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Editorial | Reports on ISRP-9

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EDITORIAL *Paul Bergstrom*

Dear Members,

This issue concludes volume 17 and deals mostly with news from our recent symposium.

We now resume a regular publication schedule with Volume 18 number 1 to be issued shortly.

I once again urge the membership to contribute articles or ideas for articles to me in order that we can revitalize this enterprise. Paul Bergstrom

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REPORTS : I S R P - 9

9th International Symposium on Radiation Physics
and
Workshop on Radiation Based Analytical Techniques

Cape Town, South Africa

24th - 31 October, 2003

Report by Dan Jones, Regional Vice President

Report by Dudley Creagh, Regional Vice President

Report by Paul Bergstrom, Executive Councillor

Report by

Dan Jones

Regional Vice President, Africa and Middle East

The ninth edition of the triennia International Symposium on Radiation Physics (ISRP-9) was held in Cape Town, South Africa from 27-31 October 2003. The Symposium was the latest one in a series which began in Calcutta in 1974 and thereafter continued in Penang (1982), Ferrara (1985), São Paulo (1988), Dubrovnik (1991), Rabat (1994), Jaipur (1997) and Prague (2000). A 2½ day Workshop on Radiation Based Analytical Techniques was held immediately prior to ISRP-9 (24-26 October 2003). Both events were organised and coordinated jointly by the International Radiation Physics Society (IRPS) and iThemba Laboratory for Accelerator Based Sciences (iThemba LABS).

The Organizing Committee of the 9th International Symposium on Radiation Physics and the Workshop on Radiation Based Analytical Techniques observed the basic policy of non-discrimination and affirmed the right and freedom of scientists to associate in international activity without regard to such factors as citizenship, religion, creed, political stance, ethnic origin, race, colour, language, age or sex, in accordance with the Statutes of the International Council of Science (ICSU). At the Symposium and Workshop no barriers existed which prevented the participation of ***bona fide*** scientists.

The Symposium and Workshop were generously sponsored by the South African Department of Science and Technology (DST), iThemba LABS, the National Research Foundation (NRF), the International Union of Crystallography (IUCr), the International Center for Diffraction Data (ICDD) and the South African Nuclear Energy Corporation (NECSA). The sponsorship received was used entirely to support financially the attendance of delegates (mainly African). A total of 40 delegates were supported - from small contributions to registration fees, to full sponsorship.

There were 153 delegates from 39 countries who attended the Workshop and ISRP-9. It was very pleasing that there were so many (65%) from developing countries and especially from Africa. Naturally the majority of delegates were from South Africa. Globally it has been a difficult period recently with terrorism, war, the economic downturn and the threat of SARS. However, the presence of 76 delegates from outside Africa affirmed the commitment of scientists to foster international goodwill and communication. The delegate profile is given in ***Table 1.***

TABLE 1 : Delegates

COUNTRY	Number	Developing	Advanced	Africa
Argentina	1	✓		
Australia	6		✓	
Austria	1		✓	
Belgium	1		✓	
Botswana	1	✓		✓
Brazil	3	✓		
Chile	1	✓		
China	1	✓		
Croatia	5	✓	✓	
Czech Republic	2	✓		
Denmark	1		✓	
Egypt	2	✓		✓
France	2		✓	
Germany	4		✓	
India	2	✓		
Italy	7		✓	
Japan	3		✓	
Kenya	3	✓		✓
Malaysia	1	✓		
Mexico	1	✓		
Morocco	2	✓		✓
Mozambique	1	✓		✓
Namibia	1	✓		✓
Netherlands	2		✓	
New Zealand	1		✓	
Nigeria	2	✓		✓
Portugal	3		✓	
South Africa	64	✓		✓
Spain	2		✓	
Sweden	2		✓	
Taiwan	1	✓		
Tanzania	1	✓		✓
Thailand	2	✓		
Turkey	2	✓		
Ukraine	1	✓		
UK	9		✓	
USA	9		✓	
TOTAL	**153**	**22**	**15**	**9**

	Delegates	Percentage	Countries	
South Africa	64	42%	1	
Rest of Africa	13	8%	8	9
Advanced	53	35%	15	
Developing	100	65%	22	37

The Workshop was opened by Prof John Sharpey-Schafer, Director of iThemba LABS, while ISRP-9 was opened by Dr Khotso Mokhele, President of the National Research Foundation.

The programmes for both ISRP-9 and the Workshop covered a wide variety of topics. The speakers were scientists of international repute who provided the basis for stimulating discussion and vigorous debate. The Workshop was an innovation for these international symposia and the number of delegates who attended indicated that it was a great success, a notable forum for learning and a template for the future. The generosity of all the invited speakers, who agreed to pay their registration fees, enabled the Organizing Committee to reduce the costs for delegates from developing countries which contributed in no small way to the significant attendance of delegates from these countries.

The international Workshop on Radiation Based Analytical Techniques (24-26 October) held at iThemba LABS was attended by 73 delegates. It was aimed at scientists and technologists involved in industrial and academic research and development who wished to familiarize themselves with the capability and relevance of the full range of radiation based techniques available to analyze and characterize materials. The emphasis was on x-ray fluorescence, x-ray diffraction and particle-induced x-ray emission. In addition the Workshop also attracted postgraduate students desirous of becoming conversant with modern techniques of materials analysis and applications. The programme of 22 lectures, which was given by a team of leading international scientists drawn mainly from Africa and Australasia, covered all the fundamental scattering and absorption techniques with x-ray, neutron, proton and electron probes.

