I R P S BULLETIN

Newsletter of the International Radiation Physics Society

Vol 9 No 4 **DECEMBER 1995/JANUARY 1996**

From the Editor :

As you can see from the membership list included in this issue the IRPS is not a large organization. Nevertheless it fulfils a number of important functions which are often neglected in larger professional societies. It is important that we recognize and value their worth so that we might work to make our society more relevant to our own, and the scientific community's, needs.

Our strength lies in the breadth of our interests. Within our community we can find people who are interested in subjects as diverse as astrophysics and particle physics, radiation safety and the study of museum artefacts using modern techniques of analysis, nuclear physics and atomic physics, and so on.

Our strength lies also in the fact that our members represent a United Nations of science, with members from almost every country in the world.

Because of the disparity of opportunity which has existed in the past, many of these countries have not had the privilege of continuous growth which the developed nations currently enjoy. Their scientific facilities are not so grand as those of the more developed nations.

It has been the aim of the IRPS to foster the world-wide growth of Radiation Physics, which is a discipline integral to the growth of knowledge, science and technology, and ultimately, economies. We have had as one of our basic tenets the encouragement of scientists from all nations to enter into scientific discourse in a spirit of true friendship and co-operation.

We must all work towards making our society more successful in 1996 so that its work in scientific and human terms may prosper.

Let 1996 be a successful and happy year for us all.

Dudley Creagh

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PRESIDENT'S COLUMN

John Hubbell

My Meeting with Cherenkov: Some Impressions

Earlier this year (1995) Pavel Cherenkov's daughter Elena Pavlovna Cherenkova wrote me, inviting me to write something about her father (1904-1990) for a "collection of memories" now in preparation by his colleagues at the P. N. Lebedev Physical Institute in Moscow. The following account is what I sent her:

"Among my global travels and visits, one of my most memorable was when I was in Moscow in August 1979, and I met with Academician and Nobel Laureate (Physics 1958) Pavel Alekseevich Cherenkov. This meeting, arranged by my good friend and colleague Boris Govorkov, took place in the Photomeson Laboratory at Troitsk, also known as the "Academic City," just south of Moscow.

Boris Govorkov had mentioned that I would be visiting the "laboratory of P. A. Cherenkov," but I had not fully understood what he meant, as I thought of Cherenkov only as an illustrious name out of the past, known to every physics student and physics practitioner and to many others, but who had likely died some years ago. To my great, happy and spine-tingling surprise, upon arriving at his office, I found the legendary Cherenkov to be very much alive. He was then a spry, white-haired short-statured man, still providing inspiration, guidance and direction to the fundamental researches going on in his laboratory.

Pavel Alekseevich had just turned 75 (July 28, 1979) and was still enjoying the glow of the jubilee and open-house celebration the laboratory had organized in his honor. In 1958 he shared in the Nobel Prize in Physics with fellow Russians I. Y. Tamm and I. M. Frank for his discovery of the "Cherenkov effect" while a graduate student at the USSR Academy of Sciences Institute of Physics in 1934.

In the Cherenkov effect, charged particles traveling at velocities near the speed of light enter a clear material such as plastic or glass with a high refractive index, causing the effective speed of light to decrease proportionately, but with less effect on the massive charged particles. Hence we have particles in the material traveling "faster than the speed of light," resulting in a complaint, against this violation of Einstein's edict, in the form of the eerie and beautiful blue light (Cherenkov radiation) seen, for example, around the radioactive spent reactor fuel-rods deep in a swimming-pool storage facility.

In the process of introductions, I gave Cherenkov my National Bureau of Standards (Radiation Theory Section) business card. He immediately reached in his desk drawer and pulled out his own card (Russian on one side, English on the other, as is customary). He then signed and dated it without my asking, and gave it to me, knowing, I am sure, that this would be the prize souvenir of my entire USSR scientific-exchange program tour.

Cherenkov was not too comfortable using English, nor I Russian, but Govorkov and another of his colleagues, Lollii N. Shtarkov, were fluent in both, and were helpful in our conversation. Cherenkov apologized that he would not be showing me around his laboratory facilities himself, due to his "regimen," but assured me I would be in good hands with Govorkov and Shtarkov, and asked us to return to his office at the end of our tour.

Left to right : John Hubbell, Pavel Cherenkov, Boris Govorkov, Lollii N. Shtarkov, at Troitsk, near Moscow

On our tour, I was particularly impressed by a detector array consisting of a series of square scintillator plates traversed by the high energy particles from the accelerator. At each of the four corners of each plate was a photomultiplier, sufficiently fast to measure the elapsed time of flight of the light from the traversing particle to each of the four photomultipliers, and hence map the trajectory of the particle (and its products) through the entire stack of plates.

