

## Newsletter of the Indian Academy of Sciences

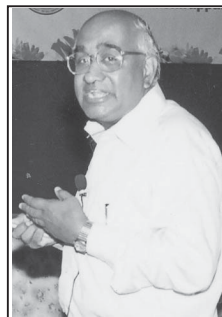
### 2005 Annual Meeting

The seventy-first Annual Meeting of the Academy was held at Bharathidasan University, Tiruchirapalli from November 11 to 13, 2005. A good number of Fellows – about 120 – and an unusually large number of teacher invitees, many from educational institutions in and around Tiruchirappalli, were present.



Large audience at the meeting

The opening lecture by the President of the Academy, TV Ramakrishnan, was on "Transition metal oxides: Quantum many-body physics meets solid state chemistry". He surveyed a large number of currently active research areas, including perovskite oxides, colossal magnetoresistance in manganites, cuprates and their phase diagram, and some theoretical approaches to these phenomena. As he expressed it, 'chemical realities and increasing ability to make and probe things lead to unexpected new worlds'. The older familiar pictures fail in these new realms, and theorists need to puzzle over new materials and new phenomena. The talk succeeded admirably in bridging physics and chemistry in selected areas.



A special half day Symposium on 'Physics and Chemistry of Materials' under the overall convenership of CNR Rao covered unusually large ground, much

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## Forthcoming Events – 2006

17<sup>th</sup> Mid-Year Meeting, Bangalore  
(14–15 July 2006)

72<sup>nd</sup> Annual Meeting, Devi Ahilya Vishwavidyalaya, Indore  
(10–12 November 2006)

## Refresher Courses

Phylogenetic biology  
University of Mysore (10–23 July 2006)

Tensors and their applications in engineering sciences  
IISc, Bangalore (1–15 Nov. 2006)

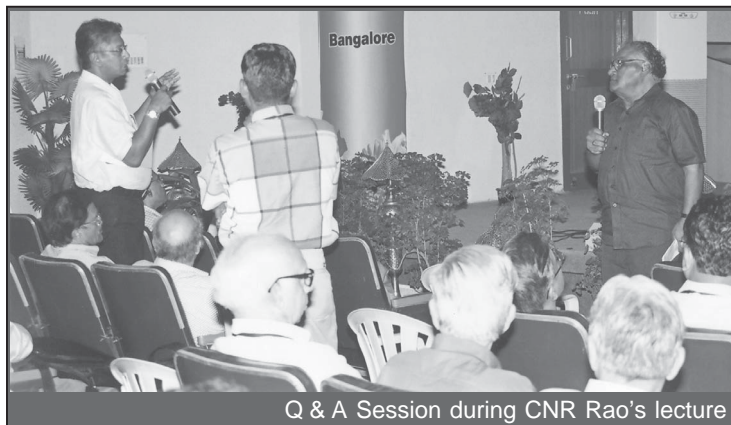
Advanced topics in chemistry  
Lady Doak College, Madurai (Nov. 2006)

Experimental physics course for Kerala teachers  
Kerala University, Trivandrum (June 2006)

## Lecture Workshops

Excitements in computational physical and bio-sciences  
IIIT, Hyderabad (12-17 June 2006)

High energy physics, condensed matter physics and astronomy and astrophysics  
Mumbai University (October 2006)



Q & A Session during CNR Rao's lecture

of it inaugurated in his own work over the decades. The five speakers, all of them close collaborators of the convener, spoke about manganites, oxide materials, nanomaterials, and open-framework structures. This symposium was capped by a public lecture titled 'Science for our future: Personal reflections on doing science in India' to a very large audience, at the beautiful and spacious BHEL auditorium, wherein Rao recalled his life-long experiences and challenges, and the impact his work has had at the international level.

The second Symposium of the meeting on 'Genomic Landscape and Structure of the People of India' was put together by Partha P Majumder. This fascinating story of the movements of human populations over a few tens of thousands of years, starting in Africa and passing through India to other parts of the world, showed how DNA and chromosome studies at the microscopic level can shed light on questions till recently examined mainly by archaeological and anthropological methods. In his opening presentation, Majumder described how female and male population movements are susceptible to separate study and one can reconstruct the entire process of peopling of India. Other speakers covered human prehistory, cultures and migrations in India from the archaeological viewpoint; genomic approaches in general and studies of haploid chromosomes in particular; and what such studies have to say about our past and what remains to be done. Readers of *Patrika* are invited to have a look at a very fine account of these research efforts in an article by Majumder and D Balasubramanian in the January 2006 issue of *Resonance*.

The second public lecture by V Shanta of the Cancer Institute, Chennai was given to another large audience at the



New Auditorium of Bishop Heber College, on the topic 'Cancer causes and prevention'. The speaker, recently honoured by the Magsaysay Award, gave a very informative and lucid presentation bringing home the magnitude of the burden of cancer in India, including the continuing annual increase in incidence of various

types. Many cancers can be traced to lifestyles and the environment in the widest sense. By the same token, many of them are preventable, by such measures as reducing exposure to cancer-causing factors and changes in personal habits and hygiene.

The first special lecture on 'Volcanic poisoning and mass extinctions' by KV Subbarao dealt with events on the Indian subcontinent over 60 million years ago, the Deccan volcanic episode which caused global mass extinctions. The disappearance of dinosaurs may be due to this or, alternatively, to a meteorite impact. Apart from different technical aspects and impressive pictures of the 'canyons' in the Western Ghats, the speaker also spoke about the impact of research in India in this field, on a global scale.

RK Shyamasundar's special lecture on 'Computer science: Scientific and engineering fascinations and challenges' dealt with a subject of great current intellectual as well as technological interest. The emphasis was rightly on the basic concepts which have evolved slowly compared with applications. Ideas such as computability, robustness, universality, Turing machines and artificial intelligence have considerable subtlety and are not so easily grasped even by scientists in other fields. The speaker succeeded in conveying the essence of these ideas to a diverse audience.



Lectures by recently elected Fellows and Associates



Cultural Programme as part of the Annual Meeting

covered a wide range from 'Portal hypertensive bleeding' by SK Sarin to 'Image mining' by Subhasis Chaudhuri, and from 'Supercooled liquids' by Shankar Das to 'Human papillomavirus' by MR Pillai.

Thanks to the untiring efforts of the local hosts, in particular M. Lakshmanan and M. Palaniandavar and volunteers from the university and the several educational institutions in the town, the arrangements for all aspects of the meeting were excellent.

## 2006 ELECTIONS

### Fellows:

#### Banerjee, Soumitro

Indian Institute of Technology, Kharagpur  
Areas of interest: Nonlinear dynamics, and electrical engineering



#### Basak, Amit

Indian Institute of Technology, Kharagpur  
DNA-interacting agents, asymmetric synthesis, and enzymology



#### Basu, Joyoti

Bose Institute, Kolkata  
Molecular microbiology with special reference to mycobacteria, understanding host-pathogen interactions, and membrane biology



#### Bhat, B. V. Rajarama

Indian Statistical Institute, Bangalore  
Quantum probability, operator algebras and operator theory



#### Bhat, G. S.

Indian Institute of Science, Bangalore  
Tropical convection, boundary layer and field studies



#### Bhattacharya, Samaresh

Jadavpur University, Kolkata  
Inorganic chemistry, coordination chemistry, and organometallic chemistry



#### Bose, Arup

Indian Statistical Institute, Kolkata  
Probability and statistics



#### Chakravarty, Charusita

Indian Institute of Technology, New Delhi  
Chemical physics, and theoretical and computational chemistry



#### Deb, Kalyanmoy

Indian Institute of Technology, Kanpur  
Optimization and design, genetic algorithms, and multiobjective optimisation



#### Dev, Bhupendra N.

Institute of Physics, Bhubaneswar  
Surface & nanoscale physics, X-ray physics, and ion-solid interactions



**Ghosh, Swarna Kanti**

Tata Institute of Fundamental Research, Mumbai  
Infrared astronomy, interstellar medium, and astronomical instrumentation

**Guru Row, T. N.**

Indian Institute of Science, Bangalore  
Chemical crystallography, intermolecular interactions, and polymorphism and drug design

**Hasan, Gaiti**

National Centre for Biological Sciences, Bangalore  
Inositol trisphosphate, and calcium signalling in neuronal physiology

**Jayaraman, A.**

Physical Research Laboratory, Ahmedabad  
Atmospheric science, aerosols, and radiative transfer

**Khurana, Jitendra P.**

University of Delhi South Campus, New Delhi  
Photoperception and signal transduction in plants, structural and functional genomics, and plant hormone action

