



# JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

JAKKUR, BANGALORE – 560 064



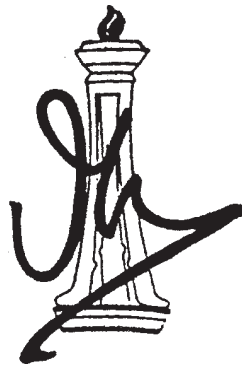
## ANNUAL REPORT 2007-2008



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**JAWAHARLAL NEHRU CENTRE FOR  
ADVANCED SCIENTIFIC RESEARCH**

**(A Deemed University)**

Jakkur, Bangalore – 560 064.

Website: <http://www.jncasr.ac.in>

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# The Centre

## Foreword

It gives me great pleasure in presenting the Eighteenth Annual Report of the Centre, for the year 2007-2008.

The Centre is one among the leading institutions in the country for higher learning and research in frontier areas of science and engineering. The Centre has also been recognized as a Deemed University. During the year, significant contributions have been made in the research areas of materials science, theoretical physics, molecular biology and genetics, evolutionary and organismal biology, chemical biology, engineering mechanics and geodynamics. The Centre has witnessed a phenomenal growth in various academic activities. Many of the new activities have stabilized and have made an impact on both research and potentially useful applications. The student strength is increasing steadily adding to the vibrant atmosphere in the campus.

Several of the Centre's Faculty have done extremely well during the last year and have been decorated with prestigious awards including the **Shanti Swarup Bhatnagar Prize** of the CSIR. It is extremely fortunate that the Centre is being considered as one of the potential places for taking up an academic career by young researchers. Many new faculty members have joined the Centre over the last year and with this increase in young faculty members, we hope to expand our research and academic efforts in the years to come.

**Prof. C.N.R. Rao's Education Foundation** has generously donated funds to establish a Hall of Science which will be named as "**Prof. C.N.R. Rao Hall of Science**". The Centre is also adding various infrastructural facilities to take care of the needs of various academic activities. In all these endeavours, continued encouragement and support of Department of Science and Technology is gratefully acknowledged.

The publication statistics have shown very impressive progress and during the year 292 papers have been published in international and national peer reviewed journals. After obtaining the status of Deemed University, 42 students have obtained Ph D Degrees; 10 students M S (Engg.) and 6 students M S (Int. Ph D) degrees. While 9 students for Ph D and 5 students for M S (Engg.) degree completed all the academic requirements for the award of respective degrees during this year, 4 students have submitted theses for the Ph D degree which are under process. The student strength has been steadily increasing, keeping the academic activities as vibrant as ever. With the admission of 50 students for various programmes, the present student strength is 141.

Several new initiatives like nanoscience and computational materials science have taken root in the Centre with substantial support from DST. Various infrastructural facilities have also been upgraded to cope up with the increased activities at the Centre. The proposal of the Centre for establishing an International Centre for Materials Science has been approved by the DST and the work has been progressing. A new programme of Integrated Ph D in Materials Science has been started from the academic year 2007-08 with an intake of 10 students.

In addition to pursuing research in various contemporary areas, the Centre also has several Science Outreach Extensions and Fellowship Programmes. One such activity is the Summer Research Fellowship Programme for young students. During the year, 4,810 applications were received, out of which 120 were offered fellowships, in addition to 49 selective renewals from the previous year. This is one of the highly acclaimed programmes of the Centre and the students are very appreciative of the benefits, enabling them to get inspired towards scientific research during early stages of their education. Honorary Faculty Members of the Centre have also made significant contributions to the various academic and research programmes of the Centre. We acknowledge their participation in training young students under the Summer Research Programme.

The Project Oriented Chemical Education (POCE) programme has successfully completed four years, having an impact on the student community. While the first batch of POCE students has completed their 3 year POCE course during July 2006, the second batch completed during July 2007. Ten meritorious students from across the country have been selected for this year. As part of their on-going programme, students of POCE worked with faculty members at the Centre on small projects during their mid-semester break. Now in its fifth year, this programme has attracted a lot of attention across the country and the students undergoing this programme have highly appreciated its structure and content.

