September
www.quamp.org
Booking required

Particle Beams for Cancer Therapy

Talk by Prof. Bleddyn Jones of University Hospital Birmingham

Merseyside Branch
Liverpool Medical Institution
3 May

www.iop.org/Our_Activities/Local_Branches/Merseyside/index.html

An Electricity Grid for the 21st Century

Talk by Prof. James MacDonald of the University of Strathclyde.

Merseyside Branch
Chadwick Lecture Theatre, University of Liverpool
15 May
www.iop.org/Our_Activities/Local_Branches/Merseyside/index.html

Key Insight Business Briefing: the Chief Scientific Advisers

Speakers followed by dinner.

Business and Innovation
76 Portland Place, London W1
15 May
www.iop.org/activity/business/index.html

The Training of Physics Teachers

Joint meeting with the Education Group.

Higher Education Group
University of Leicester
16 May
www.iop.org/activity/groups/subject/hed/index.html

Industrial Visit

Visit to Atmel North Tyneside Microelectronics.

North Eastern Branch
Atmel, Siemens Way, North Tyneside
16 May

<http://iop.ncl.ac.uk/events.php>
Ticket only

Wear at High Temperatures

Speakers on recent advances and the industrial drivers of research.

Tribology Group
76 Portland Place, London W1
16 May
www.iop.org/Conferences
Registration required

ONE-DAY MEETING

Experimental Techniques of Semiconductor Research

A course that is aimed primarily at new researchers who are working in experimental semiconductor physics and semiconductor technology.

Semiconductor Group
East Midlands Conference Centre, Nottingham
13 November
www.iop.org/Conferences
Booking required

Suck, Squeeze, Bang, Blow: the Physics of the Jet Engine

Talk by Neil Glover of Rolls-Royce.

Midland Branch
University College Worcester
17 May
www.iop.org/Our_Activities/Local_Branches/Midland/index.html

Mechanics of Medical Devices

Conference with invited speakers.

Stress and Vibration Group/Polymer Physics Group
76 Portland Place, London W1
23 May
www.iop.org/Conferences
Registration required

notices

NEW BUSINESS AFFILIATES

TMS Development International

NEW MEMBERS

Gary Atkinson, Netta Cohen, Julian Daniels, Robert Hadfield, Philip James, Kathryn Lancaster, Sien Lau, Anthony Lyng, Yevgen Melikhov, Amyas Phillips, Randy Ramadhar Singh, Craig Thomas,

Jeremy Thomas, Morgan Wascko, William Womersley.

NEW FELLOWS

Christopher Bowdery, Ian Cullis, David Flint, Helen Reynolds.

IN MEMORIAM

SS Ballard (US), John Barr (Exeter), Barrie Bartlett, Roger Blin-Stoyle, Denys Brown, Ronald Cooper, David Dew-Hughes, Ronald

Graham, Alan Joy, D R McCall (Sheffield), Valerie McConnell, John Richardson (Plymouth), Gordon Rogers, Aderji Sahiar, Gallienus Smith, Derek Taylor (London), Reginald Wall, Peter Ridgway Watt, John Wilson (Sunbury-on-Thames).

WANTED

Scientists to apply for a BA media fellowship, which will enable them to experience first hand how

science is reported by spending a summer placement working in a media organisation.

Successful applicants will work with a national press, broadcast or internet journalist and it is hoped that they will come away better equipped to communicate their research and expertise to the public and their colleagues.

Participants will learn to work within the conditions and

constraints of the media to produce accurate and well informed pieces about developments in science.

The aim is to create a greater awareness of and understanding about the workings of the media among practising scientists, clinicians, social scientists and engineers.

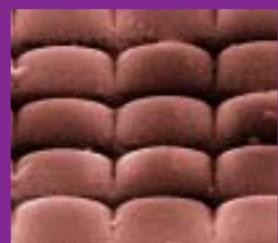
For further information and an online application visit www.the-ba.net/mediafellows. The deadline

for applications is 18 April 2007.

MEMBER OFFER

Online subscription prize draw
Adrian J Richards from Berowra, New South Wales, Australia, is February's prizewinner. He wins a 2 GB data stick. For your chance to win a data stick, pay your membership subscription online at <http://members.iop.org> when you receive your subscription notice.

www.nasm07.org.uk



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- an exhibition of scientific instruments, equipment and techniques
- short course on corrosion in parallel with the conference

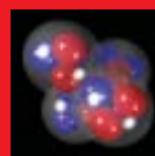
For further information, e-mail jasmina.bolfek-radovani@iop.org.

18-20 September 2007, University of Southampton, UK
Organised by the Applied Physics and Technology Division of the Institute of Physics

Late poster submissions 1 July
Early registration deadline 1 July
Late registration deadline 10 August



IOP Institute of Physics



The Cluster Conference

3-7 September 2007, The Holiday Inn, Stratford Upon Avon
<http://www.iop.org/Conferences>

The Cluster Conference

The international nuclear cluster conference is held every four years and has a history dating back to 1969. The last meeting was in Nara Japan. The focus of the Stratford conference will be the rather beautiful clustering of nucleons within the nucleus to form stable subunits. These then interact with each other, giving rise to exotic vibrational and rotational modes. The conference will provide the forum for the latest experimental and theoretical developments in this field.

National organising committee

N I Ashwood, N Curtis, M Freer
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University of Surrey

For further information, visit the conference website or e-mail claire.garland@iop.org.
<http://www.iop.org/Conferences>

IOP Institute of Physics

Physicists face a spooky skeleton

Bruce Rosenblum describes how a meeting with Einstein led to a book about quantum physics and consciousness.