**Kundu, Gopal Chandra**

National Centre for Cell Science, Pune  
Signal transduction, cancer biology, and regulation of gene expression

**Majumder, Hemanta K.**

Indian Institute of Chemical Biology, Kolkata  
Biochemistry, molecular biology, and parasitology

**Mandal, Chitra**

Indian Institute of Chemical Biology, Kolkata  
Glycobiology, immunobiology, and glycoimmunology

**Mandal, Nibir**

Jadavpur University, Kolkata  
Structural geology, and tectonics

**Puri, Sanjay**

Jawaharlal Nehru University, New Delhi  
Statistical physics, condensed matter physics, and nonlinear dynamics

**Rajasekharan, Ram**

Indian Institute of Science, Bangalore  
Biological sciences, lipid metabolism, and plant biotechnology

**Ramakrishna, B. S.**

Christian Medical College & Hospital, Vellore  
Gastroenterology/medicine, transport physiology, and cell biology

**Ramakrishnan, S.**

Indian Institute of Science, Bangalore  
Polymer synthesis, polymer folding and assembly, and hyperbranched polymers

**Raychaudhuri, Amitava**

Harish-Chandra Research Institute, Allahabad  
Particle physics

**Sengupta, Surajit**

SN Bose National Centre for Basic Sciences, Kolkata  
Condensed matter physics, statistical mechanics, and materials science

**Sonti, Ramesh V.**

Centre for Cellular & Molecular Biology, Hyderabad  
Plant-microbe interactions, plant genetics, and bacterial genetics

**Thelma, B. K.**

University of Delhi, New Delhi  
Human genetics, pharmacogenetics, and medical genomics

**Trivedi, Sandip P.**

Tata Institute of Fundamental Research, Mumbai  
String theory, particle physics, and quantum field theory

**Visweswariah, Sandhya S.**

Indian Institute of Science, Bangalore  
Cell biology, protein structure and function, and biochemistry



## Honorary Fellows

**Ranajit Chakraborty**

University of Cincinnati  
Ohio, USA

**Michael L. Klein**

University of Pennsylvania  
Philadelphia, USA



## RAMAN PROFESSOR



Prof. Anne McLaren is a Principal Research Associate of The Wellcome Trust and Cancer Research Institute at the University of Cambridge in UK as well as a Member of the European Molecular Biology Organization (EMBO). She visited India as the twenty-third Raman Professor of the

Academy during the period November – December 2005. McLaren is a distinguished mammalian geneticist, an authority on early mammalian development and has made major contributions to our understanding of mammalian development, especially its genetic and epigenetic underpinnings. Her research has ranged widely over developmental biology, reproductive biology, and genetics including molecular genetics, using the laboratory mouse as a model. She was the head of the MRC Unit on mammalian development for over 25 years and received some of the world's highest scientific honours. She has been an adviser to the UK Government on policies concerning human embryo technology and stem biology. During her visit to India she was based at the Indian Institute of Science and visited and lectured at Bangalore and Hyderabad.

## SPECIAL ISSUES

### Asteroseismology

**Guest Editor: Ram Sagar and S Seetha**

*Journal of Astrophysics and Astronomy*, Vol. 26, Nos. 2/3, June/September 2005, pp. 117–357

Stars have been observed for ages. It is only recently that we have been able to study the interiors of the stars. Stars oscillate, exhibiting pulsations – different stars pulsating in different ways – and the study of the interiors of stars by studying these pulsations is termed 'Asteroseismology' similar to the seismology of Earth where the Earth's interior is understood by studying the oscillations during an earthquake.

There are several stars which exhibit pulsations: the classical Cepheids, the Sun, rapidly oscillating Ap stars, delta-Scuti variables, beta-Cep stars, white dwarf variables, sub-dwarf B stars, etc. For some stars, the observations and theoretical interpretations have been going hand in hand, whereas for some, theoretical explanations of observed frequencies are currently not possible, and in some others observations indicate a lack of oscillations where they are theoretically predicted. An international workshop on

asteroseismology was organized by the Aryabhata Research Institute of Observational Sciences (ARIES) at Nainital in December 2004. The workshop held to coincide with the golden jubilee of the Institute was primarily to discuss the current maturity in the field and understand as many types of stellar oscillators as possible.

This special issue comprises a collection of refereed and accepted papers based on the presentations at the workshop.

### Chemical reactivity

**Guest Editor: PK Chattaraj**

*Journal of Chemical Sciences*, Vol. 117, No. 5, September 2005, pp. 359–616

Considering the importance of chemical reactivity and its strong foundations within a conceptual density functional theory (DFT) framework this special volume was brought out. Leading experts in this field from across the globe contributed papers on diverse aspects of reactivity theory.

These papers cover the whole gamut of topics within a DFT parlance encompassing different systems such as clay-type inorganic materials, boron porphyrin complexes, zeolites and hypervalent silicon compounds, as well as various concepts such as electron localization function, molecular quantum similarity, condensed atomic indices, Coulomb holes, reactant resolution, higher order energy derivatives, excitation energy, charge sensitivity, reaction force, electron propagators, separability and N-representability. There are also contributions which deal with intramolecular hydrogen shifts, cycloaddition reactions, interactions among toxins and biosystems, and electronegativity equalization. Two papers by Ralph G Pearson and Robert G Parr give a personal account of the evolution of the hardness concept. Parr in his article sets out fourteen problems in DFT.

### Nanoscience and technology

**Guest Editors: AK Sood, KN Ganesh, CS Sundar and AK Raychaudhuri**

*Pramana*, Vol. 65, No. 4, October 2005, pp. 547–748

The dawn of 21<sup>st</sup> century is marked by the birth of a new science *Nanoscience* and the emanating *Nanotechnology*. Nanostructures are intermediate in size between molecular and mesoscopic structures (length scale up to ~100 nm). As a result, they are uniquely suited for detailed atomic-level engineering. Viewed as molecules, they are so large that they provide access to realms of quantum behaviour that are not otherwise accessible;



viewed as materials, they are so small that they exhibit characteristics that are not observed in larger structures. They combine small size and complex organizational patterns with the potential for very high packing densities and strong lateral interactions. Individual nanostructures involve clusters, quantum dots, nanoparticles, nanowires and nanotubes; collections of nanostructures involve arrays, assemblies and superlattices.

The uniqueness of the physics, chemistry, structural response and dynamics of the nanostructures constitutes the essential motivation for studying nanomaterials. Their electronic and magnetic characteristics are often dominated by quantum behaviour. They are emerging as key components in information technology devices with unprecedented functions. Many clear applications for nanotools and nanostructures are already evident and are targets of several emerging technology development programmes. Successful applications of nanoscience and nanotechnology require a fundamental understanding of properties of isolated individual nanostructures and ensembles, design and construction of nanoscale building blocks, interconnections to achieve new functions, bio-inspired fabrication of functional nanosystems and physics of molecular electronics.

Some of the nanotechnology products comprise of high-density information storage devices, new protective coatings for corrosion/erosion resistance, thin layers for optical filtering and thermal barriers, nanostructured polymers and catalysts, highly porous, sponge-like materials and aerogels for catalysis and energy applications, sensors for detecting pico and femtomoles of substances, self-assembled systems and lithographs etc. Development of tools and techniques for characterizing nanostructures is also a challenging area. Nanoscience and nanotechnology thus uniquely combine the concepts of engineering physics, materials chemistry and biology into making functional devices of unimaginable versatility for a variety of health, societal, and environmental applications.

Keeping in pace with the global nanotechnology competition, the Department of Science and Technology, New Delhi launched a national programme 'Nanoscience and technology initiative' to focus on the overall research and development in this area and create advanced facilities encompassing universities, national laboratories and industry so that India can become a significant global player in this area and help bring the products of technology to the benefit of people.

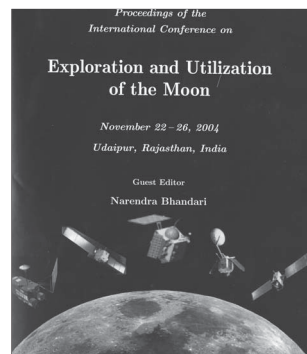
This special volume which appeared in two issues of *Pramana* presents peer-reviewed contributions in the area of Nanoscience by various researchers supported by the programme during the past two years and presented at the First National Conference on Nanoscience and Technology held at NCL, Pune during March 2005.