A similar programme in Biology (POBE) has successfully completed its second year and 10 students from across the country have been selected for this year. The first and second batch of 20 students will be attending for training of about two months in laboratories of MBGU and EOBU besides attending special lectures and seminars at the Centre. The POBE 2006 batch will be receiving their certificates after successful completion of their training.

Prof C N R Rao and his co-workers have found that nanoscale metal oxides and nitrides show room-temperature magnetism because of surface effects. The team found that even nanoparticles of high temperature superconductors can become ferromagnets – a surprising result since superconductivity and ferromagnetism are usually incompatible.

Prof Tapas Kumar Kundu's group has synthesized an inhibitor of p300/CBP from garcinol, a principal component of locally available Kokum (*Garcinia indica*) fruit. This inhibitor is nontoxic to human cells and represses the replication of HIV in infected cells.

The Centre continues to provide an excellent academic atmosphere for intellectual interaction and pursuit of knowledge which is the result of untiring efforts of students, the faculty and honorary faculty and other members of the Centre. I take this opportunity to thank and acknowledge the enthusiastic help the Centre has received from its well wishers and friends and look forward to their continued cooperation. The Department of Science & Technology has always positively supported all the academic and developmental activities of the Centre which is greatly appreciated and thankfully acknowledged.

M R S RAO  
President

## INTRODUCTION

The Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, a premier research institute in the country, was established in the year 1989, the birth centenary year of Pandit Jawaharlal Nehru, by the Department of Science and Technology. The objectives of the institute shall be to pursue and promote scientific research and training at the highest level in the frontier and interdisciplinary areas of science and engineering. The number of publications in international journals of repute and the filing of patents are steadily increasing year by year. The Centre, which is just eighteen years old, is creating news regularly in the scientific world with its breakthrough discoveries. The Centre has collaborations with several national and international institutions. In recognition of the achievements of the Centre, the Ministry of Human Resource Development (GOI) has accorded the status of Deemed University, to enable the Centre to train quality manpower. The faculty members of the Centre have received national and international recognitions. Several faculty members of the Centre are Fellows of National and International science and engineering academies.

Prof C N R Rao, the founder of the Centre, held the office of President from 1989 to 1999. He is presently the Honorary President of the Centre and Chairman of the Scientific Advisory Council to the Prime Minister. Prof V Krishnan, who succeeded him, served as its President from 2000 to 2003. Prof M R S Rao is presently the President of the Centre.

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## OBJECTIVES

The objectives of the Centre are:

- ☆ To carry out front-line research in selected thrust areas of science and engineering;
- ☆ To promote collaborative research with scientists at the Indian Institute of Science and other institutions in the country;
- ☆ To provide a national and international forum for in-depth discussions on important scientific topics in areas of vital interest to scientists of the Centre and in the country at large;
- ☆ To organize periodic winter and summer schools in certain areas, where young talented scholars would be associated;
- ☆ To provide opportunities for talented young students to carry out research projects;
- ☆ To provide facilities to visiting scholars and faculty, from all over India and abroad, to work for extended periods with the faculty of the Centre;
- ☆ To publish monographs and reports on frontier and futuristic areas of science as well as monographs of educational value.

☆☆☆

## PROGRESS

The Centre has completed eighteen years with several memorable and exciting moments. The main campus at Jakkur now houses the Chemistry and Physics of Materials Unit, Educational Technology Unit, Evolutionary and Organismal Biology Unit, Engineering Mechanics Unit, Geodynamics Unit, Molecular Biology and Genetics Unit, and Theoretical Sciences Unit. The Chemical Biology Unit and the Condensed Matter Theory Unit are housed at the IISc Campus. A seminar hall, a well-furnished accommodation for academic visitors and a Visitor House are also located at IISc campus. New Faculty appointments have been made in some research areas. While the new Nanoscience Centre, equipped with the state of the art facilities for advanced research in materials science, and the new building for Engineering Mechanics Unit have been fully functional, the International Centre for Materials Science will be ready in couple of months. The infrastructural facilities were upgraded to be commensurate with the increased activities.

