

## Accelerators and radiation physics research\*

Ananda Mohan Ghosh, ex Head of the Department of Physics, Bose Institute, Kolkata breathed his last on 22 May 2004 at his Kolkata residence. His research areas focused on radiation physics of gamma rays, and also neutron physics, with more than 125 publications, including a monograph published by EURATOM. According to John Hubbell, National Institute of Standards and Technology, Gaithersburg, MD, USA, Ghosh had a critical role in drawing together a global radiation physics family from researchers throughout the developing and developed countries of the world. To commemorate the first death anniversary of Ghosh, a National Conference on Accelerators and Radiation Physics Research was organized. The conference had 80–85 participants.

The first speaker, P. P. Kane, IIT Mumbai, while speaking on 'Elastic scattering of X-rays and gamma rays', briefly described techniques like the use of multi-section filters/absorbers in small-angle scattering studies, development and utilization of uniform spectral sensitivity counters for measurements of cross-sections for Compton scattering and photoelectric effect, study of photon energy albedos with counters having a response or efficiency proportional to photon energy, employment for 10–70° scattering of azimuthally symmetric targets conforming to surfaces of revolution around the source–detector axis, annular source arrangement frequently used in EDXRF analysis of materials as an attractive choice for measurements of cross-sections for scattering through angles larger than about 110°, and so on. He also gave an introduction to theoretical formalisms necessary for understanding experimental data in terms of atomic Rayleigh and Delbruck scattering contributions.

The next speaker was R. H. Pratt, University of Pittsburgh, USA. While speaking on 'Recent theoretical developments in photon–atom scattering', he described the recent developments in the theory of elastic and inelastic photon–atom scattering, considering implications for applications. The topics covered in elastic scattering were (1) edge reasons, where more sophisticated descriptions are needed to describe the features used in determination of composition of materials, (2) anomalous scattering, used in determination of structures, (3) polarization phenomenon and (4) Delbruck scattering, addressing light–light scattering. On inelastic scattering, Pratt spoke about (1) validity of impulse approximation as the basis for determination of atomic momentum density from Compton profiles, (2) resonant Raman scattering, and (3) infrared rises.

A. A. Tajuddin, Universiti Sains Malaysia spoke on 'Ionizing radiation tests on *Rhizophora* spp. to evaluate its suitability as a phantom material'. According to him, interest is in quality treatment in radiotherapy, which depends on accurate and precise means of dose delivery to the intended target volume. This is ascertained by accurately absorbed dose distribution measurement in a phantom. In a quest to design and fabricate water substitute phantom materials to simulate the radiation dose, the *Rhizophora* spp. can be a possible alternative, he added. His lecture focused on the characterization of this wood phantom at various diagnostic and therapeutic energies, including details on absorption and scattering studies and also comparison with some other phantom materials.

Sudipta Narayan Roy, Visva-Bharati, Santiniketan, talking on 'Low energy photon scattering revisited', reviewed some aspects of the field of photon scattering, mainly in the gamma-ray regime.

D. T. Khating, North-Eastern Hill University, Shillong spoke on 'Radiation physics research'. His talk included instrumentation techniques like trace element analysis (PIXE, CPAA, ICP) and bulk element analysis using a fast neutron source. He also covered the passive monitoring of  $^{222}\text{Rn}$  and  $^{220}\text{Rn}$  that is being carried out in the indoor environment of Shillong.

Rupa Sarkar, Bose Institute, Kolkata spoke on 'New approaches in superheated drop detectors'. Superheated Drop Detector (SDD) is a unique type of radiation detector initially developed to detect neutrons in the presence of gamma ray photons. It can be used as an active and passive detector, a dosimeter, an energy spectrometer and can also be used to map radiation fields. Her lecture mainly concentrated on the underlying physics rather than the use of SDD in detecting radiation. She detailed how SDD could be used as an energy spectrometer as well as gamma-ray dosimeter.

R. Ravishankar, VECC, Kolkata, spoke on 'Radiation profile with energy spectrometric measurements and simulations around ECR ion sources'. He described the radiological safety aspects important in Electron Cyclotron Resonance Ion Sources (ECRIS), photon spectral measurements and dose rate measurements carried out with NaI (TI) detectors and different types of survey meters around the two ECRIS facilities at VECC and also Monte Carlo method-based computer code MCNP, used to simulate the scenario for obtaining photon spectrometry for different operating conditions of the ECRIS.

D. N. Sharma, BARC, Mumbai spoke on 'Safety and security of radiation sources: Indian scenario'. Radiation and the application of radioactive sources in diagnosis (using fluoroscopy, nuclear medicine and X-rays) and also therapy (brachytherapy, telegamma therapy, LINAC therapy, etc.), industrial applications (gamma irradiator, industrial radiography, nucleonic gauges, tracers for studying flow pattern of liquids in pipelines, movement of sediment in seas, etc.), agriculture (rubber research, veterinary, etc.), and research using gamma chambers were discussed. Sharma presented the Indian scenario and discussed the indigenous developments made for safety and security of these sources, including regulatory aspects to counter threat perspectives.

Tapas Bandopadhyaya, VECC spoke on 'Neutron spectrometry around positive light ion accelerators'. The methods for measurement of recoil proton spectra using liquid scintillator and associated electronics and unfolding were discussed.