## Exploration and utilization of the Moon

Guest Editor: N Bhandari

*Journal of Earth System Science*, Vol. 114, No.6, December 2005, pp. 573–822

An International Conference on Exploration and Utilization of the Moon (ICEUM-6), sixth in the series, was held during November 2004 at Udaipur, Rajasthan under the aegis of the International Lunar Exploration Working Group (ILEWG). This conference was organized at a time of renewed interest



in the exploration of the Moon and a large number of lunar missions were being planned. This new era started with the SMART-1 mission of European Space Agency (ESA) which attained a lunar orbit on 15 November 2004, just before the conference, exhibiting the success of the ion propulsion system. This mission is expected to be followed by Lunar-A and SELENE by Japan, Chandrayaan-1 by India, Chang'E by China and the Lunar Reconnaissance Orbiter (LRO) by USA during the next few years. There will thus be a continuous presence on the Moon till the end of this decade, and possibly a permanent presence during the next decade, offering excellent opportunities for international collaboration. The ILEWG endeavours to optimize the scientific and technical outcome of these various missions by facilitating international collaboration and by debating priorities, problems and strategies.

The main themes of the Udaipur Conference encompassed all scientific aspects of the Moon — robotics, engineering, space flight dynamics, navigation and control, lunar exploration programmes of various International Space Agencies (ESA, ISRO, Russia, NASA, JAXA and China), first results from ESA's SMART-1 mission, programmes of future lunar exploration (Lunar-A, SELENE, Chandrayaan-1 and Chang'E missions and development for lunar bases) and next generation science and technology missions to the Moon. A programme, specifically for young lunar explorers, and reviews and results from previous missions such as Clementine and Lunar Prospector were also included.

In addition, round table discussions on science questions and priorities, international collaboration and Moon–Mars roadmap and technology and resource utilization were held. The conference issued a joint declaration known as the Udaipur Declaration.

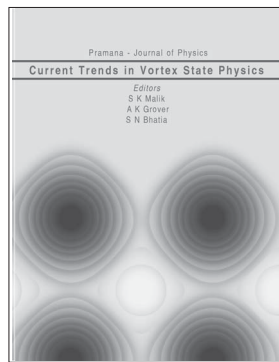
The present volume contains 29 papers accepted after a review process. These papers include topics such as

origin and early evolution of the Moon, orbital dynamics, science on the Moon, results of Clementine mission, new missions to the Moon, e.g. Lunar-A, SELENE, Chandrayaan-1, Chang'E, and Telerobotic explorations of the Moon.

### International Vortex Workshop

**Guest Editors: SK Malik, AK Grover and SN Bhatia**

*Pramana*, Vol. 66, No. 1, January 2006, pp. 1–312



The idea of this special issue on vortex state studies originated when the Tenth International Vortex Workshop (IVW-10) was being planned to be held at TIFR, Mumbai during January 2005. Normally no formal proceedings of such workshops were being brought out but it was felt that it would benefit the

scientific community if articles on contemporary subject in the area of vortex physics are published. There was enthusiastic response to this idea resulting in the emergence of this issue which hopefully is timely and useful to the scientific community at large, specially the young researchers.

The vortex state refers to the mixed phase of superconductors, where the magnetic field permeates and microscopically sub-divides the specimen into normal cylindrical regions surrounded by circulating supercurrents in the form of vortices. A superconductor in a magnetic field can sustain large current density without dissipation of heat only if the vortices do not move around and/or start flowing. Though the vortex state studies have been on for a long time, the discovery of high temperature superconductivity gave a fresh impetus to this field. This discovery in metallic copper oxide systems in 1987 raised the hope that these materials would transform the electrical power and the microelectronics industry. However, insurmountable difficulties in devising innovative ways to prevent the movement of vortices at boiling point of liquid nitrogen in the high temperature superconductors slowed down their development for novel applications.

The discovery of high temperature superconductivity gave an opportunity to a large section of the community of condensed matter physicists, statistical physicists, material scientists and engineers to study the vortex state in a variety of materials. The appearance of a very comprehensive and timely article in *Reviews of Modern Physics* in 1994 further attracted the attention of researchers in this area of physics, culminating in the holding of Workshops on Vortex Dynamics. The number of researchers working in this area has

steadily increased as gauged by the number of prospective participants in such workshops. The Nobel prize in Physics for the year 2003 was awarded to AA Abrikosov, who pioneered the idea of vortex state in superconductors.

This special issue presents twenty six articles on a variety of areas in vortex research. It includes a review on experimental results in vortices in dilute Bose – Einstein condensates which is a new topic added to the deliberations of the tenth vortex workshop.

### Metal oxides and related materials

**Guest Editors: S Natarajan and TN Guru Row**

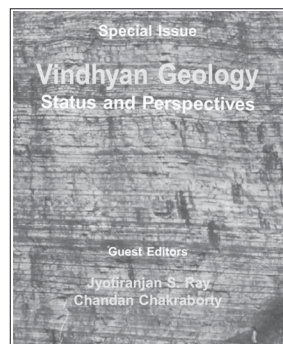
*Journal of Chemical Sciences*, Vol. 118, No. 1, January 2006 pp. 1–154

This special issue contains a collection of articles contributed by participants of an international conference on “Recent development in metal oxides and related materials” held in Bangalore during January 2006, jointly organized by the Solid State and Structural Chemistry Unit of IISc and the JNCASR. It contains sixteen articles on a variety of topics in chemical sciences which lie at the forefront of current international activity. The topics include: carbon nanotubes, fluorescence resonance energy transfer, nanoparticle synthesis, magnetic transport properties of rare earth manganates, lead-acid battery, density matrix renormalization group theory, ionic conduction, electronic homogeneity of ordered double perovskites, synthesis by molten salt method, layered hydroxides and its fictionalization, low-dimensional phenylarsonates, polyoxovanadates, layered vanadium phosphates and bismuth tungstates. The editors believe that the diversity and range of topics would make this volume useful to many practitioners of chemical sciences.

### Vindhyan geology

**Guest Editors: JS Ray and C Chakraborty**

*Journal of Earth System Science*, Vol. 115, No. 1, February 2006 pp. 1–184



Several significant events in earth history occurred during the Proterozoic Era affecting the lithosphere, atmosphere and the biosphere. Covering almost two billion years of geologic time, the Proterozoic Era witnessed the formation of stable continents, an oxygenated atmosphere, evolution of multicellular life and extensive glaciations. India has been an integral part of the supercontinents prior to Gondwanaland, and hosts several Proterozoic sedimentary successions that contain information on ancient depositional environments and processes. The Vindhyan supergroup of central and

western India is one such major sedimentary succession. With a rock record that embraces much of geological time and space, the Vindhyan rocks have been extensively studied over the last few decades. However, it is particularly the last few years that have seen a surge of research on these rocks, in part because of a couple of contentious fossil discoveries with profound implications.

It was therefore felt that a comprehensive volume including the recent advances in Vindhyan geology would be valuable in bringing about a better understanding of the development of this great succession and the global implications of various discoveries. This special issue contains eleven peer-reviewed research papers that cover many aspects of the Vindhyan. The main goals of this multidisciplinary research volume are to: (a) evaluate and synthesize the large quantity of data available from earlier studies; (b) present new data, ideas and methods to resolve the outstanding issues; and (c) identify the future areas for research.

The papers in this volume deal with the stratigraphy and sedimentology of the Vindhyan rocks on the paleobiology, on the new stable isotope data from the carbonate formations in the Son valley, the results of a seismic reflection study in the Vindhyan of Rajasthan, a review of the recent geochronology of the Vindhyan sequences and the petrological and geochemical aspects of kimberlitic rocks that intrude the Vindhyan supergroup.

## PUBLIC LECTURES

### *Soap bubbles and crystals*

**Jean Taylor**

(New York University, USA)

19 October 2005, Indian Institute of Science, Bangalore



Creating a mathematical model for soap bubble clusters required the development of a new subject, Geometric Measure Theory. It was only in 1976 that the “rules for bubbles” observed a century before were actually proved. The internal structure of metals, ceramics, and other materials is related to soap bubble clusters, but has many more features. Current research involves shrinking, slipping, sliding, and rotating crystals.

### *The arrow of time*

**Joel L Lebowitz**

(The State University of New Jersey, USA)

17 November 2005, Indian Institute of Science, Bangalore

In the world about us the past is distinctly different from the future. Milk spills but doesn't unspill; eggs splatter but do not unsplatter; waves break but do not unbreak; we always grow older, never younger. These processes all move in one direction in time – they are called “time-irreversible” and define the arrow of time. It is therefore very surprising that the relevant fundamental laws of nature make no such distinction between the past and the future. This leads to a great puzzle – if the laws of nature permit all processes to be run backwards in time, why don't we observe them doing so? Why does a video of an egg splattering run backwards look ridiculous? Put another way: how can time-reversible motions of atoms and molecules, the microscopic components of material systems, give rise to the observed time-irreversible behaviour of our everyday world? The resolution of this apparent paradox was the subject of this talk.