The first day was focused on the basic properties of the various probes and described how specific analytical problems could be matched to the most appropriate methods.

On the second day demonstrations were given (at the iThemba LABS' van der Graaff accelerator facility) of the application of several radiation based methods to individual problems ranging from trace element analysis and structure identification in minerals and industrial products to the study of wide-ranging environmental and conservation issues.

On the third day there was a special tutorial session, sponsored by the International Center for Diffraction Data (ICDD), on the analysis of powder diffraction data using the Rietveld technique. The tutorial was given by Profs B J Kennedy (University of Sydney) and D C Creagh (University of Canberra) in the iThemba LABS' Computer Laboratory and attended by 22 delegates. Prof Kennedy's trip was partially sponsored by the ICDD. A CD containing the PowerPoint presentations and The Rietveld tutorial was distributed to all attendees.

The 9th International Symposium on Radiation Physics (27-31 October) was held at the spectacular Protea Hotel President located on the beachfront at Bantry Bay and was attended by 153 delegates. The scientific programme consisted of both oral and poster sessions. The oral sessions included both invited and contributed papers. The latter were selected by the Prize Committee from among the poster submissions for which the presenting authors had indicated their willingness to present the papers orally. There were two such categories in which the best papers in each were selected - a general one and one for ***bona fide*** graduate students. Students were encouraged to participate in the process as the oral presenters each received a monetary prize. The best presenter in the general category also received a monetary prize. The topics covered in the Symposium included all aspects of radiation physics (including non-ionizing radiation) encompassing, but not limited to :

- fundamental processes
- sources and detectors
- physical and material sciences
- medicine and biology
- space
- earth and environmental sciences
- technology and industrial applications.

A total of 23 invited papers were delivered by speakers from 13 different countries. Six proffered poster presentations in the general category and four in the student category were chosen for oral presentation. A total of 104 posters were presented in 3 poster sessions. The refereed texts of the oral papers and extended abstracts of the poster presentations will be published in a special issue of the journal ***Radiation Physics and Chemistry***. The list of prize winners is given in ***Table 2.***

There is no doubt that both meetings were resounding successes from both the social and scientific point of view and benefited a large number of African scientists and students who were able to learn from foremost authorities about the latest techniques, research and developments in the wide-ranging field of radiation physics. Hopefully the knowledge gained will enable them to enhance their careers and impart their knowledge to young Africans, which will ultimately be of benefit to South Africa and other African countries. The meetings also served to showcase South African science and technology in the international arena which has potential for attracting financial support and promoting collaborative projects.

TABLE 2 : Prizes Awarded

STUDENT PRESENTATIONS	
L Ali (UK) *(First Prize)*	The structure and organisation of Type IV collagen in normal and glycated basement membrane.
D de Villiers (South Africa) *(Second Prize)*	The development and application of radiometry in the mineral and agriculture industries.
M E Eisa (South Africa) *(Third Prize)*	High-resolution nuclear microprobe elemental mapping of teeth enamel-dentine interface exposed to acidic conditions.
P Thanomngam (Thailand) *(Fourth Prize)*	Monte-Carlo simulation of bremsstrahlung interference due to K-shell photoelectrons in Compton scattering experiments.
BEST SELECTED ORAL PRESENTATION	
L C Longoria (Mexico)	Determination of ^{226}Ra and ^{235}U in soils samples by gamma spectrometry.
BEST POSTERS	
M Assiamah (South Africa)	Dosimetric techniques for mammography x-ray beams.
R C Barroso (Brazil)	Coherent scattering characteristics of normal and pathological human tissues.
	Elemental determination in sediments from Sepetiba Bay - Brazil using x-ray fluorescence
	Evaluation of heavy metals levels in the Paraíbo dc Sul River by SR-TXRF in muscle, gonads and gills of *Geophagus Brasiliensis*.
K Jakovčić (Croatia)	A search for solar hadronic axions.
G Tylko (South Africa)	X-ray microanalysis method of elemental content evaluation in the brain of musca domestica exposed to heavy metals.

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NEW MEMBERS and ADDRESS CHANGES

Welcome to New Member :

Mr Krishna Prasad Aryal, Nepal

New Members' addresses are listed in the Contact Members' Details
(click on country next to name)

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REPORTS : I S R P - 9

Workshop on Radiation Based Analytical Techniques

by

Dudley Creagh

Regional Vice President, Australasia

The Workshop on Radiation Based Analytical Techniques was held at iThemba Laboratories, Cape Town, from 24 to 26 October 2003, just prior to the ISRP9 Congress.

It was the first attempt by the IRPS to hold such an event, and it was a response to the perceived need to give young African scientists formal instruction in radiation based analytical techniques. The attendance of young scientists was facilitated by generous grants from the International Commission for Diffraction Data and the International Union of Crystallography.

Around sixty scientists attended the Workshop and, as can be seen in ***Figure 1***, these scientists came from a wide range of countries. About twenty-five were young scientists.

The invited speakers, fifteen in all, came from eight countries: Australia, South Africa, Brazil, the United Kingdom, the Netherlands, Egypt, New Zealand, and Italy.

The first two days were devoted to lectures on aspects of x- and g-ray scattering and spectroscopy, neutron diffraction and scattering, and ion beam spectroscopy.

On the first day Dudley Creagh spoke on the basic interactions of radiation with materials. Brendan Kennedy built on this introduction in his illuminating lecture on x-ray and neutron diffraction. Chris Chantler completed the section on fundamental properties and interactions with a talk on the absorption and scattering of x-rays.