The Centre is equipped with good quality Library, excellent Computer Laboratory, Centre for Computational Materials Science, Lecture Halls, a Chemical Education Laboratory, a Conference Hall, a Seminar Hall, a Poster Presentation Hall, Faculty Offices and the Administrative Office. A new Webpage in English and Hindi has been launched.

The Centre pursues excellence in research and education in frontier and interdisciplinary areas of science and engineering. It provides a stimulating academic environment to talented and motivated students to pursue scientific research. The students' strength as on 31<sup>st</sup> March 2008 was 141. The research training at the Centre has led to the award of 49 Ph D degrees, 17 M S degrees, 10 M S (Engg.) degrees and one M Sc (by research) degree so far.

Reforms have been introduced in Research Admissions procedures to maintain high quality research and training programmes. The Centre continues to be at the forefront of cutting edge science and engineering research in the country.

The Centre has emerged as a place for interdisciplinary research, with effective interactions among scientists with backgrounds in biology, chemistry, engineering and physics. The JNC community has been working not only in pursuit of research, but also on dissemination of science-related activities reaching out to the common man.

The Centre's faculty members have received number of national and international recognitions. Prof CNR Rao, Linus Pauling Research Professor and National Research Professor, has been conferred the Honorary Degree of Doctor of Science, Northwestern University, Illinois, awarded the Nikkei Prize for Science, Technology and Innovation, Japan, D Sc (*Honoris Causa*) by Kalyani University, West Bengal and has been declared Laureate of the Khwarizmi International Award by the Government of Iran. Prof M R S Rao, President, has been awarded Dr B R Ambedkar Centenary Award for the year 2005 and TWAS Medal Lecture Award 2008. Prof K S Valdiya has been honoured with Athmaram Puraskar. Prof Rama Govindarajan has been awarded Shanti Swarup Bhatnagar Prize and Prof Swapan K Pati has been awarded the Bronze Medal of the Chemical Research Society of India, 2007. Prof. Meheboob Alam received the inaugural 'Asian Young Fluid Dynamicist Award (2007)'.

The Faculty members of the Centre have published around 292 scientific papers in reputed international journals during the year 2007-08.

Many patent applications were filed by the faculty members for new inventions.

The Centre is actively pursuing interaction with academic institutions and universities globally and expanding its formal ties with other international and national research organizations and Universities by signing MOUs for collaborative research, exchange of graduate students and consultancy projects.

Honorary Faculty Members of the Centre have continued to play an important role in guiding academic and extension activities of the Centre.

Summer Research Fellowships, Project Oriented Chemical Education Programme, Project Oriented Biological Education Programme, Visiting Fellowships, Extension Programmes and Academic Exchange Programmes have attracted wide attention and were highly successful. Fifteen candidates from R & D institutions have been offered Visiting Fellowships for 2007-2008. Out of Nine candidates were offered DST Postdoctoral Fellowships in Nano Science and Technology for 2006-2007, six have joined and continuing their fellowship in different Universities/Institutions in the country.

Since the beginning of the financial year 2007-08, 35 Discussion Meetings/Workshops were conducted, either wholly or partially supported by the Centre. About 60 seminars, 9 Fluid Dynamics Colloquia, 3 JNC Colloquia and 7 International Conferences/Workshops/Schools were held.





## HIGHLIGHTS OF RESEARCH AND OTHER ACTIVITIES

### Research

The **Chemistry and Physics of Materials Unit** has established a heteroepitaxy laboratory for growth and characterization of GaN and related materials at ICMS. A national facility of ultra high resolution electron microscopy has been launched with the support from DST. Following the observation of universal ferromagnetism in oxide nanoparticles, GaN and CdS nanoparticles have been shown to be ferromagnetic. The LSL group has set up the first laboratory doing drug protein interactions on therapeutically important proteins such as p300 and CARM1 using surface enhanced Raman spectroscopy (SERS) and have developed the proof of principle for diagnostics using SERS in the HIV subtype detection without PCR amplification.

