ARCHIVE EDITION OF

IRPS BULLETIN

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Main

FROM THE EDITOR

Dudley Creagh

This is my last editorial for this century. Sounds portentous: but when one looks back at the past century, about two-thirds of which I have experienced at first hand, I am in awe of the changes which have occurred. I am even more in awe, perhaps in a state of apprehension is the best way
to describe my feelings, of what is to come in the new century.

Change will occur, that is certain.Speaking of change: as you will see later in the newsletter it has become necessary to change the constitution of our Society because times have changed significantly since its creation fifteen years ago. Some of the changes are minor: but they are significant. The first seeks to set up an Advisory Board to assist the Council in its work. It is hoped that this will increase the number of people able to contribute to the administration of our Society. The second seeks to expand the range of membership by the omission of "ionizing" from the description of the activities of our Society, thereby allowing membership of people interested in optical and infrared spectroscopy, magnetic resonance imaging, radiation effects of mobile telephones, and the like, to participate in the activities of our Society. A third allows full members in good standing to append the letters MIRPS (Member of the International Radiation Physics Society) after their name. The fourth clarifies the requirements for nomination of members for election to the IRPS Council.

Which brings me to the definition of "in good standing." We have always endeavoured to be an inclusive society, and to that end have set our membership fees at a low figure, chosen to reflect the
affluence of the country in which a member is employed. A member "in good standing" has paid the appropriate membership fee.

The fees are due on 1 January 2000. We are not seeking arrears if such exist for a member: merely the fee for the year 2000. The Vice-Presidents for the various regions will be able to give members an indication of their status and how best to pay.

HAVE A HAPPY AND ENJOYABLE NEW CENTURY!

NEWS ABOUT MEMBERS

Dr. Alexander E. Shikanov

ongratulations on your election to a Full Member
in the Academy of Ecology and Nature Management,
and that you now lead the pulse neutron logging
and small generators problems as
Chief of the Laboratory of the FNGGC.

We wish to report the death of

IGOR MARTIANOV

Our deepest sympathy to his family

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PRESIDENT'S COLUMN

Bikash Sinha

Synchrotron radiation and its utilization for material science of the next century has become a central goal of Indian science.

Indus, the synchrotron complex, at Indore in Central India has therefore turned into a major Centre of all kinds of activities in this area. Indus, of course, is reminiscent of the ancient Indian civilization when science and humanities flourished abundantly in India.

Rather more recently, Saha Institute of Nuclear Physics, in Calcutta, has been a centre of a great deal of material science research and development work with its excellent facilities recently acquired and developed for advanced material science research, under the distinctive leadership of Professor Milan Kumar Sanyal of the institute.

Synchrotron radiation is going to play an important role in the framework of a Science and Technology collaboration programme between India and Italy, promoted by the governments of the two countries.

In the context of this programme, the Workshop on the Utilization of the ELETTRA Synchrotron Light Source was organised at the Saha Institute of Nuclear Physics (SINP) in Calcutta, India, from November 10th to 13th, 1998. The main objective of the organizers was to present to the Indian researchers the scientific opportunities available at the ELETTRA storage ring in Trieste, Italy. The success of the workshop - it was attended by around 100 participants from various Indian institutes and universities - was the best indication of the interest of the Indian scientific community in the use of synchrotron radiation.

The strategic interest of this India–Italy collaboration was clearly stated during the opening session of the workshop. After the welcome address by Professor Bikash Sinha, Director of the SINP, both the Indian Secretary of the Department of Science and Technology (DST), India - Professor V.S. Ramamurthy - and the Italian Ambassador to India, his excellencyG. Zucconi, emphasized the importance of the co-operation programme between the two countries. The scientific scope of the workshop was presented by the Director of the Inter-University Consortium for DAE Facilities,

Dr. B.A. Dasannacharya. The inaugural session was closed by the two conveners of the workshop, Dr. Adolfo Savoia and Professor Milan Kumar Sanyal, who made some introductory remarks and votes of thanks, respectively.

