

tion chemistry and bioinorganic chemistry' through presentation of the structure and properties of a variety of transition-metal complexes.

Achieving higher precision measurements in high energy physics while searching for the innermost structure of matter in the subnuclear domain such as leptons, quarks, bosons, etc. was explained by Sunanda Banerjee (Tata Institute of Fundamental Research, Mumbai). Experiments at the large electron-positron collider at CERN have tested 'even the quantum corrections as predicted by the Standard Model of particle physics', according to Banerjee. These collaborative experiments involved physicists from all over the world and had Indian scientists playing a significant role. He also detailed the high precision detectors that have been constructed for this experiment at TIFR.

K. S. Krishna (National Institute of Oceanography, Goa) outlined the nature of the lithosphere deformation obtained from geophysical data collected in the northeastern Indian Ocean. These studies throw insight into the ages of seismic sequences, the intraplate deformations

and the way the central Indian Ocean lithosphere had changed over time, from the ongoing collision of plates of India with Asia. The oceanic response of folded mountains could also be correlated with the time of faulting.

Other topics covered were by: (a) Abhishek Dhar (Raman Research Institute, Bangalore) on 'Understanding transport in one-dimensional systems' with studies on heat transport based on statistical physics that enabled calculation of specific heat, compressibility, magnetic susceptibility starting from a microscopic description. (b) Vijay B. Shenoy (Indian Institute of Science, Bangalore) on 'Adhesion instabilities in soft films' and pattern formation. These experiments have implications on pattern transfer technology. (c) T. N. Venkataramana (Tata Institute of Fundamental Research, Mumbai) on 'Topics in discrete groups', a study of discrete groups of semi-simple Lie groups and their rigidity properties. (d) S. V. S. Murty (Physical Research Laboratory, Ahmedabad) on 'Mars and Earth: A comparative planetology'. He described the planets Mars and Earth and traced their evolutionary processes

through the study of nitrogen and noble gas isotopes in Martian meteorites and in Earth's mantle.

S. V. Dhurandhar (Inter-University Center for Astronomy and Astrophysics, Pune) spoke of 'Gravitational wave astronomy: A new window to the universe'. Detection of direct gravitational wave radiation is of interest to astrophysicists. With the advent of the construction of laser interferometric observatories and new improved detectors such as in the LIGO, VIRGO, GEO600, TAMA300 and AIGO500 projects and the space-based NASA-ESA mission, LISA that is to be ready in a decade, all of which are expected to lead to determination of gravitational waves that would revolutionize our understanding of the Universe. IUCAA is involved with the gravitational wave projects in various ways such as hierarchical methods for coalescing binaries, analysing outputs from network of detectors as in aperture synthesis etc.

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MEETING REPORT

Weather and climate modelling*

Monsoon is an important phenomenon that influences various aspects of India to a great extent, including its economy. Since India has an agro-based economy, it is absolutely crucial and important that various facets of monsoon and the associated rains be predicted as realistically as possible. It is a challenging task to all scientists for developing and improving models for finally obtaining societal beneficial forecasts. These improvements are to be acquired at all time scales with an emphasis on the initial state of the atmosphere. In order to achieve this goal, any additional data that are assimilated in the analyses system for providing

the initial conditions for the model may improve the model performance. In addition, better skill can be obtained by improvement in the parametrization schemes of various physical processes. Increasing the resolution of models could resolve the orographic forcing, leading to a more realistic rainfall prediction. In the coming years, many new observations from satellites are going to be available in high-resolution all over the globe for use in modelling. India is also entering into an ambitious plan of launching various satellites with meteorological payloads. With development of proper assimilation technique the new satellite data could enhance the forecast capabilities.

The objective of the Indo-US workshop on Weather and Climate Modelling was to bring together the scientists involved in the areas of weather and climate modelling from both the countries for exchanging views and sharing experi-

ences as well as planning future work. S. V. Singh of NCMRWF and Dr B. B. Rath of the Naval Research Laboratory, USA, coordinated the workshop. Twelve scientists from USA belonging to six major establishments participated in the deliberations. Indian scientists from various organizations like India Meteorological Department, NCMRWF, Indian Institute of Tropical Meteorology, ISRO (SAC) and Indian Institute of Technology (Delhi and Roorkee) had participated. In addition, representatives from user community like Indian Air Force, Indian Navy, Snow and Avalanche Study Establishment and Indian Council of Agricultural Research (Central Research Institute for Dryland Agriculture), and various universities participated in the workshop. In all, there were about 120 delegates. The presentations and discussions were mainly confined to three broad themes, viz. (i) improvement of global analysis –

*A report on the workshop on 'Weather and Climate Modelling' organized at NCMRWF, New Delhi during 7-9 February 2002 under the aegis of Indo-US Science & Technology Forum.

forecast system, (ii) mesoscale models: cloud and land surface process, and (iii) dynamical extended range prediction.