In **Education Technology Unit**, translation and production of the **Learning Science** series both as CD-ROMs and books in Hindi were taken up. The Learning Science programmes were organised in association with different institutes for students and teachers from various schools.

In **Engineering Mechanics Unit**, Wavelet techniques have been used to detect periodicities in Indian monsoon rainfall and to test them for statistical significance. An experimental setup has been designed to study convection in the limit of very high Rayleigh ( $\sim 3 \times 10^{11}$ ) and Schmidt (proxy to Prandtl number,  $\sim 5 \times 10^5$ ) numbers to mimic mantle convection. The use of wavelet techniques in the study of turbulent flow (e.g. jet) has led to measurements related to the life cycle of a coherent structure as it passes through a test section in the apparatus in which the jet is produced.

The studies at **Evolutionary & Organismal Biology Unit** revealed that the circadian organization of the *Camponotus* ants is adaptively plastic, and assumes appropriate configurations depending on their roles in the colony. Theoretical studies have suggested that constant mortality in the pre-reproductive phase should have a major stabilizing effect on population dynamics.

In **Molecular Biology and Genetics Unit**, the *Molecular Parasitology Lab* has initiated a 'Systems Biology' approach to decipher the interactome of various metabolic pathways of the *Plasmodium* apicoplast for complete understanding of the biological network of the parasite. The *Vascular biology Lab* has derived two new hES cell lines, *BJNh19* and *BJNh20* from discarded grade III human embryos. *Transcription and Disease Lab* has employed glucose derived carbon nanospheres for introducing *cell impermeable*, only known HAT activator into the cells as well as animals.

In **Theoretical Sciences Unit**, the statistical mechanics of bosons in a confining potential with an optical lattice has been studied by using an inhomogeneous mean-field theory. The School on Biomolecular Simulations Nov 6 - 16, 2007 was organized.

**International Centre for Material Sciences** which is the first international centre of its kind devoted to research, education and extension in materials science, established in the confines of a scientific cum educational institution. The research facilities include: Ultra High Resolution Electron Microscope, Pulse Laser Deposition. Molecular Beam Epitaxy System, X-ray Diffractometer and others.

The **Centre for Computational Materials Science** developed a new interatomic potential model for atomistic simulations of a room temperature ionic liquid, [bmim][PF<sub>6</sub>] based on results from ab initio MD simulations as well as physical property data from experiments.

### Academic

During the year, 50 students (10 Students for Integrated Ph.D, 25 Students for Ph.D, 13 for MS (Engg.) and one for MS degree were admitted. 14 students were awarded Ph D, 4 students M S (Engg,) and one student was awarded M S (Int. Ph D) degree.

### Fellowship & Extension Programmes

Under the Summer Research Fellowships Programme about 170 fellowships were awarded. The JNC-TWAS-ROCOA – Summer Research Fellowships programme was launched whereas in the Project Oriented Chemical Education (POCE) Programme 26 undergraduate students attended. The POBE programme has

successfully completed two years with 20 students from various institutions in the country undergoing interactive training.

### **Vigilance**

The Centre follows the vigilance guidelines from time to time. Prof N Chandrabhas was appointed as Vigilance Officer. The Vigilance Officer and Administrative Officer attended the Annual Meeting of CVO with Vigilance Officers of subordinate offices and Aided Institutions. The Vigilance Awareness Week was celebrated during November 2007 which included a lecture to the community. The Centre informed the services, the initiatives taken for improvement of the system, procedures, complaint handling policy and the other avenues for redressal of grievances etc. All the reports and returns were submitted in time.