The scientific sessions started with three talks that gave the audience an overview of the synchrotron radiation facilities in the two countries : Indus 1 and Indus 2 for India in the near future, and ELETTRA, which is operational for Italy. A panel discussion followed to introduce the audience to the organizational aspects of the India-Italy collaboration in synchrotron radiation research. Dr. B.A. Dasannacharya, the coordinator of the panel discussion, explained the India–Italy bilateral agreement for the utilization of ELETTRA, and during the discussion all the main aspects of the co-operation were thoroughly explained, in particular the proposed evaluation produced and the importance of establishing scientific collaborations.

18 Indian and 8 Italian speakers contributed to the lively oral sessions of the workshop, centered around the main research activities carried out at ELETTRA. The main topics of these talks were surface structure, macromolecula crystallography, photoemission and microscopy, diffraction, small angle scattering and EXAFS.

These considerations were discussed in detail during a boat tour on the Ganges River, which concluded the workshop and was the last occasion for scientific conversations and planning future projects, as well as for the Italian participants to thank their hosts for their wonderful hospitality. All agreed that the main purpose of the Calcutta Workshop, which was to trigger the interaction between scientists from the two countries, had been fully reached, and everybody is now waiting for the next and most interesting steps of the India–Italy collaboration on synchrotron radiation, which will be the experiments performed in Trieste by the Indian researchers who will come to use the light of ELETTRA.

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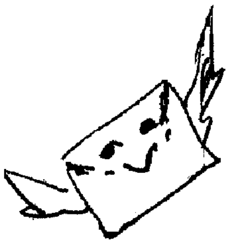
LETTERS TO THE EDITOR



Dear Ed :

After having read the two letters to the editor on the two possibilities for the bulletin (Sept 99), I have to agree with Alex Bielajew. I simply receive too many e-mail messages daily (but I am NOT the one he doesn't identify!) and don't have time to browse the web. I envy those who have!

Having the printed copy of the Bulletin in my snail-mail inbox is the only way I will read it. I know. But I acknowledge that people have different possibilities and schedules, so there is a place for both editions. Why don't you simply ask by e-mail "Do you still want to receive the hard copy of the IRPS Bulletin?" Y or N.

I am sure there will be many responding like Ralph Nelson: N, and many like Alex and myself: Y.

The only remaining problem is what to do with those who don't reply. Whatever, I believe there will be savings in postage and printing.

Best wishes

Pedro

Pedro Andreo, Austria

MEMBERS' PAPERS

One Synchrotron for Britain and France?

Malcolm Cooper

IRPS Vice President (*United Kingdom*)
Deparment of Physics, University of Wawick
Coventry U.K.

The love/hate relationship between "les Rostbifs" and "the Frogs" is not just being tested by France’s refusal to import British beef and Britain’s counter claim that the French feed their livestock on some pretty unmentionable substances. "No", or "non", the x-ray scientists are getting pretty upset with their governments over an agreement to coalesce plans for two new national synchrotrons and build just one machine in Britain.

Ten to fifteen years ago both countries had synchrotrons to be proud of, LURE at Orsay outside Paris, producing leading work in atomic physics and the SRS at Daresbury, near Warrington in the UK, having great successes, for example in macromolecular crystallography. Everyone realised for some time that the days were numbered for these so-called "second generation machines" which were originally designed with the bending magnets as the radiation sources rather than just mechanisms for steering the electron or positron beam around in a closed path. Even when "insertion devices" were added into the straight sections no number of upgrades could make them compete in brightness or brilliance (the latter takes account not only of the natural collimation of the beam but also the very small source size from which it is emitted) with "third generation machines" such as ESRF in Grenoble (on stream 5 years ago) and its younger relatives: APS at Argonne, USA and SPRING-8 at Himeji, Japan. On the other hand the demand in the three continents cannot be satisfied by these super machines alone: only the most suitable and most highly rated experiments will win beamtime on them. Other national facilities are needed. The Americans have NSLS at Brookhaven, the Germans have HASYLAB in Hamburg, the Japanese have the Photon Factory, and numerous countries with gross national products a fraction of these have there own rings.