A section on spectroscopic techniques followed, with papers given by Dudley Creagh
(x-ray spectroscopy), Anselmo Paschoa (g-ray spectroscopy on uranium in soils) and
E. Sidderas-Haddad (charged particle spectroscopy).

After a tour of the XRD, PIXE, nuclear microprobe, and Rutherford Backscattering facilities at the iThemba Laboratories, Malcolm Cooper delivered a lecture entitled "Synchrotrons and Brilliant" which introduced formally the topic of synchrotron radiation and its applications.

The second day was devoted to specific applications of radiation in scientific projects. Brendan Kennedy gave an introduction to Rietveld Analysis. Henk Schenk spoke on the uses of x-ray diffraction. M. Hartig spoke on the use of x-rays to study stress and the topic of texture analysis. W. Przybylowicz discussed x-ray fluorescence analysis and in a later talk he gave a description of the use of the nuclear microprobe in geological applications.
J. Mesjaz-Przybylowicz gave a description of the use of the nuclear microprobe in biology. D. Britton gave a paper on positron beam spectroscopy and E. Sidderas-Haddad spoke on accelerator mass spectrometry. The analysis of atmospheric aerosols was discussed by
H. Annegam. N. Iksander gave two very interesting papers on the use of a variety of analytical techniques to study important objects in the Cairo Museum collection of antiquities.

For something completely different as far as applications (though still dealing with dead bodies) Murray Bartle described how dual energy x-ray systems have been adapted to assist in analysis of meat packs and wool bales in the New Zealand export industry.
Andy Buffler spoke on the use of neutrons in the detection of contraband. F. de Beer gave examples of the use of neutron radiography in the study of porous media. Finally, F. Casali showed, in an elegant paper, the use of high resolution x-ray digital tomography for non-medical applications.

On the third day Brendan Kennedy and Dudley Creagh held a workshop on Rietveld analysis and relational databases. This workshop was attended by twenty-two, mostly young, scientists. The proceedings of the workshop, as represented by the presentations of the speakers, have been made available to all the participants of the workshop.

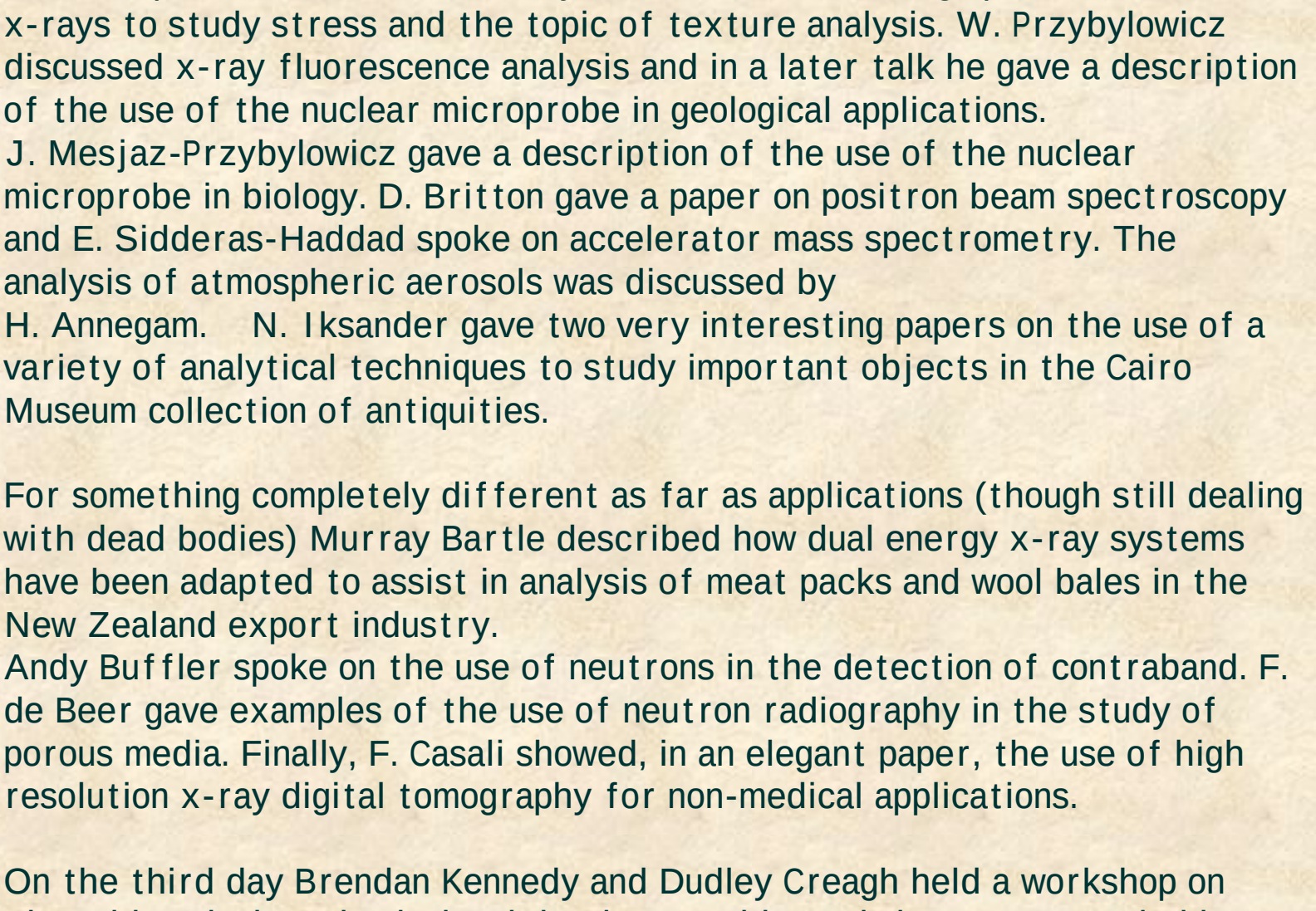

Fig. 1 Participants of the Workshop on Radiation Based Analytical Techniques.