### *A shock wave cosmology*

**Blake Temple**

(University of California, USA)

23 January 2006, Indian Institute of Science, Bangalore

In this talk the speaker discussed a model of cosmology that refines the standard model of cosmology (based on the Friedmann universe) by the incorporation of a shock wave. The model explores the possibility that the explosion of the Big Bang that caused the outward motion of the galaxies, was an explosion of finite total mass, instead of the infinite mass explosion inherent in the standard model. In the shock wave model, which is based on the author's recent joint work with J. Smoller, the explosion of the Big Bang generates an outgoing, spherical, entropy satisfying shock wave that emerges from the centre of the explosion at the instant of the Big Bang, (something like the blast wave of a nuclear explosion), and the expanding galaxies correspond to the region inside the wave. One of the main consequences of this model is that when the shock wave is far enough out to be consistent with astronomical observations, (beyond one Hubble length – the distance light can travel since the Big Bang explosion), the whole explosion begins inside a (time reversed) Black Hole – a White Hole in which everything is exploding outward instead of collapsing inward. In the shock wave model, the universe eventually emerges from the Black Hole, and from then on expands like the famous Oppenheimer – Snyder solution – a finite ball of matter expanding into empty space. We are inside the explosion, but to an observer in the far field beyond the shock wave, the end stage of the explosion would look like a giant supernova. It also follows from our model that information about the shock wave

propagates inward from the shock wave, into a large shadow region of uniform expansion at the centre of the explosion – and to an observer (like us) on the inside of this shadow region, everything looks exactly like the Friedmann universe up until the time when the shock wave comes into view from the farthest field of observations. That is, in the shadow region, up until the time when the shock wave comes into view, everything looks the same as in the standard model. Other interesting consequences of the shock wave model include the unexpected emergence of the correct equation of state at the Big Bang, the breaking of the time symmetry by the entropy condition, and interesting mathematical consequences of the reversal of space and time inside the Black Hole. In this talk the speaker gave an introduction to Einstein's theory of general relativity, and then discussed this shock wave cosmology within this context. The talk began and ended with a computer visualization of our model due to Zeke Vogler.

### **Brighter than a million suns: the FERMI @Elettra project**

**Carlo Rizzuto**

(University of Genova and Elettra Laboratory, Trieste)  
1 February 2006, Indian Institute of Science, Bangalore

The FERMI@Elettra international project is developing a light source, using Einstein's equivalence between mass and energy, to produce light flashes billions of times more brilliant than any present technique, spanning over all colours, and with a time structure allowing to film the behaviour of materials down to atomic levels.

The light will be generated by a "free electron laser", based on electrons travelling near the speed of light, shedding part of their mass-energy in a coherent way, when stimulated by magnetic forces. The continuous improvement in the capability of studying, understanding and designing new materials has allowed the development of new products, from metallic bearings or catalysers to microchips and medical drugs, and has been a main component of the knowledge fuelling the most impressive and durable industrial and economic growth of the last centuries.

The study and modification of materials, down to the individual atoms, requires the use of "probes" either to capture the information on how the various qualities arise, or to manipulate them. One of the most powerful probes is the light, "reading" the inside of materials or "writing" lithographies.

The development of FERMI will allow to explore and modify materials, with a time and space resolution that could not be thought of until recently and is expected to open entirely new frontiers.

### **Reflections on the legacy of Harish-Chandra**

**Robert P. Langlands**

(Institute for Advanced Study, USA)  
20 March 2006, Indian Institute of Science, Bangalore

This lecture was an attempt to understand Harish-Chandra's place in the mathematical firmament. Harish-Chandra made outstanding contributions to harmonic analysis on reductive groups. His research centred around the study of semi-simple Lie groups and Lie algebras and he created a theory which had implications for many domains from geometry to number theory. Harish-Chandra was a Fellow of the Academy and died in 1983 when he was sixty.

## **DISCUSSION MEETINGS**

### **Instructional Workshop on Operator Theory and Operator Algebras**

**Indian Statistical Institute/Indian Institute of Science, Bangalore**  
**12–17 December 2005**

The workshop consisted of a short course on Lie groups and representation theory (by A Sitaram). H Upmeyer presented a survey of Toeplitz operator algebras on bounded symmetric domains. There were a variety of lectures on topics from Banach space geometry, model theory, operator algebras, Hopf algebras and harmonic analysis. An interesting lecture by M Putinar on relations between positivity and decompositions of polynomials as sums of squares was also held. This workshop preceded an international conference on "Operator theory and operator algebras" which was held from December 19 to 22, 2005.

### **Intracellular calcium signalling**

**Orange County, Coorg**  
**30 November – 4 December 2005**

This international meeting held at Orange County was attended by participants from six countries, with a majority from India. The meeting was timed to coincide with recent rapid advances in the area of calcium signalling triggered by emerging post-genomic technologies. A Rao (Harvard) presented her work on the use of RNAi screening technologies to discover novel components of the cellular calcium signalling circuit. R Lewis (Stanford) spoke on the function of one such component STIM, in sensing and regulating intracellular calcium. K Rao (ICGEB, New Delhi) discussed the link between calcium and cell death

signals in the immune system followed by D Clapham (Harvard) who discussed the function of a novel calcium channel (Catsper) in regulating cell motility. Mike Berridge (Cambridge) and Ole Petersen (Liverpool) provided historical perspectives on the development of the field and their visions for its future in the light of recent developments. There were other talks on the function of calcium in physiological systems such as vision by (KW-Yau, Johns Hopkins and RC Hardie, Cambridge), insect flight (Gaiti Hasan, NCBS, Bangalore), olfaction by K Stortkuhl (Germany), A Fiala (Germany) and V Rodrigues (TIFR, Mumbai) and animal development (N Spitzer, UCSD; K Mikoshiba, Japan; A Millar, Hong Kong; T Schwarz, Harvard). Lectures on novel functional aspects of several molecules that are central to calcium signalling were delivered by CW Taylor (Cambridge), R Dolmetsch (Stanford), T Shuttleworth (Rochester), A Galione (Oxford), R Padinjat (Cambridge) and C Montell (John Hopkins). There were excellent contributions from younger scientists drawn from the participants. In conclusion the meeting drew together a number of emerging threads on the molecules that mediate the effects of calcium in cellular physiology.

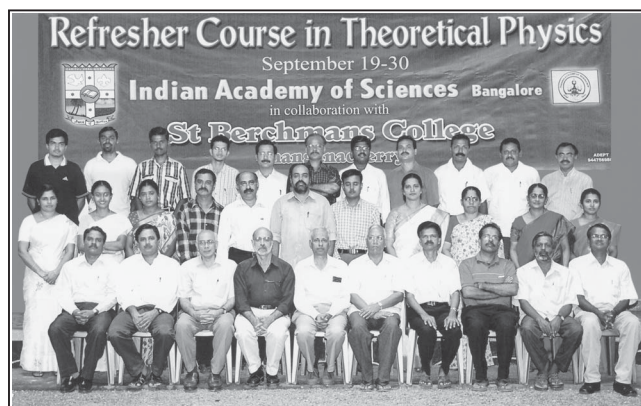
## REFRESHER COURSES

### Theoretical Physics

SB College, Changanassery

September 19 – 30, 2005

No. of participants: 28



**Course Director:** S Chaturvedi (Univ. of Hyderabad)  
**Course Co-ordinator:** C A Xavier (St. Berchmans College, Changanassery)

**Resource persons:** N Mukunda (IISc, Bangalore); S Chaturvedi (Univ. of Hyderabad); R Simon and R Jagannathan (Inst. of Math. Sci., Chennai) and V Balakrishnan (IIT, Madras)

Theoretical physics is one of the toughest areas in physics, which is often ignored by students as well as

teachers. A better understanding of the subject provides equal importance to both theory and experiment. Equipping the teaching community with all the aspects of theoretical physics is, therefore, very important in physics education. This course was organized keeping this in mind.

The topics of the course included: tensor analysis and relativity, group theory and applications, nonlinear dynamics, and integral transforms. The programme consisted of three 90 min lectures in the morning followed by two tutorial sessions in the afternoon. There were also common lectures of a more general nature. The participants were given course materials and books on theoretical physics.