The French and the British have been developing their plans for SOLEIL and DIAMOND, respectively for many years in the expectation that their governments would eventually see sense and each hand over the few hundred million dollars to construct these toys, on the grounds that we shall deliver everything from the structure of the HIV virus to the mechanism of high temperature superconductivity, with the meaning of life thrown in somewhere along the route.

In Britain it did begin to look as though the battle was won when the Wellcome Foundation (a charitable trust originally created by the Drug Company of the same name) put up over half the construction cost, coupled with a not unreasonable proviso that a large number of beamlines must be dedicated to large molecule crystallography. About 12 months of "horse trading" seemed to be converging on a specification for the machine (2.5-3.2 GeV), if not for its location. After discovering that Wellcome’s headquarters, near Cambridge, were geologically unsuitable (built on an old quarry) a number of sites other than Daresbury were promoted including universities in England (mine included) and Scotland. Then leaks from "usually reliable sources" revealed that the Rutherford Appleton Laboratory, home of the ISIS spallation neutron source, was the favourite of the Government and the Research Councils. This proposal doubtless arose from (i) a scientific appreciation of the synergy between x-ray and neutron studies, the best example of which is the juxtaposition of the ESRF and ILL in Grenoble, and (ii) an accountant’s estimate that it would save loads of money. I bet I know which argument the science minister found more persuasive.

Things started to go wrong this summer. Firstly the UK science minister, Lord Sainsbury, publicly worried about the political wisdom of removing another government facility from the North (Daresbury is near Manchester and Liverpool), thus giving Daresbury staff a glimmer of hope that their jobs might be preserved and their northern university customers good cause to renew their protests. That was all before the 1999 summer holidays when governments go into limbo and surprisingly everyone else seems to get along fine. This year, however, in August, French scientists were devastated to learn that their government had abandoned their own SOLEIL synchrotron project and "bought into" the "New UK synchrotron" (definitely no longer to be called DIAMOND in case anyone thought that those two "Ds" had anything to do with Daresbury). To say that French scientists are upset would be like saying that Napoleon was disappointed at Waterloo: they are up in arms with their Science Minister. Letters to the press, non co-operation and all those other feeble tactics employed by scientists and academics who have too much of a conscience to cause any real trouble to anyone: the French government is not about to fall on this issue.

It is truly difficult to see how this compromise could work to anyone’s advantage, except those ministers whose job it is to draw the purse strings tighter and tighter. And what about the location? The Rutherford Appleton Laboratory, south of Oxford requires a journey through Heathrow, where the first hour is spent walking to the baggage claim area and the second hour (or so it seems) watching other peoples’ baggage arrive. The Rutherford Lab was built next door to Harwell which was originally meant to be inaccessible; it was literally not on the map - this was supposed to confuse "the enemy"- because neutrons always have had other uses than scientific research. It still seems to be in the middle of nowhere. By contrast Daresbury is a mere 20 minutes by taxi from Manchester airport which is far quicker to escape from than Heathrow. Unlike Orsay, neither site is on a rapid transit train line to whisk one to civilisation when the beam goes down or the autopilot can safely be set. Entertainment, Daresbury style, consists of one pub within walking distance and...well apart from watching English teams lose at football/cricket/rugby etc. on the TV, that’s it.