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REPORTS : I S R P - 9

Report

by

Paul Bergstrom

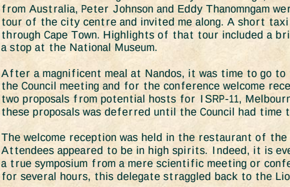
Executive Councillor

The 9th International Symposium on Radiation Physics was held from October 26 through October 31 at the Protea Hotel President in Cape Town, South Africa. The Symposium was preceded by a Workshop on Radiation Based Analytical Techniques, held at iThemba Labs.This report describes the editor's experiences at the Symposium. A separate description of the workshop appears in this issue of the Bulletin.

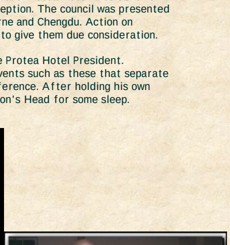
This correspondent arrived in Cape Town on the morning of Sunday, October 26, checking in at the Lion's Head Lodge. In the lobby of the Lodge, two delegates to the symposium from Australia, Peter Johnson and Eddy Thanomngam were about to embark on a walking tour of the city centre and invited me along. A short taxi ride later, we were walking through Cape Town. Highlights of that tour included a brief visit to the Dutch Fortress and a stop at the National Museum.

After a magnificent meal at Nandos, it was time to go to the Protea Hotel President for the Council meeting and for the conference welcome reception. The council was presented two proposals from potential hosts for ISRP-11, Melbourne and Chengdu. Action on these proposals was deferred until the Council had time to give them due consideration.

The welcome reception was held in the restaurant of the Protea Hotel President. Attendees appeared to be in high spirits. Indeed, it is events such as these that separate a true symposium from a mere scientific meeting or conference. After holding his own for several hours, this delegate straggled back to the Lion's Head for some sleep.



Zhengming Luo definitely enjoyed the dinner !!



Dan Jones and Naomi Haasbroek

Early Monday morning, the meeting commenced in earnest. Dr. Dan Jones, the conference organizer, and Professor Malcolm Cooper, outgoing President of the Society, acknowledged the support of those organizations and individuals whose contributions made the conference possible. As an example, it was noted that the speakers had all agreed to pay their own way, including registration fees, thus making money available for a substantial number of participants from developing countries.

The opening address was given by Dr. K. Mokhele, President of South Africa's National Research Foundation. He gave an elegant retrospective of South Africa in its first 10 years of democracy. His talk touched on a variety of issues, societal as well as scientific. Among the latter was an overview of the South Africa Large Telescope.

The first scientific session was on **Fundamental Processes in Radiation Physics**. Dr. V.R.K. Murty of the University of Botswana was the chair.

The first talk in this session was on ***"Discrepancies in QED"*** by Professor Chris Chantler of the University of Melbourne. QED can exhibit accuracy of 1 part in 10^{14}. Professor Chantler listed recent issues and articles in QED. Subjects of current interest include the radius of the proton, correlation, higher Z H-like atoms, form factors and exotic species. He reviewed quantization, the Lamb shift, g-2 and possible time variation of the fine structure constant. Dr. Chantler pointed out that some early error bars attached to theoretical predictions have proven inadequate and discussed his work using an electron beam ion trap.

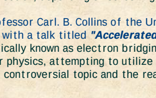
Professor Horst Schmidt-Bocking of the Institut fur Kernphysik of the Universitat Frankfurt followed Professor Chantler's talk with a talk on the ***"Dynamics of Multiple Ionization of Atoms and Molecules by Electron, Photon an Ion Impact"***. These disparate processes are all studied using the COLTRIMS, an instrument developed by Professor Schmidt-Bocking's group. Professor Schmidt-Bocking first described this, seemingly ubiquitous device that uses **COL**d gas jet **T**argets and then applies **R**ecoil **I**on **M**omentum **S**pectroscopy (in a nearly 4p solid angle) to the secondary particles produced in the collisions between the primary particles and the gas target. The multi-hit position sensitive channel plate detectors allow detection of some particles to within 100mm Professor Schmidt-Bocking describes the device as a multi-fragment reaction microscope. The work of the Frankfurt group tends to the fundamental, examining the dynamics of quantum-mechanical many-particle systems. While some textbooks might claim that one can't watch the motion of electrons, the Frankfurt group has worked hard to make this line an, appropriately, fuzzy one, revealing the details of many processes. The ones discussed at the ISRP-9 were the double and single photoionization of He, D_2, and CO, multiphoton ionization in strong laser pulses, and ion-atom collisions (eg. H_2^+ + He, Ne^{10+} + SF_6, U^{29+} + C_3F_8). In the latter cases, Dr. Schmidt-Bocking pointed out the relevance to radiation damage and how hot electron beams are directed in the forward direction, depending on screening.