In Cherenkov's office, besides his desk, bookshelves and blackboard, was a small conference table. On this table there materialized a steaming teapot, some small cups, a bowl of apples, a smaller bowl of wrapped pieces of candy, a bottle of cognac and some small, partly red-glass shot glasses. Of these items we managed a modest lunch, finishing with a cognac toast. Cherenkov, with a twinkle in his eye, complained that "the bargain was not complete" if I didn't drain my glass, since I had taken just a taste in deference to Cherenkov's Nobel Prize status and excused myself from the rest with "At home I am a teetotaler." On principle, I held fast and did not drain my glass. In the lunch conversation Cherenkov expressed considerable interest in American politics. The tea-party wound up with a picture-taking session, which all, including Cherenkov, seemed to enjoy. It is my pleasure and honor to have met him personally.

By a remarkable coincidence, in the same month as Cherenkov's death, January 1990, I was in India for a collaborative x-ray fluorescence yield project with Prof. P. N. Trehan's group at the Panjab University in Chandigarh. During that same India visit, in Calcutta, I had a somewhat similar surprise visit with another Nobel Laureate (Peace 1979) Mother Teresa in her convent home. I had just wanted to see where she lived, but it turned out she was "at home" and willing to chat with my Indian colleague S.C. Roy (Bose Institute, Calcutta [and our IRPS Membership Coordinator]) and me, and give me her blessing, with my hand in hers. She also now has one of my business cards, but unlike Cherenkov, the dear little beloved lady had no card to reciprocate.

Those two visits, with P. A. Cherenkov in August 1979 and with Mother Teresa in January 1990, are without doubt the two most exciting visits of my life.

"Cherenkov radiation" is used throughout the nuclear physics and high-energy accelerator experimental world as the basis for a variety of "Cherenkov detectors" of central importance to any such work. Cherenkov's name and his discovery have become "part of the language" of physics and of our general knowledge of our amazing cosmos. Although he was not of great physical stature, he casts a very long shadow (or light, actually) over both the history and the future of radiation physics. Pavel Alekseevich Cherenkov has definitely joined the "immortals" of the global human family."

NEWS ITEMS

Dudley Creagh, School of Physics
University College, UNSW, ADFA, Canberra, Australia :

New Synchrotron Radiation Opportunites for Australian Scientists

(From Canberra Times, Canberra, Australia, 19 December, 1995)

The common-place aspects of life are often the least appreciated and the least understood. We take for granted the action of soaps and detergent, and buy them on the basis of glitzy advertisements rather than on the way they work. We buy waxes and oils to preserve objects we treasure, yet we do not know quite how they work. We "surf the net" without knowing what must be done in research and development terms to provide the infrastructure which underpins this search for information, but not necessarily understanding. We use sophisticated pharmaceuticals and applaud the progress made in the biotechnology without knowing how these are developed.

It is not necessary, of course, to understand in detail how scientists conduct research in these very diverse fields. What is important is the recognition of the common factor in each of these research fields, the use by scientists of extremely bright light sources produced by the acceleration of charged particles in particle accelerators. These sources, trillions of times more bright than the x ray machine in a doctor's surgery, are referred to as synchrotron radiation sources. They produce a continuous spectrum of radiation including components ranging from x rays through the visible to the infra-red.

In his "Innovations Statement" the Minister for Industry, Science and Technology, Senator Peter Cook announced funding for a new research initiative aimed at increasing Australia's access to advanced synchrotron sources. This funding will enable research to continue at the Australian National Beamline Facility at the Photon Factory, Tsukuba, Japan, and to extend its research to the very new, and highly brilliant light source, the Advanced Photon Factory, Chicago, USA.

The Photon Factory collaboration was made possible through the efforts of Dudley Creagh (Australian Defence Force Academy) and Stephen Wilkins (CSIRO-Division of Materials Science and Technology). Their links with Japanese scientists led to an offer for Australia to establish an experimental station at the Photon Factory, After some initial difficulties in attracting funding their proposal for the development of a synchrotron radiation facility at the Photon Factory was ultimately investigated by an ASTEC committee. This committee later incorporated their proposals in the ASTEC Report "Small Country-Big Science" which was tabled in parliament in 1989. As a consequence of this report a consortium, the Australian National Beamline Facility comprising

ANSTO, CSIRO, ARC, DIST, ADFA and the ANU was formed, with funding of $ 3.3M for the first triennium. Funding of $1.11M has been allocated since then. The beamline was designed and constructed in Canberra at the ADFA and the unique diffractometer was constructed in Melbourne by the CSIRO-DMST.