Don’t expect to read in the next issue of the IRPS Newsletter that all has been resolved. This saga will run for some time and, I predict, run true to everyone’s worst caricatures of politicians. There could be a parliamentary Select Committee enquiry to establish how we got to where we are, and progress forward (lack thereof) will leave all synchrotron users frustrated and the Daresbury staff demoralised. Of course there is a simple solution if only both governments had the sense to see it. Compromise half way. Warwick and Kenilworth are full of French restaurants and Warwick University is one of the best holiday centres in the country with theatres and concert halls for the scientists who take themselves seriously and cheap bars and cinemas for the research students who know what really matters. Of course I would be the obvious person to direct the whole venture - for a suitably large pay rise and freedom from the tyranny of marking endless undergraduate lab reports. If this is not acceptable I have the ultimate solution. Let’s build it half way between France and England, in the middle of the channel. After all, if the Japanese can build a floating airport I see no real difficulty in making a floating synchrotron ring: they all look just like giant lifebelts anyway. With a half way stop for trains in the channel tunnel it could recover costs as a tourist attraction for holiday makers who are bored on their channel crossings now that duty free sales within Europe are banned. Maybe I should talk to the Minister, but there is just a chance that he might take me seriously.

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WORLD NEWS

WHOEVER THOUGHT IT WOULD COME TO THIS !!!

(Article : "The Importance of Physics"
Australian Academy of Science Newsletter No. 45, 1999, p3)

In March the International Union of Pure and Applied Physics adopted a statement on the importance of physics to society, with the aim of increasing the wider community's appreciation of this basic science. The statement is reproduced below.

Physics - the study of matter, energy and their interactions - is an international enterprise which plays a key role in the future progress of humankind. The support of physics education and research in all countries is important because:

- Physics is an exciting intellectual adventure that inspires young people and expands the frontiers of our knowledge about nature.
- Physics generates fundamental knowledge needed for the future technological advances that will continue to drive the economic engines of the world.
- Physics contributes to the technological infrastructure and provides trained personnel needed to take advantage of scientific advances and discoveries.
- Physics is an important element in the education of chemists, engineers and computer scientists, as well as practitioners of the other physical and biomedical sciences.
- Physics extends and enhances our understanding of other disciplines, such as the earth, agricultural, chemical, biological, and environmental sciences, plus astrophysics and cosmology subjects of substantial importance to all peoples of the world.
- Physics improves our quality of life by providing the basic understanding necessary for developing new instrumentation and techniques for medical applications, such as computer tomography, magnetic resonance imaging, positron emission tomography, ultrasonic imaging, and laser surgery.

In summary, for all these reasons, physics is an essential part of the education system and of an advanced society. We therefore urge all governments to seek advice from physicists and other scientists on matters of science policy, and to be supportive of the science of physics. This support can take many forms such as:

- national programs to improve physics teaching at all levels of the educational system

- building and maintaining strong departments in universities (and other academic institutions) with opportunities for grants to support research

- scholarships and fellowships for both undergraduate and graduate students studying physics

- adequate funding for national laboratories and the formation of new ones as appropriate

- funding and facilitating international activities and collaborations .

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Buckyball Interference

From Physics World, Post-Deadline
Vol 12, No 11, 1999, p5

The interference pattern formed when a beam of electrons passes through a double slit is clear evidence that electrons can behave as both waves and particles. This wave particle duality lies at the heart of quantum mechanics, but physicists remain intrigued by the boundary between the quantum and classical worlds. Neutrons, atoms and small molecules have all shown quantum-interference effects. Now Markus Arndt and co-workers at the University of Vienna have observed the wave-like behaviour of carbon-60 molecules. The "buckyball" molecules are at least an order of magnitude more massive than any other object where wave properties have been observed (Nature 1999 401 680).

The Austrian researchers passed a collimated beam of carbon-60 molecules through a silicon-nitride diffraction grating and detected the interference pattern by ionizing the molecules using a laser and counting the number of ions produced. The grating contained 50 nm wide slits that were separated by 100 nm. The team clearly observed the central maximum and the two first-order diffraction peaks of the pattern.

The essential features of the pattern could be explained by standard diffraction theory provided that the width of the beam and its velocity distribution were taken into account. Arndt and co-workers determined from the velocity distribution that the most probable de Broglie wavelength of the molecules was 2.5 picometres, about 400 times smaller than their diameter.