After a break for tea and coffee, Professor Carl. B. Collins of the University of Texas at Dallas finished the opening session with a talk titled ***"Accelerated Emission from Isomeric Nuclei"***. This subject, generically known as electron bridging mechanisms (EBM), is at the interface of atomic and nuclear physics, attempting to utilize x-ray photons to probe nuclear levels. It is a somewhat controversial topic and the reaction at the Symposium reflected this.

The next session, **Radiation Physics in Space, Earth and Environmental Sciences**, was chaired by Isabelle Lopes, co-organizer of the upcoming ISRP-10 in Coimbra.

The first talk of this session, ***"Detection of Anti-Personnel Landmines using Neutrons and Gamma Rays"***, was delivered by F. D. Brooks of the University of Cape Town. The problem considered is enormous. There are approximately 100 million abandoned landmines in more than 70 countries, causing nearly 25000 deaths and even more injuries each year. Many such mines are of the anti-personnel variety and are small and of plastic composition, rendering them difficult to detect. The International Atomic Energy Agency has a coordinated research program to address this problem through nuclear methods. This program involves scientists from sixteen countries. Among the nuclear methods discussed were neutron capture or neutron inelastic scattering, followed by emission of characteristic gamma rays or analysis of slow neutrons after their moderation by the hydrogen in the explosives.

The symposium then broke for lunch. Lunch was provided for conferees in the restaurant of the President, conveniently located a few feet from the conference room. Lunch was served buffet style.



A thought-provoking coaster !!

Lunch was followed by the remaining talks of the session. The first was from R. J. de Meijer of the Rijksuniversiteit Groningen, the Netherlands on the ***"Quest for a Nuclear Georeactor".*** This subject is motivated by attempting to understand the energy production inside the earth and the origin of the Earth's magnetic field. The ratio of abundances of ^{3}He and ^{4}He in the atmosphere is a critical parameter in these studies. A recently hypothesized explanation for these questions was an 8 km diameter nuclear georeactor at the center of the earth with power output at the terawatt level. Such a reactor would produce copious amounts of tritium needed to account for atmospheric ^{3}He. Poisoning of the reactor, by its own byproducts, could account for the decreasing or flipping of the earth's magnetic field. Dr. de Meijer reported on a proposal to verify the reactor by measuring anti-neutrinos from the fission process through inverse beta decay.

The session closed with a talk by David Cohen of the Australian Nuclear Science and Technology Organisation on ***"Accelerator Based Studies of Atmospheric Pollution Processes"***. This talk examined the methods utilized to understand dust emissions from open cut or strip mines, the contributions of motor vehicle traffic and industries to pollution in Australian cities and the characterization of east Asian aerosols and their effects on climate. The physical techniques utilized include ion beam analysis (IBA), particle-induced X-ray and Gamma-ray emission (PIXE and PIGE), particle elastic scattering analysis (PESA) and Rutherford backscattering (RBS). The session was closed at this point and tea was served.

The day concluded after tea with the session **Radiation Sources and Detectors**, chaired by Dr. Suprakash Roy of the Bose Institute, Kolkata.

The first talk in this session was by Professor Isabelle Lopes of the Universidade de Coimbra on ***"Detectors for Medical Radioisotope Imaging: Demands and Perspectives"***. Dr. Lopes presented a general review of the needs of medical radioisotope imaging. These needs were then formulated into requirements for detectors. The needs were drawn chiefly from the fields of prostate imaging, scintimammography, PET-mammography and PET for pets. Multiple-modality systems (e.g. PET-CT) were analyzed. Among the detector types considered were NaI and BGO.

The day concluded with a talk by Herman Winick of the Stanford Linear Accelerator Center on ***"SESAME: A 3rd Generation Synchrotron Light Source for the Middle East Region"***. As has been discussed previously in the pages of the Bulletin, SESAME is the Synchrotron-light for Experimental Science and Applications in the Middle East and is based on an initial German gift of the 0.8 GeV BESSY I facility. The project is now conceived to be a 2.5 GeV 3rd generation synchrotron with 13 straight sections for insertion devices. The beam should have an emittance of 25 nmrad. Members of the project include Bahrain, Egypt, Iran, Israel, Jordan, Pakistan, the Palestinian Authority, Turkey and the United Arab Emirates. The project is under construction approximately 30 km north-west of Amman in Jordan. The initial beam lines are being planned for MAD Protein Crystallography, SAXS and WAXS for polymers and proteins, powder diffraction in materials science, UV/VUV/SXR Photoelectron Spectroscopy and Photoabsorption Spectroscopy, IR Spectroscopy and XAFS. The educational mission of the synchrotron is of great importance. A group of Middle East scientists and engineers have completed 2 years of training at European synchrotrons. Scientific workshops and other meetings have been held. The facility is expected to have hundreds of users.

The meeting was called to order the next (Tuesday) morning by Professor William Dunn of Kansas State University for a session on **Radiation Physics in Technology and Industry**.

The first speaker, Dr. Murray Bartle of the ISOSCAN Institute of Geological and Nuclear Sciences in Lower Hutt, New Zealand presented some ***"New Uses of X-Ray Transmission Techniques in the Animal-Based Industries"***. The challenge of this field is to provide real-time, non-invasive measurements of the composition of animal-based products. In particular, Dr. Bartle focused on measurement related to the meat and wool. The chief parameter of interest in the meat-processing industry is the chemical lean, which is measured with a multi-energy x-ray transmission scanner. The analagous parameter for wool is the wool base, which quantifies the purity of the wool. The equipment must balance accuracy and precision with robustness, ability to detect faults and ease of use. It must withstand industrial conditions and be able to interface to plant databases. The effective atomic number enables one to differentiate between lean and fat. The x-ray energies used vary between 70 and 140 keV.