The workshop was structured so that under each broad theme, scientists from both the countries presented the state-of-the-art available in their respective country and identified the problems encountered. There were eleven presentations from the US scientists and ten presentations from the Indian scientists. After presentations by the scientists, group discussions were held.

The presentations under the theme 'Improvement of global analysis – forecast system' focused on two aspects, viz. parametrization of physical processes and data assimilation. Thrust was on improving the forecast skill through assimilation of enhanced satellite-derived observations from the existing as well as future satellites, including Indian satellites, viz. INSAT 2E, METSAT, INSAT 3A and INSAT 3D. It was felt that the THORpex (The Hemispheric Observing System Research and Predictability Experiment) programme under WWRP (World Weather Research Programme) would provide the right kind of opportunity for India to make optimal usage of the enhanced operational observing system,

including the new satellite data for improved predictions of high-impact weather systems. In order to improve the model performance, ensemble forecasting with more members and multi-model super ensemble-based unified schemes for various physical processes were suggested.

Related to mesoscale modelling aspects, many presentations emphasized the importance of the land surface processes and surface characteristics in prediction of circulation patterns and regional scale weather systems. Performance of various kinds of mesoscale models was shown both over US as well as Indian regions. NCAR's effort in designing the next generation mesoscale model (WRF) was also discussed. Model performance of COAMPS (Coupled Ocean/Atmosphere Mesoscale Prediction System) in simulating tropical cyclone structure and track was presented. It was shown that the newly developed high-resolution initialization system improved the tropical cyclone structure analysis and forecast.

Joint cooperation in the field of disaster management in terms of cyclone-warning systems was urged. In general, a consensus was reached for mesoscale

assimilation with optimal usage of regional observations, along with improved representation of microphysical processes. Verification and validation aspects were also identified as key issues for future work.

Under the theme 'Dynamical extended range prediction', results on the simulation of Asian summer monsoon in the coupled ocean atmosphere (Cane-Zebiak) model and SST variability were presented. Presentations were also made on the procedure being followed for forecasting monsoon on long range in India. A need was felt to pursue studies on monsoon forecasts under the global warming scenario with specific role of snow cover and sensitivity of soil wetness.

Several topics identified for joint collaboration, may lead to long-term scientific arrangements with different organizations. As a follow-up of this workshop, NCMRWF and NCAR have already signed an MOU for collaborative research on 26 July 2002.

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MEETING REPORT

Emerging trends in biotechnology – stem cells*

Stem cell research has emerged as the most vibrant biological research activity. This is evidently a reflection of the fact that these cells have the capacity of self-renewal and the potential to differentiate into one or more cell types depending on the signals *in vivo*. The applications of such cells clearly go beyond medical

imagination, as they can possibly be used in the treatment of diseases like Parkinson's, Alzheimer's, diabetes, heart disorders, spinal cord injuries or for development of *in vitro* assay system for drug discovery and toxicity or for understanding basic developmental process. Rightly so, the journal *Science* (published by the American Association for the Advancement of Science, USA) believes that stem cell research would be actively pursued not just by academia, but also by the industry.

The international conference to discuss advances in this area was therefore a very timely effort. B. S. Bajaj (Chairman, All India Biotech Association – Southern Chapter) welcomed the guests and explained briefly the objectives of the conference. Martin J. Evans (Director, Cardiff School of Biosciences, Cardiff

University, UK), the discoverer of embryonic stem cells, delivering the keynote address on stem cells, described the events that resulted in the landmark discovery of mouse embryonic stem cells. He also discussed various potential applications, ethical and regulatory issues pertaining to stem cell research. He warned that stem cells are still in a research mode and have a long way to go before they are adopted in clinical practice.

He presented various aspects of embryonic stem cells and their ability to carry mutations introduced to test the function of a gene and an understanding of the disease process. He also covered new concepts in experimental mammalian genetics and their use in gene targeting, trapping and genetic manipulation. He highlighted the potential of embryonic

*A report on the international conference on 'Emerging Trends in Biotechnology: Stem Cells – Technology, Potential and Trends', organized by the All India Biotech Association – Southern Chapter, jointly with Andhra Pradesh Government, Centre for Cellular and Molecular Biology, Centre for DNA Fingerprinting and Diagnostics and Department of Animal Sciences, University of Hyderabad and supported by the Indian Council for Medical Research and other pharma and biotech industries, from 2 to 4 May 2002 at Hyderabad.