One of the most intriguing aspects of quantum interference is that the interference pattern only forms when we cannot know which slit the particle passed through. However, detection of infrared photons emitted by vibrational transitions of the molecules could, in principle, reveal the path taken and thus destroy the interference pattern. Luckily, the wavelength of this radiation is too long (about 10 mm) to reveal which slit the molecules travelled through.

Arndt and co-workers expect that their methods can be extended to even larger macromolecules, and maybe even viruses, to probe the fuzzy boundary between quantum and classical physics.

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Polarizing Eyes Show Way Home

(From Physics World, Post-Deadline,, Vol 12, No 11, 1999, p5)

Polarized light is used widely throughout physics. It can be employed to measure the magnetic and electric properties of materials, and to encode secret messages in quantum cryptography. But physicists are not alone in exploiting polarization. Bees and ants, for instance, use the pattern of polarized daylight as a compass. And now zoologist Marie Dacke at Lund University in Sweden and co-workers from Australia, the UK and the US have found that the eyes of Drassodes cupreus, a member of the spider family, contain polarizing optics unlike those of other insects (*Nature* 1999 **401** 470).

Dacke and colleagues found that one pair of eyes on top of D. cupreus's head lacks a focusing lens and therefore fails to form images on the retina. Instead each eye comprises a mirrored V-shaped trough filled with photoreceptors, which makes them appear bright blue. Light reflected from each surface is polarized along the long axis of the trough, and the long axes of the eyes are oriented roughly at right angles to one another. When the researchers shone polarized light at the spider, only one eye appeared blue. The opposite happened when they rotated the plane of polarization by 90°. Dacke and co-workers believe that the spider compares the signals from its left and right eyes to navigate.

For most of the day sunlight is effectively unpolarized, so the spiders are not able to discern a clear polarization signal. Immediately after sunset, however, the light is polarized mainly in one direction, suggesting that the eyes are designed for navigation at dusk and dawn when the spiders are most active.

To test this theory, the team mapped the movements of several spiders kept indoors under polarized and unpolarized light. Nearly all the spiders found their way back to their nests after foraging trips when the light was polarized, but only 30% made it home under unpolarized light.

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Standard Model wins Nobel Prize

Peter Rodgers

(From Physics World, News , Vol 12, No 11, 1999, p7)

The last Nobel prize of the 20th century has been awarded to the two theorists who showed how to eliminate the infinities that plagued the unified electroweak interaction and thereby laid the foundations of the highly successful Standard Model of particle physics. Gerard 't Hooft was working as Martinus Veltman's PhD student at the University of Utrecht in the Netherlands when he showed how to "renormalize" the electroweak theory. The pair then went on to work out the details of how to perform the calculations. 't Hooft and Veltman share the prize, which is worth SwKr 7.9 million (about £590 000).

By the late 1960's Sheldon Glashow, Abdus Salam and Steven Weinberg had shown how to unify quantum electrodynamics (QED), the theory that describes electromagnetism, and the weak nuclear force, which is responsible for radioactivity. Their theory predicted the existence of three new force-carrying particles the neutral Z boson and the charged W+ and W bosons but not their masses. The obvious challenge to theorists was to remove the infinities that cropped up during the calculation of particle masses and other quantities that could be measured in experiments. This is what 't Hooft and Veltman did in the early 1970s. The Standard Model is now able to explain the results of all particle physics experiments, and was able to predict the mass of the top quark before it was observed in l995.


Winners – Gerard 't Hooft and Martinus Veltman

Veltman was born in the Netherlands in 1931 and received his PhD from Utrecht in 1963. He was professor there from 1966 to 1981 and then moved to the University of Michigan in the US. Now retired and living in the Netherlands, Veltman is the emeritus MacArthur professor at Michigan. 't Hooft was born in the Netherlands in 1946 and received his doctorate in 1972. He has been a professor at Utrecht since 1977.