The unique scientific equipment which has been created at the Photon Factory is regarded as the best in the world for its type, and to date more than one hundred scientific groups from eleven universities and six government instrumentalities have conducted experiments in Japan.

The present project builds on the outstanding success of the Photon Factory both scientifically and as a means of enhancing collaboration between Australian and Japanese scientists.

The consortium receiving funding in the Innovations Statement comprises ANSTO, CSIRO, DIST, ADFA, and the Universities of New South Wales, Sydney, Melbourne, Queensland, Western Australia, and Monash University. Our existing facilities at the Photon Factory will be maintained and extended, and we will gain access to extensive facilities at the substantially more intense synchrotron source, the Advance Photon Source.

Why do scientists require access to these light sources? A good example is the development by Peter Colman's group (CSIRO) of an anti-influenza drug, which is currently undergoing clinical trials. Modern techniques of drug design involve the determination of the structure of the virus by x ray diffraction. Because only very small crystals of the virus can be grown extremely high x ray intensities are required, and these are available only at synchrotron radiation sources.

With the high brightness available at a synchrotron radiation source it is possible to follow the time evolution of chemical, bio-chemical, and bio-physical processes, such as photo-synthesis, the structure and action of membranes, and the chemical and physical changes in muscle action .

Another important example is the study of corrosion and corrosion prevention. Corrosion and the need for its prevention costs Australia more than one billion dollars per year. These processes occur in thin layers at the surface of the material under study. The active layer may be only one molecule thick. High x ray intensities are required if the processes involved in corrosion are to be observed as they occur. By understanding the kinetics of these processes better strategies for corrosion prevention can be developed.

The active elements in semi-conductor devices used in computers have become very small because of the need for high packing density and high speed of operation. Highly intense x ray sources are required if we are to be able to study their structure and to relate this to their performance.

Through access to the high brightness facilities of the Photon Factory in Japan and the Advanced Photon Source in the USA advances in the development of pharmaceuticals, the study of the formation of cells and membranes, the study of the processes of catalysis, the mechanisms associated with corrosion and corrosion protection, materials science, and semiconductor technology will be possible.

The facilities at the Photon Factory will be developed further, with modifications to the existing x ray diffractometer to enable studies of chemical and physical changes at high temperature and the study of electrochemical processes as they occur. Facilities for the study of polymers and processes occurring at surfaces will be extended.

At the Advanced Photon Source thew Australian group will become part of three different consortia, having access to a wide range of sophisticated instrumentation. Some of this instrumentation will be designed and developed in Australia, at ADFA, the University of Melbourne, and the ANU. One of the consortia, BIOCARS, is devoted to the study of biological materials and biochemical processes. It is to this consortium that groups like the CSIRO group will belong. The second consortium, CHEMMATCARS, targets materials science, and in particular processes which occur at surfaces and interfaces in solid and liquid systems, and the structure and behaviour of polymeric materials. The third consortium, SRI-CAR, develops new instrumentation for advanced research. We are especially interested in this consortium because of our expertise in this area of design and the fact that the Minister has charged us with the investigation of the feasibility of building synchrotron radiation facilities in Australia for the APEC region. We can use this consortium as the training ground for the next generation of Australian instrumentation designers.

As well, each of the Universities has contracted to contribute towards a Post-Doctoral Fellowship Scheme which will have as its principal aim the fostering of research using high brilliance sources by young Australian graduates in biology, chemistry, engineering, materials science, materials science and physics,. Through such an educational programme we can ensure that they are able to have access to the best facilities available in the world, and that the future leaders of Australian have had the experience of the kind of science used in research and development in the most advanced and sophisticated environments.

What are the anticipated outcomes of this project? The easiest to predict is the production of new drugs. Already Australian scientists have used synchrotron radiation for the determine of the structure of viruses, for the identification of the active sites in those viruses, and for the identification of chemicals which are likely to be more attractive to the virus than human protein. Indeed, in the USA, drug companies must produce the x ray diffraction patterns of their product before it can be registered for trials, and ultimately for sale.