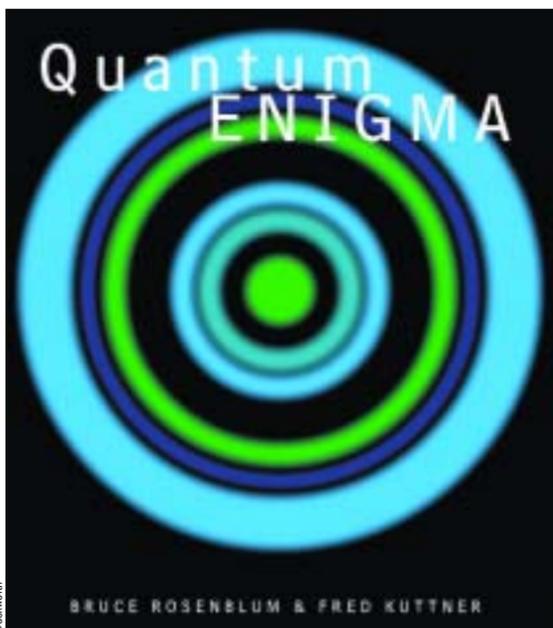
"You physicists deal with some pretty weird stuff!" said my architect neighbour, rolling his eyes. He had just seen the "international hit" movie *What the Bleep?* After illustrating quantum uncertainty by showing a basketball in several places at once, the film gradually moves to the quantum channelling of the Atlantis god, Ramtha; and on to yet greater nonsense.

My neighbour's belief that I was involved with such things embarrassed me. But half a century ago I experienced a more serious embarrassment. A fellow physics graduate and I were asked by our host at Princeton if we would like to spend the evening with Albert Einstein.

Einstein, in sweatshirt and slippers, joined us in his living room. I remember tea and cookies and Einstein calling us his "young colleagues". He soon asked about our quantum mechanics course and was pleased that we used David Bohm's text. He wondered how we felt about Bohm's treatment of quantum mechanics' philosophical problems and, in particular, about his then recent attempt to resolve the problem of observer-created reality. "David did something interesting," Einstein mused, "but it's not what I told him to do."

We disappointed him. We did not know what he was talking about. Quantum mechanics courses, then and now, focus on the mathematical formalism, not on the deeper meanings. Einstein's most serious objection to the theory was to its claim that a physical reality is created through observation: "I like to think the moon is there even if I am not looking at it." He also rejected as "spooky" the theory's predicted entanglement of remote objects. What bothered Einstein has increasingly haunted me over the decades. But as an industrial physicist, and later a university professor, I had more pressing concerns.

About 15 years ago it was my turn to teach the physics department's course for non-science students. I decided that emphasising the enigmatic aspects of quantum mechanics would be fun and should appeal



Seeing all of the strange things that physics can reveal makes some people vulnerable to all sorts of nonsense.

mathematical parts of the quantum enigma course into a light-hearted, but completely sound, treatment of the implications of quantum mechanics that should intrigue non-scientists. The result was our book *The Quantum Enigma: Physics Encounters Consciousness*. Although its first sentence is "This is a controversial book", every experimental result and explanation in quantum theory that we present is completely undisputed. It is our focus on the meaning of these facts that is controversial.

We explore the encounter with consciousness in the contending interpretations of the meaning of quantum mechanics – as distinct from merely showing how the mysteries can be avoided "for all practical purposes". For example, the "many worlds" interpretation, which has the world (and you) splitting at every observation, is also called the "many minds" interpretation. The transactional interpretation has your future bringing about your past. "Decoherence" admits that a complete treatment will require a model for consciousness.

Physics encounters consciousness because the quantum enigma ultimately rests on the assumption that we could have done an experiment other than the one that we actually did – that we have free will. Many physicists (especially older ones) are uncomfortable with such discussion. It is often treated (dismissed?) with humour: A *Physics Today* cartoon has Schrödinger's dog whispering "Psst, Erwin, buddy... put the cat in a box with poison gas to demonstrate the influence of the observer."

Although consciousness itself is too ill-defined for physics study, the contact that physics has made with human issues fascinates non-scientists. The implicit denial in the standard texts about this "skeleton in our closet" abandons the mysteries of quantum mechanics to the purveyors of pseudoscience. Admittedly, it can be embarrassing for a physics instructor to have to face up to such an emotion-laden subject. The analogy with sex education comes to mind.

Bruce Rosenblum is professor of physics and former chair of the physics department at the University of California, Santa Cruz. *The Quantum Enigma* is published by Duckworth.

to them. When I proposed it, a colleague objected: "Though what you're saying is correct, presenting this material to non-scientists is the intellectual equivalent of allowing children to play with loaded guns."

I sympathise with his concern. Seeing all the strange things that physics can reveal makes some people vulnerable to all sorts of nonsense. I responded that I'd teach "gun safety" (i.e. the scientific method for deciding what is, and what is not, reliable science). It would inoculate against the acceptance of nonsense and also establish the grounds for accepting quantum theory in spite of its almost impossible-to-believe implications.

When Fred Kuttner joined our faculty I met a kindred spirit. The fundamentals of quantum mechanics became our research area. We decided to distill the non-mathe-

particles

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DO TRY THIS AT HOME

Featuring: Marvin and Milo

What you need: • a plastic cup or yoghurt pot
• a damp cloth • smooth string

Hey Milo, let's do chicken impressions!

To do mine, make a hole in the bottom of the plastic cup. Get an adult to help.

Cut a length of string, thread it through the hole, and tie a knot in the end inside the cup to stop it from slipping back through the hole.

Take the damp cloth and hold it tightly around the string. Now pull the cloth firmly along the string to hear the cup cluck.

Pulling the cloth along the string makes it vibrate and produce a faint sound. But the cup and the air around it also vibrate so the sound is amplified enough for us to hear it.

www.physics.org keywords: amplification