The award was welcomed by other theorists. "All the people I have spoken to have been very happy that 't Hooft and Veltman shared the prize," said John Ellis of CERN. "There is no doubt in my mind that the prize for 't Hooft was long overdue. There was basically zero interest in the Salam Weinberg model until 't Hooft's paper proving renormalization. Initially, there was some scepticism about his proof, particularly in the US, but this was soon dissipated."

Ian Aitchison, a theoretical physicist at Oxford University, said that the prizewinning work was "absolutely crucial" to the development of the Standard Model. "Before then," he says, "the weak force was not on the same footing at all as QED. Renormalizability made it as good as QED. It was also a great boost for quantum field theory itself " Experimental particle physicists have welcomed the announcement as well. Antonino Zichichi of CERN has interacted with 't Hooft in particular for many years. "He has done an unprecedented amount of physics in many fields," said Zichichi. "Whereas other theorists could announce 'there should be this', a theoretical discovery by 't Hooft corresponds to the exact calculation of how much 'this' should be." In addition to his work on the renormalization of the electroweak interaction and on "asymptotic freedom" in quantum chromodynamics (QCD), the theory of the strong nuclear force, Zichichi points out that 't Hooft's discovery of instantons in QCD has had a big impact on experiments.

Shortly after the award was announced Veltman told Dutch television: "The subject is something I have never been able to explain to my wife and children." Undeterred, Veltman told Physics World that he is "writing a book that supposedly will explain gauge theory and renormalization on as low a level as possible". About three-quarters of the book is complete.

't Hooft was giving a talk to a group of experimental physicists in Bologna when one of the audience "sneaked out to check the Internet and found out about the prize," he told Physics World . "The talk had an unusual ending."

In addition to research into the strong interaction and collaboration with experimentalists, 't Hooft is also working on quantum gravity and black holes. "My present theories entail thorough revisions in the interpretation of quantum mechanics," he said. "I am constructing models that may indicate that what is called quantum mechanics today may be closely linked to chaos and microscopic information loss at the Planck scale. One day, such ideas may perhaps be linked with string theories and related ideas. It is a long shot, but I like to believe that I can afford it, at least for a while."

't Hooft published a popular book on particle physics in 1996. Reviewing it in Physics World John Ellis prophetically urged readers to "consider whether 't Hooft and Veltman deserve more recognition than they have received so far from Stockholm and the world at large". Ellis now says that the relation between Veltman and 't Hooft reminds him of Moses and Joshua: "Veltman was the lonely prophet of non-Abelian gauge theory, who led the 'Lost Tribe' of particle theorists through the desert of quantization, but did not reach the 'Promised Land' of renormalization proved by his student. It is good that history remembers both 't Hooft and Veltman in parallel with Moses and Joshua!"

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NEW MEMBERS, ADDRESS CHANGES

Welcome to New Members :

Full details of the following Members' addresses are listed in the Members' Contact Details, accessible from the home page.

Dr Ayodeji O Awodugba, *Nigeria*	Dr Saeed Mohammadi, *Iran*
Dr Christopher T Chantler, *Australia*	Dr Mr Jong-Song Moon, *South Korea*
Mr I R Entizon, *Ukraine*	Professor John F Sharpey-Schafer, *South Africa*
Dr Dimitris Emfietzoglou, *Greece*	Professor Roberto M. Uribe, *U.S.A.*
Dr Egbert E.R. Hering, *South Africa*	

Address changes of Members :

Full details of the following Members' address changes are listed in the Members' Contact Details, accessible from the home page.

Dr Venkatesha S Arakali, *U.S.A.*	Dr R T Perry, *U.S.A.*
Dr Ines Krajcar Bronic, *Croatia*	Dr Alexander E Shikanov, *Russia*
Dr Edward N Lazo, *France*	Dr Zheng Zheng *P.R. China*

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