The second lecture of the morning was ***"Contraband Detection with Fast Neutrons"*** by Dr Andy Buffler of the University of Cape Town's Department of Physics. Noting the problems with x-ray technologies, Dr. Buffler proceeded to outline some detection schemes which rely on the use of neutrons. Neutrons are penetrating and sensitive to the isotopes of both light and heavy elements. Using thermal neutrons, one could concentrate on detecting emitted gammas. However, for fast neutrons, gammas or neutrons can be detected. Fast neutron inelastic scattering is used in the mineral industry and the emitted gammas can give location and compositional information. In fast neutron scattering analysis, one looks for neutrons scattered out of the beam. The neutron beams can be monoenergetic or have a spectrum, continuous or pulsed. The neutron technologies can also be used in conjunction with x-rays. One drawback may be the dose to contraband when the contraband consists of smuggled human beings.

The session drew to a close with a talk by Eric Dooryhee of the Laboratoire de Cristallographie-CRNS Grenoble on the use of ***"Synchrotron X-ray Analyses in Art and Archaeology"***. Dr. Dooryhee discussed the effectiveness of the use of synchrotrons over conventional x-ray techniques. The higher performance and tunability have enabled one to probe to the micrometer range. Unfortunately, some things can't be taken to the laboratory and a blending of techniques proves essential. Among the compelling uses of x-rays that were reviewed were the application of XANES, XRD and XPS to the 17th century Swedish Warship Vasa, an analysis of the green pigments in a Gothic Spanish alterpiece, an examination of ancient Egyptian cosmetics and some discussion of investigations into ceramics from southern France circa 50 -150 AD.

The first poster session was accompanied by tea, coffee and cookies. The posters were all posted throughout the week. However, the presenters were only required to stand near their posters for one of the sessions. Prizes were awarded to several posters (as outlined in Dan Jones' accompanying report.)

After lunch at the President, the organizers had arranged a motor coach tour to Cape Point. Cape Point is the promontory of land that extends into the Cape of Good Hope. Whether one believes it to be the point where two oceans (the Indian and the Atlantic) meet or not, it is clearly a special place. On the long ride there, via Simon's Town and Fish Hoek, our guide kept us amused with jokes about accountants and physicists, with stories about Napoleon's taste for the region's wines and by getting some of the Southern Right Whales to breach on cue as we rode past. Baboons were another of the attractions readily visible from the bus.

After a walk on the shore near Cape Point and a group photo, we got back on the buses and rode them to the tramway that takes one to the light house. Some walked from this point, others took the tram while still others waited and enjoyed the food and souvenir shop. The views on the way up to the light house at 250 m above sea level were stunning. After a long journey back to the President, we returned in time for dinner. I joined several colleagues for dinner at the popular Victoria and Albert Waterfront in a restaurant that specialized in grilling the indigenous fauna. Kudu, warthog, springbok and crocodile were shared around our table.

The conference opened on Wednesday morning with a session of **Selected Contributed Papers** that were selected for oral presentation. The session chair was Professor David Bradley of the University of Exeter.

These presentations were 25 minutes long. The selected presenters and their papers were

Dr. Rodolfo Figueroa of the Universidad de la Frontera, Chile on
"Resolution a sensibility for a different alternative of x-ray fluorescence: SEICXRF"

Dr. Zoran Kaliman of the University of Rijeka, Croatia on
"Compton cross-section calculations in terms of recoil-ion momentum observable"

Professor Peter Kozma of the Institute of Technological Investigations on
"Radiation sensitivity of heavy scintillators due to low-energy gamma-rays"

Dr. Luis Longoria of the Instituto Nacional de Investigaciones Nucleares, Mexico on
"Determination of ^{226}Ra and ^{235}U in soils samples by gamma spectrometry"

Dr Enzo Menapace of ENEA, Italy on
"Experimental results and model calculations of excitation functions for the production of relevant radioisotopes for metabolic radiotherapy and for PET"

Dr Carlos Pineda-Vargas of the host institution iThemba Labs on
"Nuclear microscopy of human kidney stones: comparison between two population groups" .

This session was followed by the second poster session and then lunch.

After lunch, the conference resumed with a session on **Radiation Physics in Materials Science I** and a talk by Professor Brendan Kennedy of the University of Sydney called ***"Revealing Tilts, Disorder and Phase Transitions in Perovskite Related Materials by Powder Synchrotron and Neutron Diffraction Method"***. Dr. Kennedy discussed the use of high-resolution powder diffraction methods in the study of some perovskite type oxides. Looking at the diffraction patterns as a function of temperature or pressure one can follow changes in structure due to changes in tilts of cation-oxygen octahedra. Initially, Dr Kennedy then turned to more complicated materials.

This talk was followed by that of Professor Klas Malmqvist of the Lund Institute of Technology, Sweden on ***"Accelerator-based ion beam analysis - an overview and future prospects"***. New, dedicated accelerators have lead to advances in the field of analysis of ion beams (protons, deuterons and alphas) with energies of several MeV per nucleon. Typical techniques utilizing such sources include particle-induced x-ray emission or PIXE, Rutherford backscattering spectrometry (RBS), nuclear reaction analysis (NRA), particle-induced gamma-ray emission (PIGE). Nuclear microprobes combine these techniques with imaging methods such as scanning transmission ion microscopy (STIM), secondary electron imaging (SEI) and ionoluminescence (IL). Elastic recoil detection analysis (ERDA) is based on measurements of the recoiling particles.