\*A report on the Conference on Accelerators and Radiation Physics Research held at the Bose Institute and Variable Energy Cyclotron Centre, Kolkata during 28–30 March 2005. The conference was jointly organized by the Indian Society for Radiation Physics, Bose Institute and Variable Energy Cyclotron Centre, Kolkata and International Radiation Physics Society.

D. A. Bradley, University of Exter, UK, spoke on 'Near-edge photon interactions and synchrotron-based research at Exter'. Synchrotron sources provide high brightness, highly monochromatic tunable sources of X-ray photons, allowing panoply of investigative techniques. His lecture reviewed observation of elastic photon scattering from dilute aqueous ions, use of XANES and EXAFS in examining the charge state of dopants in glassy thermoluminescence media and application of X-ray fluorescence (XRF) in detection of trace elements involved in the process of breast carcinoma. Bradley also indicated that recent synchrotron-based XRF analysis of trace elements in cancerous human tissue has demonstrated higher concentration of elements such as zinc in regions that are identified as tumours.

Shivaramu, IGCAR, Kalapakkam spoke on 'Irradiation effects on nuclear power plant concrete structures'. The calculated neutron fluence and cumulative gamma dose received by the concrete surrounding the PFBR and the results of irradiation effect on moisture level and its detection by gamma scattering method were presented. The approximate threshold radiation levels to create measurable damage in concrete, the type of damage and deg-

radation due to irradiation and the results of studies conducted and reported in the literature to investigate the effects of irradiation on aggregates, cement pastes and mortars were also reviewed.

Amar Sinha, BARC, spoke on 'Phase contrast imaging-A simulation study'. X-ray radiography is a powerful non-destructive method used in materials and medical science. However, X-ray phase contrast radiography produced contrasts not only on differences in absorption but also on differences in the real part of the refractive index. Sinha presented a method of simulation for the development of such a system using simple 2D and 3D objects like circular, spherical, and cylindrical fibre. The results were encouraging and illustrated the various aspects of such imaging techniques like coherent requirement, source-to-object distance, object-to-detector distance and so on.

P. Sethulakshmi, BARC, spoke on 'Radiological safety aspects of cyclotron and PET facilities'. She stated that 'Positron emission tomography' (PET) is the latest diagnostic modality in nuclear medicine and has wide applications in the field of oncology, neurology and cardiology. PET uses isotopes which are cyclotron-produced. Both medical cyclotron

and PET facilities involve the use of radiation and hence it is necessary to provide adequate structural shielding for these facilities in order to keep the radiation doses to occupational workers and the public within permissible levels. She presented an evaluation of the doses in a 16.5 MeV medical cyclotron facility and PET facility using computational and experimental measurements.

Maitreyee Nandy, SINP, Kolkata spoke on 'Neutron emission from spallation sources: Estimation using quantum molecular dynamics'. She cited some examples of new frontline research initiatives on accelerator-based neutron sources that are being taken up worldwide to get slow, high intensity neutron beams for use in neutron science projects, transmutation of long-lived radioactive wastes from nuclear fuel cycle and so on. Theoretical estimation done in the framework of quantum molecular dynamics approach in conjunction with a statistical decay model was also presented.

---

**Minakshi De** (*S. Ramaseshan Fellow*), lives at 35, Garpar Road, Kolkata 700 009, India. e-mail: amitkde@satyam.net.in

---

## MEETING REPORT

### Six months after the tsunami\*

A meeting was held recently to discuss the unexpected tsunami that struck the shores of South India and other neighbouring countries on 26 December 2004. An under-sea earthquake that occurred at 07:58:53 local time in Sumatra caused the tsunami. The tsunami was among the deadliest disasters in modern history, and killed more than 240,000 people. The epicentre of the earthquake was in the Indian Ocean, north of Simeulue island, off the western coast of northern Sumatra, Indonesia. The resulting tsunami devastated the shores of Indonesia, Sri Lanka, South India, Thailand and other countries, with waves of

tens of metres height. It caused serious damage and loss of life as far as the east coast of Africa, with the farthest recorded death due to the tsunami occurring at Port Elizabeth in South Africa, 8000 km away from the epicentre.

The objective of the meeting was to discuss different aspects of the tsunami, including our scientific knowledge of the phenomenon, its environmental, historical, sociological, psychological and behavioural dimensions, and the most appropriate action that the country might take so that the large losses in human life and property that accompanied the December 2004 tsunami will not be repeated. The meeting brought together scientists, representatives from the government, historians and social groups that have been involved in tackling the consequences of the disaster. There

were about fifty participants: twenty of them speakers (including six from outside Bangalore) and the rest invitees.

The meeting began with a welcome speech by K. Kasturirangan, Director, National Institute of Advanced Studies (NIAS), Bangalore, who stressed the need for attention to the problem from a variety of different viewpoints. This was followed by an introduction by R. Narasimha, who highlighted the need for better understanding and monitoring of tsunamis; they do not give long warnings like cyclones, but on the other hand, once it is known that a tsunami has been triggered, the rest of its course can be predicted sufficiently accurately to take action to prevent loss of life, provided an efficient method of issuing warnings along the coastlines can be institutionalized.

---

\*A report on the one-day discussion meeting entitled 'Six months after the tsunami' held on 16 June 2005 at the National Institute of Advanced Sciences, Bangalore.