The teacher participants represented institutions from Alappuzha, Kolkata, Changanacherry, Chennai, Delhi, Kochi, Kollam, Mumbai, Parumala, Perambalur, Puttur, Sivakasi, Solapur, and Trichy,

### Probability, stochastic processes and applications

Cochin University of Science and Technology, Kochi

September 26 – October 7, 2005

No. of participants: 38



**Course Director:** M K Ghosh (Indian Institute of Science, Bangalore)

**Course Co-ordinator:** A Krishnamoorthy (CUSAT, Kochi)

**Resource persons:** B Rajeev and S Ramasubramanian (ISI, Bangalore); B Krishnakumar (Anna University, Chennai); RP Pakshirajan (Bangalore); MK Ghosh and Srikanth K Iyer (IISc, Bangalore); A Krishnamoorthy and MN Narayanan Namboodiri (CUSAT, Kochi).

The schedule of the course included one lecture of 90 min duration with four sessions each day. The lecture topics covered probability measure on metric spaces, stochastic models, stochastic calculus, deterministic and stochastic control, queueing theory, Toeplitz and quasi – Toeplitz matrices, probability theory, and stochastic differential equations.

Each participant received a copy of the books by B Oksendal, by SM Doss and by KL Chung and Farid Aitsahlia.

The teachers were from Assam, Bhagalpur, Bodinayakanur, Burdwan, Chennai, Cheyyar, Chittoor, Coimbatore, Guwahati, Kannur, Kochi, Kolenchery, Kollam, Kottayam, Madurai, Palakkad, Pattambi, Rajampet, Tiruchirappalli and Thiruvananthapuram.

## Foundation course in physics and chemistry of the earth

University of Allahabad, Allahabad  
November 7 – 27, 2005

**No. of participants: 13**

**Course Director:** A K Gupta (University of Allahabad)

**Resource persons:** AK Gupta, VK Gaur (C-MMACS, Bangalore); S DasGupta and Nibir Mandal (Jadavpur); Pinaki Majumdar (HCRI, Allahabad).

This course for young faculty and researchers in the field of Earth Sciences was aimed at sharpening the conceptual foundations of young earth scientists towards creating capabilities for understanding and analysing planetary systems and processes generally relating to the earth in particular, in a quantitative manner. It was thus designed to focus on the most basic aspects of physico-chemical principles and their numerical application in calculating the thermodynamic conditions of critical earth processes such as lithospheric stretching leading to development of sedimentary basins, physics and chemistry of melts, amongst other topics. This course focussed on the following three topics and their numerical applications to earth science problems: (a) continuum mechanics, (b) thermodynamics, and (c) physico-chemico mineralogy.

The course consisted of two lectures every day followed by two tutorials, both of 75 minutes. Two theory and practical classes were also conducted on each day.

The teacher participants were drawn from Ahmedabad, Allahabad, Bangalore, Dehra Dun, Kolkata and Tiruchirappalli.

## Physics of the Atmosphere

Indian Institute of Science, Bangalore  
November 14–25, 2005

**No. of participants: 38**

**Course Director:** BN Goswami (IISc, Bangalore)

Resource persons: R Narasimha (JNCASR, Bangalore); J Srinivasan, BN Goswami, Sulochana Gadgil, GS Bhat, R Nanjundiah, SK Satheesh (all of CAOS, Bangalore); D Sengupta, M Venkatachalappa and P Siddheswar



(Bangalore University) PV Joseph (Kochi); BH Subbaraya, V Jayaraman and G Viswanathan (ISRO, Bangalore).

The teacher participants were from Allahabad, Anjar, Bangalore, Chennapatna, Chikballapur, Ernakulam, Guwahati, Hoshiarpur, Jhansi, Jharkhand, Kakinada, Kanchipuram, Kannur, Karaikudi, Malout, Mangalore, New Delhi, Pudukottai, Pune, Rewa, Srinagar, T.Kallikulam, Tirunelveli, Tumkur.

## Extracts from the report

As teaching of atmospheric physics is not widespread in the country, the philosophy of this course was to introduce important phenomena in the atmosphere and to give an overview of quantitative aspects of dynamics and thermodynamics that provide physical understanding and predictive capability of these phenomena. Observing techniques, diagnosis of global observations and development of three-dimensional global models for weather and climate predictions were discussed. Recent development in this field was also highlighted as special lectures.

In his inaugural talk J Srinivasan highlighted the recent and exciting developments in atmospheric sciences. The course began with some basics such as composition of the atmosphere, atmospheric general circulation, horizontal and vertical structure of wind and temperature by Goswami followed by atmospheric thermodynamics by GS Bhat and atmospheric radiation by J Srinivasan. With this background PV Joseph and P Siddheswar introduced the synoptic systems, monsoon depression, equation of motion and continuity equation. M Venkatachalappa spoke on atmospheric waves and R Nanjundiah introduced complexities of developing three-dimensional general circulation models for prediction of weather and climate and highlighted the challenges in developing more accurate models for prediction of weather and climate. Satheesh discussed aerosols, clouds and precipitation. Special topics on Indian monsoon and its variability by S Gadgil, El Nino and Southern oscillation (ENSO), global warming, tropical cyclone (TC) and thunderstorms were also discussed in order to provide a flavour of interesting physical processes involved in some

of the important and challenging weather and climatic phenomena.

The afternoon sessions were devoted to demonstrations and laboratory work. Some fluid dynamics movies illustrating some basic fluid dynamics processes (e.g. drag, vorticity etc) were shown to the participants. An introduction to principle involved in remote sensing techniques was given by Satheesh who also demonstrated the working of the automatic weather station and various radiometers and instruments used for measurement of aerosol. Bhat demonstrated how density stratification could lead to certain oscillations in the atmosphere and ocean. A visit to ISRO Satellite Centre to understand various steps of satellite integration was also arranged.

Quantitative aspect of the atmospheric sciences was emphasized throughout the course. In order to carry forward quantitative aspect of the training during the course the participants were given a book entitled 'Meteorology – Understanding the Atmosphere' by Steven A Ackerman and John A Knox. The book covers a wide range of topics covered during the course. It is envisaged that the teacher participants will involve students in their respective places to maintain regular record of these important climatic variables. This is expected to not only provide good records of climatic data over a number of places but also enthuse some young students to get into this field.

Five special lectures on 'Origin and evolution of the atmosphere' by BH Subbaraya; Indian satellite programme for climate studies by V Jayaraman; atmospheric radars by G Viswanathan; ENSO and seasonal prediction by Jerome Vialard and 'palaeoclimate reconstruction' by GB Pant were arranged.

The participants expressed the hope that the course provided them the confidence and excitement to teach introductory atmospheric science course being offered in many institutions.

## Applied Stochastic Processes

Indian Statistical Institute, New Delhi

December 5 – 17, 2005

**No. of participants: 20**

**Course Directors:** S Ramasubramanian and RL Karandikar

**Resource persons:** RL Karandikar and Abhay Bhatt (ISI, New Delhi); Siva Athreya and S Ramasubramanian (ISI, Bangalore); Anish Sarkar and Rahul Roy (ISI, New Delhi)

The teacher participants represented institutions from Bangalore, Baroda, Bhimavaram, Burdwan, Chirala,

Cochin, Dehra Dun, Gangtok, Gorakhpur, Kolkata, Narasaropet, Ongole, Pune, Thiruvananthapuram, Vettavalam, Vidisha, Vijayawada.

The aim of the refresher course was to introduce to the participants some aspects of probability theory and stochastic processes applicable in some disciplines without bringing in heavy mathematical machinery. These were illustrated via some simulations. A conscious effort was made to have participants from diverse backgrounds, consequently the mathematical background assumed was minimal. After explaining the basic concepts of probability theory, the lectures quickly went on to cover topics such as Markov chains, Martingales, branching processes and Poisson processes. Monte Carlo methods with reference to Markov chain Monte Carlo were also covered and illustrated.

## LECTURE WORKSHOPS

### Chemistry for society – Reactions to reality

Sri Sathya Sai Institute of Higher Learning,  
Prasanthinilayam

24–26, September 2005

**Participants:** 108 students and teachers from Sri Sathya Sai Institute

**Speakers:** V Chandrasekhar (IIT, Kanpur); SS Rajan and P Ramamurthy (Univ. of Madras); S Rengaraj (Hongkong); Surendra Kulkarni (GE Advanced Materials); A Venkateshwarlu (Reddy's Research Foundation); HB Singh (IIT, Mumbai) G Muges and A SriKrishna (IISc, Bangalore); R Venkateswarlu (Andhra University); G Manickam (Biocon, Bangalore); S Sri Hari (Kakatiya University); KV Srinivasan (NCL, Pune); D Basavaiah (Univ. of Hyderabad).