As well, we have some experience in the study of very thin layers deposited on surfaces, whether they be protective coatings on surfaces or thin epitaxial layers grown on surfaces in a semi-conductor device. We may expect that, with the increased brilliance available at the APS we shall be able to study the kinetic processes occurring at these surfaces and interfaces. In particular we should be able to observe dynamically the manner in which layers of long-chain molecules organize themselves to form membranes and cells. This may lead to advances in cell biology.

It will be possible to study the kinetics of muscle movement, studying the change in muscle structure as a function of time. The effect of ill-health on muscle structure and performance can be studied. The effect of diabetes on collagen from heart muscle has already been studied at the Photon Factory.

Australia has always had a good reputation for the design of new scientific devices but our isolation and lack of "big science" facilities has caused many of our best scientists to leave and work elsewhere. Through access to the wide range of instrumental development being undertaken at the APS we expect to increase our competence in all aspects of design. The ultimate aim of this is the creation of an Australian synchrotron radiation source to serve the APEC countries. Without the APS experience we could not contemplate making this step in our scientific development.

Synchrotron radiation can be used very effectively to solve problems by the manufacturing and mineral processing industries. One example is the development of surfactants to protect zinc-allume sheeting which BHP produces in large quantities, and which is now protected using toxic dichromate baths. Although major firms in some industries in Japan (Hitachi, NTT, NEC) and the USA (IBM, Bell Laboratories, Boeing, and all the leading pharmaceutical companies) regard study of their products using synchrotron radiation as part of the production process, Australian industry has in general yet to be convinced of its benefits. We aim to remedy this deficiency during the life of this project, and help to make Australia a truly "smart" nation, rather than one that is information saturated..

S C Roy, Department of Physics,Bose Institute, Calcutta, India :

Extract from : Stargazers gather food for thought

(Debkumar Mitra and G S Mudur, The Telegraph, Calcutta, India, 25 October, 1995)

Solar gamma rays: Prof Suprakash Roy led a team of astrophysicists from the Eastern Centre for Research in Astrophysics (ECRA) to study the amount of solar gamma radiation present in the earth's atmosphere at Diamond Harbour. It is a part of the total gamma radiation which also comprises cosmic and natural (arising out of radioactive decay on earth) gamma rays. The scientists recorded a drop of about 25 per cent in the total gamma ray radiation during the total solar eclipse.

Professor Roy said "It appears that the presence of the moon between the sun and the earth blocks the solar gamma rays. Most of it is shielded during the appearance of the corona, when the moon's shadow covers the entire sun. So, the data collected at 08:49:32.7 am contributes most to the corresponding analyses. The deviation in measurement with respect to those studied just before and after the eclipse, obtained from today's observations, can be accounted for by solar gamma rays.

He added "We are not certain of the amount but the anaolysis of the data based on today's observations will definitely help us to study the rate of change in solar gamma rays in the atmosphere."

ISRP-7

MEETING

24 – 28 February,

1997

Jaipur

INDIA

1996

January

7–10 *29th Midyear Topical Meeting of the Health Physics Society*, Wyndham Paradise Valley Hotel, Scottsdale, Arizona

18 *Radiation Protection Measurements: Are they defensible in court?* Commonwealth Institute, London, UK; Dr R Strong, Society for Radiation Protection, 148 Buckingham Palace Road, London SW1W 9TR, UK. Fax +44 0171 824 8112
Phone +44 0171 823 4971

18–25 *International Schools and Conference on X-Ray Analytical Methods (AXAA)*, Sydney, Australia; N Stephenson, AXAA '96 Secretariat, GPO Box 128 Sydney, NSW 2001 Australia

March

15–20 *Sixth Conference of Nuclear Sciences and Applications*, Cairo, Egypt; Prof Dr A I Helal, Atomic Energy Authority (ESNSAS) 101 Kasr El-Eini Street, Cairo, Egypt.
Fax/phone +20 2 3543451

April

14–19 *1996 International Congress on Radiation Protection (IRPA9)*, Congress Center Hofburg, VIenna, Austria; WWW – http://www.tue.nl/sbd/irpa/9irpacon.htm #9th Int IRPA Con

May

7–10 *Sixth International Radiopharmaceutical Dosimetry Symposium*, Gatlinburg, Tennessee, USA; Audrey S Stelson, RIDIC.
Phone +1 423 576 3450

20–24 *International Symposium on Ionising Radiation : Protection of the Natural Environment*, Stockholm, Sweden; The Swedish Radiation Protection Institute, Carl-Magnus Larsson, S-171 16 Stockholm, Sweden. Fax +46 8 729 71 08