The last talk of this session, ***"Polymer surfaces in bottles and electronics"***, was delivered by Dr John Macdonald of Cardiff University in the United Kingdom. Dr. Macdonald talked about the use of grazing-incidence x-ray diffraction to study the molecular structure and ordering at polymer surfaces. He discussed the application to PET plastic containers and to semiconducting polymers.

The tea break was followed by the **second session on Radiation Physics in Materials Science**. The chair of the session was Professor James Oyedele of the University of Namibia.

The first talk ***"Understanding the structure of chocolate"***, was given by Professor Henk Schenk of the Laboratory for Crystallography of the University of Amsterdam in the Netherlands. In keeping with the larger theme of the symposium, Professor Schenk, the past President of the International Union of Crystallography, discussed the Union's initiative for Africa which includes free on-line journal access, donation of crystallographic equipment, post- graduate programs in crystallography, an advanced individual training course and a journal grant fund. He then put the conferees in the appropriate frame-of-mind for contemplation of chocolate with a discussion of the region around the River Zaans and it's 300 - 400 year old windmills.The discussion of chocolate structure centered around the use of x-ray powder diffraction and how this tool could probe the various phases of the crystallization of cocoa butter. Distinguishing between the phases is important as the appearance and taste of the product are affected by the phase. Time resolved studies with temperature control led to, not only an understanding of the process, but to patents and a chocolate-making machine. Professor Schenk distributed some tasty examples of the product during the course of his talk.

The final talk of the session was written by Professor Steven Wilkins of Monash University, Australia. However the talk, ***"X-ray phase-contrast imaging: the other half of radiography"***, was delivered by the society's own Dudley Creagh. Conventional radiography is determined largely by photon absorption. Ray optics are often applicable. This type of imaging is usually not quantitative. Improved contrast, higher speed, cleaner images, better resolution, lower dose and quantitative information from intensities are all on the wish lists of users of this modality. Phase-contrast imaging uses refractive or phase effects. Some of the aspects of this technique discussed were non-interferometric methods, the effects of partial coherence, factors affecting contrast and resolution, methods to retrieve phase and amplitude information and extensions to sub-micron resolution and micro-tomography. Images of fish and cochlear implants were presented and the utility of the upcoming Australian Synchrotron Boomerang to the field were discussed. This talk closed out the day's activities.

Thursday morning opened with the **second session on Radiation Physics in Space, Earth and Environmental Sciences**, chaired by Professor Jorge Fernandez of the University of Bologna.

The first talk of the session, by Dr. Geoffrey Harding of InVision Technologies was ***"Explosives detection with x-ray scatter tomography"***. After outlining the problem, the vast number of buried landmines and unexploded ordnance and the 8 commercial aircraft that were destroyed by explosives between 1985 and 1997, Dr. Harding turned the conferees' attention to the use of x-rays in detection technologies. Simple physics can relate material properties to measured data. For example, explosives have crystal structure and one can find their diffraction spectrum features. Coherent x-ray scattering tells one about the molecular structure of the material, Compton scatter about the electron density and momentum, the ratio of the two points to the mean atomic number of the material and x-ray fluorescence can identify the constituents in detail. Some discussion of beam types and the necessary collimation followed. After these basics were discussed, Dr. Harding then discussed technologies such as coherent scatter CT and the Compton landmine scanner.

This talk was followed by that of Dr. Bernd Wernsperger on ***"Noble gas monitoring within the international monitoring system of the Comprehensive Nuclear Test-Ban Treaty Organization."*** Dr Wernspergser gave an overview of the International Monitoring System, discussed the requirements and principles of noble gas monitoring and the development of noble gas equipment. There are 321 stations using some or all of the following technologies in the system :

* seismology - for underground nuclear tests,
* hydroacoustic - for underwater tests,
* infrasound for air bursts,
* radionuclide stations of which 80 collect particulates and another 40 noble gases.

One must be able to distinguish weapons from other sources. Xenon sampling is the noble gas that is sampled. Four separate institutions developed four different kinds of equipment for this kind of testing. These systems are being tested.

The conference broke for tea and coffee. Upon return to the conference room, Dudley Creagh chaired the **Student Award Presentations**.

The purpose of this session was to recognize several of the many outstanding student contributions. The speakers were :

Layla Ali of the University of Exeter on
"The structure and organisation of Type iV collagen in normal and glycated basenebt membrane,"

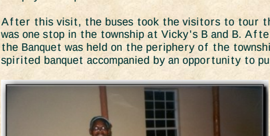
David de Villiers of Stellenbosch University on
"The development and application of radiometry in the mineral and agricultural industries,"

Mohamed Eisa of iThemba LABS on
"High-resolution nuclear microprobe elemental mapping of teeth-enamel-dentine interface exposed to acidic conditions,"

Pitiporn Thanomngam of RMIT on
"Monte-Carlo simulation of bremsstrahlung interference due to K-shell photoelectrons in Compton scattering experiments."

This session was followed by lunch and by the final poster session. After the poster session, the conferees and their spouses embarked on a visit to iThemba LABS. In addition to the game animals on view within the laboratory's gates, the tour included an overview in the lab's auditorium and visits to the neutron therapy, proton therapy, control room and physics experiment areas.