**Topics covered included:** Stannoxames and phosphonates, crystallography and drug design, scale up of reactions, organochalcogen chemistry, thyroid hormone synthesis, anti-thyroid drugs, development of bioactive lignans, etc

### Molecular endocrinology and gamete biology

Daulat Ram College, Delhi

3 – 4 October 2005

**Participants:** 59 students and teachers from the Daulat Ram and other colleges

**Speakers:** K Muralidhar, Umesh Rai and Rita Singh (all of Delhi University); Satish Gupta (NII, New Delhi).

**Topics of lectures:** Mechanism of hormone action, regulation of hormone biosynthesis and secretion, differential gene expression, germ cell apoptosis, hormonal influence on the immune system, molecular mechanisms in reproductive processes, molecular aspects of fertilization, biology of gametes, and gamete antigen based immuno-contraception.

## Modern biology: 'Facets and prospects'

**M.S. University of Baroda, Vadodara**  
10 – 11 October 2005

**Participants:** 220 students and faculty from universities and colleges

**Speakers:** V Rodrigues (TIFR, Mumbai); RK Rao (Tennessee); Utpal Nath and Annapoorni Rangarajan (IISc, Bangalore); Santha Ramakrishnan (Jubilant Biosystems, Bangalore); BB Chattoo (MS Univ. of Baroda); Sorab Dalal (Tata Memorial Centre, Mumbai); Sunita M DeSouza (Astra Zeneca, Bangalore); Vishwas Sarangadhar (Reliance, Mumbai); Subita Srimal (Mehta Partners, Bangalore).

**Topics of lectures:** Little fly, genetic control of organ shape in plants, cancer stem cells, peptidoglycan synthesis, pre-clinical and clinical studies, etc

## Frontiers in biotechnology

**CMS College, Kottayam**  
14 – 15 October 2005

**Participants :** 172 students and faculty from CMS and other colleges

**Speakers:** K Veluthambi and R Usha (MKU, Madurai); Y Annamma Varghese (Rubber Institute, Kottayam); Imran Siddiqi (CCMB, Hyderabad) and Joseph P Varghese (CMS College, Kottayam).

**Topics covered:** Genetic engineering of rice, genomics and proteomics of plant viruses, molecular markers and plant genetic resources, meiotic chromosome organization in plants, and DNA based molecular markers.

## Einstein's legacy

**St. Pious College, Hyderabad**  
28 – 29 October 2005

**Participants:** 177 students and faculty from universities and colleges

**Speakers:** N Mukunda (IISc, Bangalore); R Jagannadhan and R Simon (IMSc, Chennai) and V Balakrishnan (IIT, Chennai).

**Topics covered:** Space, time and matter, Einstein and quantum mechanics, Einstein and brownian motion, and Bose-Einstein condensation.

## Experimental physics

**Maharani Lakshmi Ammanni College, Bangalore**  
4 – 5 November 2005

Over the past five years, Academy organized seven Refresher Courses on Experimental Physics at various places in the country which were each attended by 20 to 25 postgraduate teachers. These consisted of lectures and seminars on various aspects of experimental physics and on several electronic kits developed for this purpose. The lectures were followed by the teachers carrying out a number of experiments mainly at the M.Sc level, assembling the kits and using the kits to do experiments. The kits related to: a constant current supply, a temperature controller, a capacitance measurement circuit, a signal generator and audio amplifier, an on-line data collection kit, a furnace and a lock-in-amplifier. The kits, excepting the on-line data collection kit, cost not more than Rs 2500/= each and are sufficient in their technical specifications for student experiments. They are thus cost effective and easily serviceable.

Using these kits a variety of experiments at the M.Sc level were conducted; for example: (a) the constant current source could be used for (i) measuring temperature coefficient of resistance of copper (ii) temperature coefficient of resistivity of a semiconductor and determination of energy band gap (iii) Stefan-Boltzmann constant and emissivity of a surface (iv) measurement of specific heat of copper (v) measurement of the electrical and thermal conductivity of copper to determine its Lorentz number and (vi) thermal diffusivity of brass;

(b) the capacitance measurement circuit could be used for comparison of capacitances, measurement of dielectric constant of a liquid, and measurement of the dipole moment of an organic molecule

(c) the signal generator-cum-audio-amplifier could be used for measurement of self-inductance, study of series and parallel resonant circuits, measurement of relaxation time constant of a serial light bulb, and demonstration of rotating magnetic field. Along with a bridge balance detector the signal generator can be used to study various types of AC bridges;

(d) the lock-in-amplifier could be used for measurement of mutual inductance and measurement of small resistance by AC technique;

(e) the IGCAR kit, namely on-line data collection kit, has been used for acquiring online data on atleast six experiments and for study of a ferroelectric phase transition. Many other experiments were designed and developed based on these kits; additional kits are under development.

Over the two-week period at each Refresher Course, each one of the teachers was provided with four knocked-down kits for assembly, testing and operation. The teachers were guided in gaining hands-on-experience by the

resource persons from Goa University and scientists of IGCAR, Kalpakkam. Starting from rudimentary steps like proper soldering, the teachers were led through the exercise and the programme has worked well to the satisfaction of the participant teachers.

Enthused by the positive response from the nearly 100 participant teachers so far, this two-day demonstration workshop was organized where all the kits and experiments were demonstrated before the nominated teachers with a view to bring these kits and new experiments to the attention of a wider audience.

The morning sessions were devoted to lectures on the details of the kits by KR Priolkar, Efrem D'Sa, Sadique (all from Goa University), J Jay Pandian (IGCAR) and R Srinivasan. Jay Pandian's lecture touched on several aspects of modern experimental support systems that could be configured using currently available PCs and associated software; he dealt at length on embedded systems and virtual experiments. The afternoon sessions were devoted to demonstration of the kits and related physics experiments to groups of teachers. By rotation, all the groups were shown all the kits and experiments. The teachers were provided with a detailed manual on the kits and experiments before the Workshop.

A feed back revealed that the teachers were greatly benefited by the Workshop. Some expressed the view that, although the kits and other aspects covered in the workshop were useful, there may be stumbling blocks in changing existing curricula and introducing such approaches at many colleges and universities due to various reasons. They suggested that the Academy might take up the matter at higher levels in the universities and UGC to make the programme more effective.

Following the workshop, the Academy supported a two-day workshop on New Trends in Teaching Physics, sponsored by the Indian Association for Physics Teachers, and held at the VVS College for Women at Bangalore.

## Modern chemistry and biology

**Aurora's Degree College, Hyderabad**  
28 – 29 November 2005

**Participants:** students from colleges in Hyderabad

**Speakers:** TP Radhakrishnan, Abhani Bhuyan, MV Rajasekharan and M Periasamy (all of Univ. of Hyderabad); V Nagaraja (IISc, Bangalore); Jagadish Mittur (Monsanto, Bangalore); Nasreen Z Ehtesham (NIN, Hyderabad) and Viji Draviam (Massachusetts).

**Topics covered:** Nano-materials, perspectives in coordination chemistry, GM feed, agricultural biotechnology, endonuclease and topoisomerase and chromosome segregation.

## Fundamental and advanced aspects in spectroscopy

**St. Joseph's College, Irinjalakuda**  
14 – 15 February 2006

**Participants:** 110 post-graduate students and teachers from universities and colleges in Kerala.

**Speakers:** E Arunan, BJ Cherayil, PK Das, S Ramakrishnan, KL Sebastian and S Umapathy (all of IISc, Bangalore).

**Topics covered:** Electronic, vibrational, rotational and NMR spectroscopy.

## Frontiers of physics

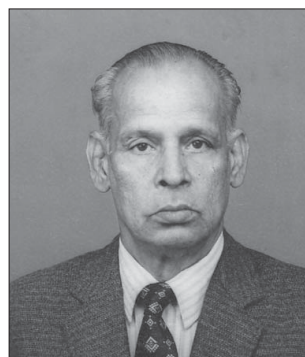
**St. Philomena's College, Mysore**  
17–18 February 2006

**Participants:** 200 students and teachers from colleges in Mysore.

**Speakers:** C Sivaram (IIA, Bangalore); GI Menon (IMSc, Chennai); Sreekanth (RRI, Bangalore); V Balakrishnan (IIT, Chennai); P Balaram, AM Umarji and S Ramasesha (IISc, Bangalore).

**Topics of lectures:** Universe, machines at the molecular scale, quantum computation, non-equilibrium phenomena, experiments at low temperatures, and organic electronic materials.