June

3–7 *Fourth International Conference on Radioactive Nuclear Beams*, Ohmiya, Japan; Mrs S Odai, RNB-4 Secretariat, Institute of Physical and Chemical Research (RIKEN), Linac Lab, 2-1 Hirosawa, Wako, Saitama 351-01, Japan
Fax +81 484 62 4689; Phone +81 484 62 111
ext. 4211; e-mail RNB4@rikvax.riken.go.jp;
WWW http://www.rarf.riken.go.jp

9-15 *5th International Conference on Applications of Nuclear Techniques – "Neutrons in Research and Industry",* Crete, Greece; G Vourvopoulos, Dept of Physics, Western Kentucky University, Bowling Green, KY 42101, USA
Phone +1 502 745-5277; Fax +1 502 745-5062
e-mail : vour@wkuvx1.wku.edu

TBA *15th Annual Panasonic International Dosimetry Symposium*, Lake Geneva, Wisconsin, USA; David Katzman, Panasonic, USA.
Phone +1 201 348 5339

July

9–12 *International Workshop on Radiation Exposures by Nuclear Facilities : Evidence of Health Impacts,* Portsmouth, England; German Society for Radiation Protection. Dr M Schmidt, University of Portsmouth, School of Chemistry, Physics and Radiography, Park Building, King Henry 1 Street, Portsmouth P01 2DZ, England
Phone +44-1705-842150; Fax +44-1705-842157

21–25 *X International Conference on Small-Angle Scattering*, Campinas, Brazil; Prof. Aldo Craievich, LNLS, Cx Postal 6192, 13081-970 Campinas, SP, Brazil

September

9–11 *Second International Workshop on the Industrial, Medical and Military Applications of Radionuclides*, Salzburg, Austria. Workshop Secretariat, Institute of Physics and Biophysics, Hellbrunnerstr. 24, A-5020 Salzburg, Austria.
Fax +43 662 8044 5704;
Phone +43 662 8044 5700;
e-mail physik@edvz.sbg.ac.at

18–20 *International Symposium on In Vivo Body Composition Studies*, Malmö, Sweden; Symposium Secretariat, Department of Radiation Physics, Malmö University Hospital, S-205 02 Malmö, Sweden.
Fax +46 40 963185; Phone +46 40 331235

October

6–9 *3rd Topical Meeting on Industrial Radiation and Radioisotope Measurements and Applications (IRRMA'96)*, Raleigh, USA;
W.F. Troxler, IRRMA'96 Conference General Chairman, Troxler Electronic Laboratories, PO Box 12057, Research Triangle Park,
NC 27709, USA. Phone +1 919 549 8661

14–16 *International Symposium on Nuclear Energy and the Environment*, Beijing, China; Leng Ruiping, Wang Hengde, Chinese Society of Radiation Protection, PO Box 2102-14, Beijing 100822, China. Fax +86 10 8539375; Phone +86 10 8510370

21–25 *4th International Conference on High Levels of Natural Radiation*, Beijing, China; Prof. Tao Zufan, Secretary General of 4th ICHLNR, Laboratory of Industrial Hygiene, Ministry of Health, 2 Xinkang Street, Deshengmenwai, Beijing 100088, China.
Fax : +86 10 2012501
Phone : +86 10 2021166 ext. 378

November

3–7 *International Conference on Radiation and Health in Israel*, Ben Gurion University of the Negev, GBeer Sheva, Israel; International COnference on Radiation and Health, Ortra Ltd., 2 Kaufman Street, Textile Center, POB 50432, Tel Aviv 61500, Israel.
Fax +972 3 5174433; Phone +972 3 5177888
e-mail ortra@trendline.co.il

1997

February

24–28 *7th International Syumposium on Radiation Physics (SIRP-7), Triennial Meeting of the International Radiation Physics Society (IRPS)*
Jaipur, India; B. Sinha, Director, Variable Energy Cyclotron Centre, 1 A/F, Bidhan Nagar, Calcutta 700 064, India
Fax +91 33 346781; Phone +91 33 370032

March

15–20 *Sixth Conference of Nuclear Sciences and Applications*, Cairo, Egypt; Prof Dr A I Helal, Atomic Energy Authority (ESNSAS) 101 Kasr El-Eini Street, Cairo, Egypt, Fax No. 00202 3543451

July

21–25 *X International Conference on Small-Angle Scattering*, Campinas, Brazil; Prof. Aldo Craievich, LNLS, Cx Postal 6192, 13081-970 Campinas, SP, Brazil