After this visit, the buses took the visitors to tour the township of Khayelitsha. There was one stop in the township at Vicky's B and B. After passing through the township, the Banquet was held on the periphery of the township at Igugu Le Africa. It was a spirited banquet accompanied by an opportunity to purchase the local crafts.



Ready for the Banquet

The Township

The final day of the symposium was dedicated to two sessions in **Radiation Physics and Biology** and the customary finale. The chair of the first session was Dr. Syed Qaim of the Research Centre Juelich.

The session started with a talk by Professor Masami Ando of the Photon Factory at KEK. His talk on ***"Development of x-ray dark-field imaging"*** discussed the extensions that his collaboration had been doing to the work of Wilkins that had been discussed at the symposium by Creagh. Their refraction based x-ray dark-field imaging system has imaged industrial, biological, medical and industrial specimens. The specimens examined, not visible with ordinary x-ray techniques, are visible with the dark-field imaging. Resolution of 5µm in conventionally low-contrast systems was observed.

This talk was followed by one of Richard Neutze of the Chalmers University of Technology on ***"Potential impact of an x-ray free electron laser on structural biology."*** After reviewing how important x-rays have been in the study of the structure of proteins, Dr. Neutze turned to some of the characteristics of x-ray free electron lasers such as short bunches, tenability, large numbers of photons per pulse and the flexible pulse structure. He discussed some of the basic physical processes such as photoelectric effect, elastic and inelastic scattering. He also discussed some of the studies performed such as looking at lysozyme trajectories, Coulomb explosions, and single molecule scattering. He also discussed some of the reconstruction techniques employed and the outlook for new techniques and sources.

The final talk of the first session was by J. Herman Poltgieter of the South African concern Lodox Systems on ***"Low dose x-ray systems."*** The particular device of which he spoke, a low dose personnel scanner, now adapted to medical technology to the problem of diamond thefts from diamond mines. For some time after the annual dose limit on diamond mine workers was lowered from 5 mSv per annum to 1 mSv, the diamond industry could not scan workers routinely for diamonds. The LODOX system can detect single diamonds of 0.5 carats or 20 0.1 carat diamonds and remain within dose limits. This device was modified to medical purposes and, christened the OLDOX, has a goal of getting quick x-rays in situations such as trauma. The dose is lowered by using an anti-scatter grid.

After a final tea and coffee break, Rex Keddy of the University of the Witwatersrand assumed the chair in time for Dr. Qaim to give his talk on ***"The use of cyclotrons in nuclear medicine."*** He discussed a number of issues in radiation therapy including radionuclide production for tracers for SPECT, common tracers for PET, new e^+ emitters, and therapeutic radionuclides. He touched on photon therapy, neutron capture therapy and the use of cyclotrons in hadron therapy and the relative advantages of each.

The final talk, ***"Heavy ion induced DNA transfer in biological cells"*** was given by Dr. Tiaphat Vilaithong of the Fast Neutron Research Facility at Chaing Mai University, Thailand. Dr. Vilaithong gave an introduction to his university, team and facility. The facility has 3 ion implanters including a 30 keV vertical machine and a 150 and 200 MeV machine. Using these beams, they can induce DNA transfer. They can do this in intact cells with bacterium surviving an hour and plant cells around 20 minutes. In ***E. Coli*** studies, they used argon and nitrogen finding the singly charged argon ion most effective. Among processes studied in Thailand and elsewhere are mutations in plants and bacteria and gene transfer into rice and tobacco pollen. Dr. Vilaithong discussed a number of recent developments in processes and sources.

After the last scientific session, outgoing President Malcolm Cooper hosted the general meeting. He announced the upcoming ISRP-10 in Coimbra to be held over the 18-22 September of 2006 time frame and to be organized by Isabel Lopes and Marguerita Costa. The associated workshop is to be organized by Professor William Dunn. Professor Jorge Fernandez is the program chair for the general meeting. Professor Lopes presented the host site and more information about this event will appear in upcoming Bulletins.

As outgoing President, Professor Cooper gave his report, focusing on the participation in the present symposium, membership issues and Bulletin contributions. He announced that the 2009 meeting would be held in Melbourne. He thanked Professor Creagh for his effort in organising the workshop at the present meeting.

Professor Leif Gerward of the Denmark Technical University then presented the results of the elections, which are reflected on the Home Page.

This led to the introduction of the incoming President, Professor Richard Pratt of the University of Pittsburgh. Professor Pratt thanked Professor Cooper for his service. He reviewed the history of the society. He talked about it's purpose and goals. He then thanked Dan Jones and his team for organizing the symposium and asked Dan Jones to close it.

Dan did this with thanks to the attending delegates.

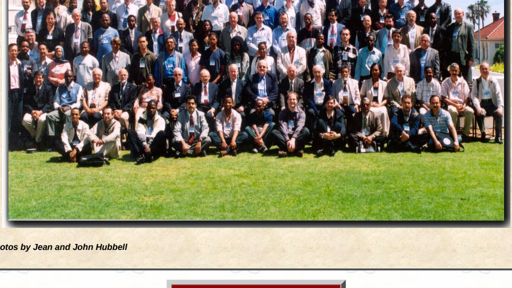
Incoming and Outgoing Presidents - Richard Pratt and Malcolm Cooper

... and more photos ...

"In Session"

The Lions Head

and the ISRP-9 Conference participants



Photos by Jean and John Hubbell

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