## OBITUARIES



**Thamarapu Vedanta Desikachary** (elected 1957) an eminent phycologist of India and a legend in algal research passed away on 5 November 2005 at Melbourne, Australia. Desikachary was born in Tirupati into a family of erudite scholars. He was educated at the Hindu High School, Tirupati and at the

Presidency College, Madras. He obtained his BSc. in botany with a first class in 1940 and then joined the University Botany Laboratory at Madras to work under MOP Iyengar, the doyen of algology in India. He obtained his MSc. Degree in 1944 and his Ph.D. in 1951 working on morphology and taxonomy of blue green algae. He served as demonstrator in Andhra University, as assistant professor at Pachaiyappa's College, Madras (1945–1947) and then as junior lecturer, University of Madras (1947–48). Subsequent to his doctorate, he was lecturer at the Saugar University (1951–1957). He rejoined

the University of Madras in 1957 from where he also got a second doctorate (DSc) in 1968. He became a professor at the University in 1964, a post he held till 1975. He played a major role in making Madras one of the centres of Indian phycology and he himself became one of the leaders in phycology in India. He guided the research of over twenty doctoral students, several of whom occupy important positions in India and abroad.

Desikachary published a large number of research papers in diverse groups of algae, and edited many books, co-published volumes on Rhodophyta and Phaeophyta and the monumental "Atlas of Indian diatoms" in five volumes with his colleagues. Desikachary also took up a large amount of unpublished material, left behind by Iyengar and published these as a series, entitled "Contributions to our knowledge of South Indian Algae".

Desikachary keenly nurtured and built the phycological tradition left behind by Iyengar. He established a culture collection of algae at the University of Madras. He was the first Indian algologist to undertake electron microscopic studies of diatom frustules and highlight the implications in taxonomy. He was also the first to initiate use of numerical methods in the taxonomy of blue green algae. His interests in diatoms included study of both living and fossil diatoms. He also made significant contributions (with Sundaralingam) towards elucidation of phylogeny and interrelationships in the Charophytes. His critical studies include the morphology and life histories of red algae (on the Nematiales with Balakrishnan) and on the Coralline red algae (with Ganesan). He established genera for commemorating Iyengar and other illustrious figures in phycology: *Iyengariella* (Cyanophyceae); *Iyengariomonas*; *Pacenfussiomonas*, *Schilleriomonas* and *Mantoniella* (Chlorophyceae, Prasinophyceae) and *Rossiella* (Bacillariophyceae). He strongly put forth Iyengar's hypothesis on the origin and evolution of the filamentous habit and postulated that the development of parenchymatous thalli in many algae is the modification of the palmelloid habit. The observations that in the 'truly' parenchymatous tissues, plasmodesmata between adjacent (and genetically related) cells get dissociated prior to cell division leading to vegetative and sexual reproduction and prior to meiosis, led him (along with BGL Swamy) to postulate that isolation and insulation are key processes in the vital phenomena of sexual reproduction and reduction division in living systems as also the survival of genetically altered cells, such as zygotes meiocytes, in situ mutants, etc. He organized the international symposium on taxonomy and biology of blue green algae in 1970 and taxonomy of algae in 1974 at the University of Madras, thus bringing about an interaction between leading phycologists from abroad with younger Indian phycologists.

Desikachary spent a year at the University of California, Berkeley, in 1953-1954 with GF Papenfuss doing

research on the red algae, followed it up by attending the International Botanical Congress and work at the Cryptogamic Museum, Paris, and two months of research on diatoms at the British Museum of Natural History in London. He also undertook a tour of research and field collection of the marine algae of Indonesia, New Zealand and Australia. He chaired the symposium on the taxonomy of blue green algae at the International Botanical Congress at Edinburgh in 1964.

Desikachary was elected a Fellow of Indian National Science Academy in 1966 and a Foundation Fellow of Phycological Society of India. He was also the Chief Editor of its Journal PHYKOS until 1973. He was also on the editorial boards of several other journals. The University of Madras awarded him the CV Raman Medal in 1959. He was also elected a member of the International Nomenclatural Committee on Algae till 1980. In appreciation of his services to the cause of Indian botany, especially morphology and taxonomy of algae, he was awarded the V.Puri gold medal of the Indian Botanical Society in December 1980. He was associated with the Madras Science Foundation for several years. He was also honoured by the American Phycological Association for his lifetime contribution at the International Phycological Congress, Durban. He leaves behind his wife Chellammal and two sons.



**Jaysukhlal Ranchoddas Merchant** (elected 1964) was born in Bombay on 14 June 1922. He did his B.Sc (Hons) in 1944 and his M.Sc and Ph.D in organic chemistry in 1946 and 1949 respectively, all from the University of Bombay. At Zurich he completed his D.Sc in organic chemistry working at the Swiss Federal

Institute of Technology with Leopold Ruzicka and V. Prelog, both Nobel Laureates. He joined CSIR as a senior fellow at NCL, Pune in 1953. From 1954 to 1957 he was associate professor of organic chemistry at the Institute of Science in Bombay and then became a full professor at the same institute until 1980. After his formal retirement from Institute of Science, he joined the DG Ruparel College (Mumbai), the SNDT Women's University (Mumbai) and the Royal Institute of Chemistry (London) as visiting professor.

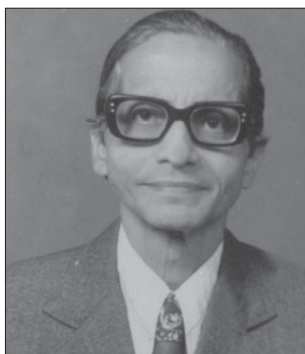
Merchant published over 200 research papers in organic chemistry of natural products as well as synthetic organic chemistry especially heterocyclic components. He worked on Indian medicinal plants; isolation and structure elucidation of alkaloids from Alangi Lamarki; isolation of constituents of indigenous plants which were reported as having anti-tumour activity; synthetic work on cyanoethylation of hydroxy and amino compounds;

synthesis of xanthenes acridines; studied action of thionyl and sulphonyl chlorides and flavonones; studied reactions of hexachloropropenes on organic compounds; etc. He made valuable contributions to the chemistry of heterocyclic compounds such as benzopyrones, pyrrolidines and indoles. He contributed to the elucidation of the structures of alkaloids like calycotomine and the Erythrina group of alkaloids. He synthesized several compounds with a possible pharmacological activity and carried out a chemical investigation of different Indian medicinal plants.

He passed away in Mumbai on 8 February 2004 but his death was communicated to the Academy only in December 2005. He remained a bachelor.

### **Samarendra Nath Sarkar**

(elected 1978) was born on 22 April 1920 in Kolkata. After his schooling from Scottish Church School in Kolkata, he joined the Presidency College in Kolkata for his B.Sc (Hons) in 1941 obtaining a first class second rank of the



University. He did even better with a first class first rank in his M.Sc (geology) in 1943. His thesis on Spango granitic complex and its metamorphic aureole in South Scotland fetched him a Ph.D in 1948 from the University of Edinburgh where he was the Government of India overseas fellow. He began his scientific career as a prospecting geologist in 1944 at private companies in Hyderabad for 2 years and then joined the Geological Survey of India in 1949. In 1952 he joined IIT, Kharagpur as a lecturer (1952-56) and became an assistant professor (1956-61). He then moved to the Indian School of Mines in Dhanbad in 1961 as a professor and head of the Department of Applied Geology. He was the Institute's Director from 1969 to 1972 but continued to work at the institute until 1980 and subsequently as a principal scientific officer.

Sarkar investigated the stratigraphy, structure, petromineralogy, and geochronology of the precambrians of (a) Bhandara-Drug-Balaghat Districts of over 6000 sq.km area covering Sausar, Sakoli-dongargarh belts (900 Ma-2500Ma old rock samples); (b) Singhbhum-Keonjhar, Sundergarh region covering 10,000 sq.km (900-3800 Ma old rocks); (c) Crystalline nappe zone in Garhwal and Kumaon Himalayas, Nainital, Ranikhet-Almora-Baijnath-Lansdowne and (d) structural control of copper ore deposits, isotope geology, fluid inclusions, trend surface

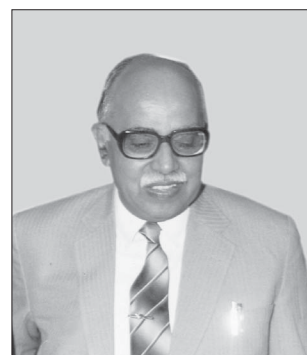
analysis, electron microprobe work, and isotope studies for genesis. As a result of his findings, many text books on stratigraphy had to be revised. His studies on the structures and geochronology of precambrians of Madhya Pradesh and Singhbhum regions as well as parts of the Kumaon Himalaya revealed for the first time the detailed chronology of sedimentary tectonic and igneous events in those difficult regions. His own determination of K-Ar ages of Precambrian rocks along with age data obtained in collaboration with Soviet geochronologists threw much new light on the correlation and geological history of the Indian Precambrian.

Sarkar received numerous honours. These include the Government of India overseas fellowship to work at Edinburgh (1946-48), the Nuffield Foundation Fellowship (1966-67) to work in geochronology in the University of Cambridge, the National Mineral Award of Government of India (1969), the Golden Jubilee Distinguished Service Award of Indian School of Mines (1976) and the PN Dutta Memorial Medal of the Asiatic Society (1981). He was elected to the Indian National Science Academy (1974) and served in its council. He was India's permanent representative in the Subcommission for Precambrian Stratigraphy of IUGS since 1966.

Although Sarkar passed away quite some time ago on 10 September 2004, the Academy was not aware of it. He leaves behind his wife Namita and two sons.

### **Antapur Venkoba Rao**

(elected 1984) was born on 20 August 1927 at Kavutalam in Andhra Pradesh. He did his MBBS from the Madras Medical College in 1949, MD in general medicine from the University of Madras in 1958 and DPM from the University of Mysore in 1961 with a first class first rank.



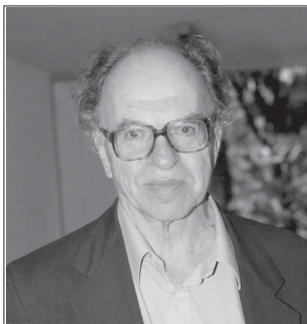
He obtained his Ph.D in psychiatry from University of Madras in 1969 for his thesis on "a study of depression prevalent in South India". In addition he was also a recipient of a D.Sc degree from University of Madras in 1978 for his study on depression and suicide behaviour. His professional career started in 1954 when he joined as assistant professor first at the Madras Medical College and later at the Madurai Medical College. In 1962 he became a full professor at the Madurai Medical College and headed its Institute of Psychiatry. Between 1985 and 1993, he was the officer-in-charge of the ICMR Centre for Advanced Research on Health and Behaviour.

Venkoba Rao's research interests spanned a wide area in psychiatry such as depressive illness, suicidology,

biological psychiatry, psychophysiology, lithiumology, transcultural psychiatry, history of psychiatry, geropsychiatry and drug addiction. His studies covered epidemiology, clinical profile; the course outcome and cultural influences on depression and its cure with lithium therapy; the nature of suicide behaviour, its causes and especially suicide 'counters'. He pioneered a suicide prevention centre and lithium and geropsychiatric clinics in India. His study in biological psychiatry related to melatonin in depressive disease, the low level of melatonin in depression and its persistence in remission as a predictor of suicide behaviour and relapse. He contributed extensively in the area of transcultural psychiatry and psychiatry of old age. He described psychiatric and organic diseases of the elderly against sociocultural context. He studied the cases of aged people in rural areas at the primary health centre level and evolved a model for a total health care for the rural aged. He has the unique distinction of demonstrating *treponema pallida* in the frontal lobes of these subjects. Venkoba Rao published over 200 research articles and monographs and three books on depressive disease, psychiatry of old age in India and lithium.

He was a recipient of numerous awards some of which are listed below: Sandoz Award (1972), MN Sen Award (1984), MK Sheshadri Award (1986), BV Roy Award (1981), International Research Scholar Award (1989) NN De Award (1992) etc. He was elected to many Academies and Societies including the Indian National Science Academy (1989) and the National Academy of Medical Sciences.

He passed away on 25 October 2005 leaving behind his wife Parvathi Devi, one son and a daughter.



**Hermann Bondi** (elected 1997), a theoretical astrophysicist best known for having helped to develop the 'steady state' theory of the Universe was born on 1 November 1919, the son of a medical doctor, and was brought up in Vienna where he studied at the Realgymnasium. Having acquired an early interest in mathematics, Bondi entered Cambridge University when his talent was soon recognized and he was awarded an exhibition in his first year. While interned as an 'enemy alien' in 1940, he gained his BA. He returned to Cambridge in 1941, and soon afterwards, met Fred Hoyle, with whom he and Thomas Gold theorized about cosmology, and in particular the origin of the universe. They were not satisfied with the then popular 'big bang' explanation for the origin of the expanding universe, and in 1948 they proposed the alternative 'steady state' theory.

The steady-state theory suggests that the universe is always expanding but maintaining a constant average density, matter being continuously created to form new stars and galaxies at the same rate that old ones become unobservable as a consequence of their increasing distance and velocity of recession. A steady-state universe has no beginning or end in time; and from any point within it, the average density and arrangement of galaxies is the same. Galaxies of all possible ages are intermingled. This hypothesis was first put forward in 1920 by the cosmologist James Jeans.

After the war Bondi – then a fellow of Trinity College, Cambridge, working with Hoyle and Gold – developed the theory further. In 1952 he published a seminal book, *Cosmology*, in which he set out the theory in full. Later, in 1959, with RA Lyttleton, he suggested that the outward movement of galaxies could be due to the action of electrical charges sufficient to cause their repulsion away from one another.

During the 1950s the steady-state theory stimulated a great deal of productive research in cosmology. However, it fell out of favour when it was discovered, from research into radio galaxies and quasars in the far universe, that the universe had been more dense, and hotter, in the past. At the time it was consistent with practically all that was known about the Universe, and during more than a decade of heated controversy, astronomers were unable to decide which of the two theories was the more credible. In 1965, however, Penzias and RW Wilson discovered the universal background radiation predicted by George Gamow which could readily be accounted for as a consequence of the 'big bang'. Since then, almost all the advances in our understanding of the universe have pointed firmly towards a 'big bang', of one kind or another, as its origin.

Coming back to his career, after his education in Vienna, Bondi felt drawn to England and joined Trinity College in 1937 with the help of Arthur Eddington. In 1940, shortly before the 'Battle of Britain' Bondi was interned on the Isle of Man and later in Canada. By 1945, Bondi was back at Trinity on a research scholarship, and scientific papers started flowing. He wrote not only on the steady-state theory, but also on fluid motion and electromagnetism, the sun's corona and geophysics. So wide ranging were Bondi's scientific interests that after he was elected a Fellow of the Royal Society in 1959, he was made to work by the British government on a range of projects about which, he confessed, he knew very little. These included feasibility studies for the Thames Barrier, the Anglo-Australian telescope, rocket launchers, communications satellites, ecology, and energy policy. He continued to publish prolifically on subjects ranging from the origin of the universe to the exponential growth of algae on the Norfolk Broads.

In 1967 Bondi became Director General of the European Space Research Organization, and in 1971, took over as the chief scientific adviser to the Ministry of Defence where he was a staunch supporter of Britain's independent nuclear deterrent. In 1977, he became the Chief Scientific Adviser at the Department of Energy and three years later was made the Chairman and Chief Executive of the Natural Environment Research Council, and a further three years later in 1983 was elected Master of Churchill College in Cambridge.

Bondi held visiting professorships at a number of universities throughout the world and won many international prizes and medals. In 1983 he became only the second British scientist to win the Einstein gold medal.

Bondi was a Raman Visiting Professor of the Academy and was in India between December 1995 and February 1996. During a period of eight weeks, Sir Hermann Bondi and Lady Bondi had a busy schedule visiting and lecturing at various scientific institutions in Bangalore, Chennai, Trivandrum, Cochin, Goa, Pune

and Mumbai. The topics of his lectures ranged from "why is it dark at night?" to the theory of gravitation from "energy in the world" to "positive atheism". He delivered an Academy public lecture on "Science: its philosophy and spirit" and his Gandhi Memorial Lecture was on "Scientific temper".

Bondi also visited Vijaywada to take part in the World Atheist Conference. Before returning to England he donated the entire proceeds of the travel money the Academy paid to him to a Gandhian Service organization in Vijaywada known as "Arthik Samata Mandal" which helps over 150 villages in Andhra Pradesh through integrated socio-economic activities.

A humanist throughout his life, he claimed never to have felt the need for religion. He was president of the British Humanist Association and of the Rationalist Press Association. Bondi was knighted in 1973.

He married Christine Stockman, whom he met when she was working as an astrophysics research student with Fred Hoyle. They had two sons and three daughters. Bondi died in Cambridge on 10 September 2005.

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*Contributions from Fellows to Patrika are welcome – brief articles of general interest, news, views, interesting anecdotes, etc.*



House at Thiruvanaikkaval in Tiruchirappalli where C. V. Raman was born on 7 November 1888.



Pictures taken in front of the house when delegates of the Academy Annual Meeting in Tiruchirappalli visited the house in November 2005. According to recent newspaper reports, this house was “demolished” by the present owner of the house.

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