### **Reservation and Official Language**

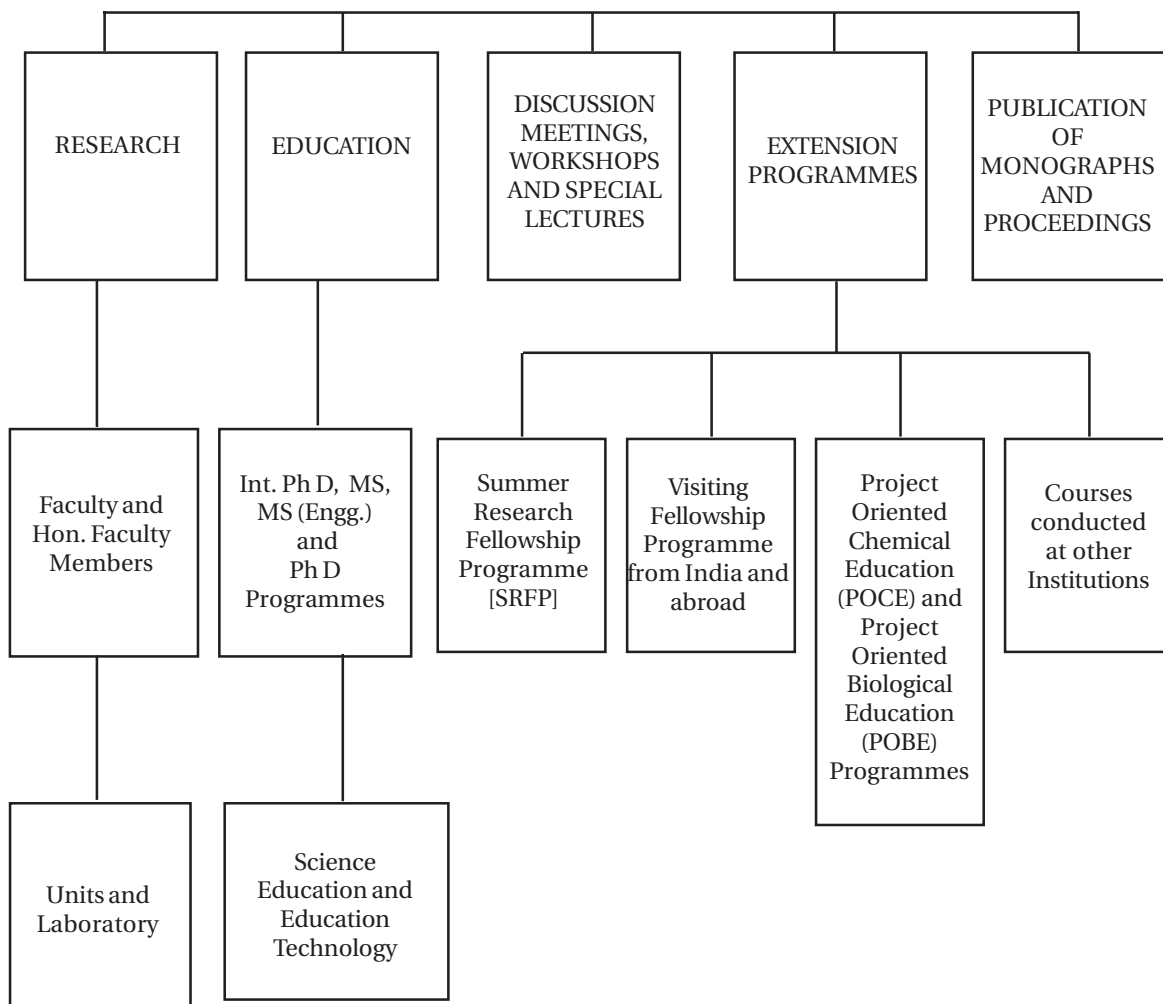
The Centre follows the national policy on reservation and official language as per rules and orders issued by the Government of India with necessary guidelines from the Council of Management from time to time.

A Complaints Committee for the prohibition of Sexual Harassment of women at work place (Centre) has been constituted.



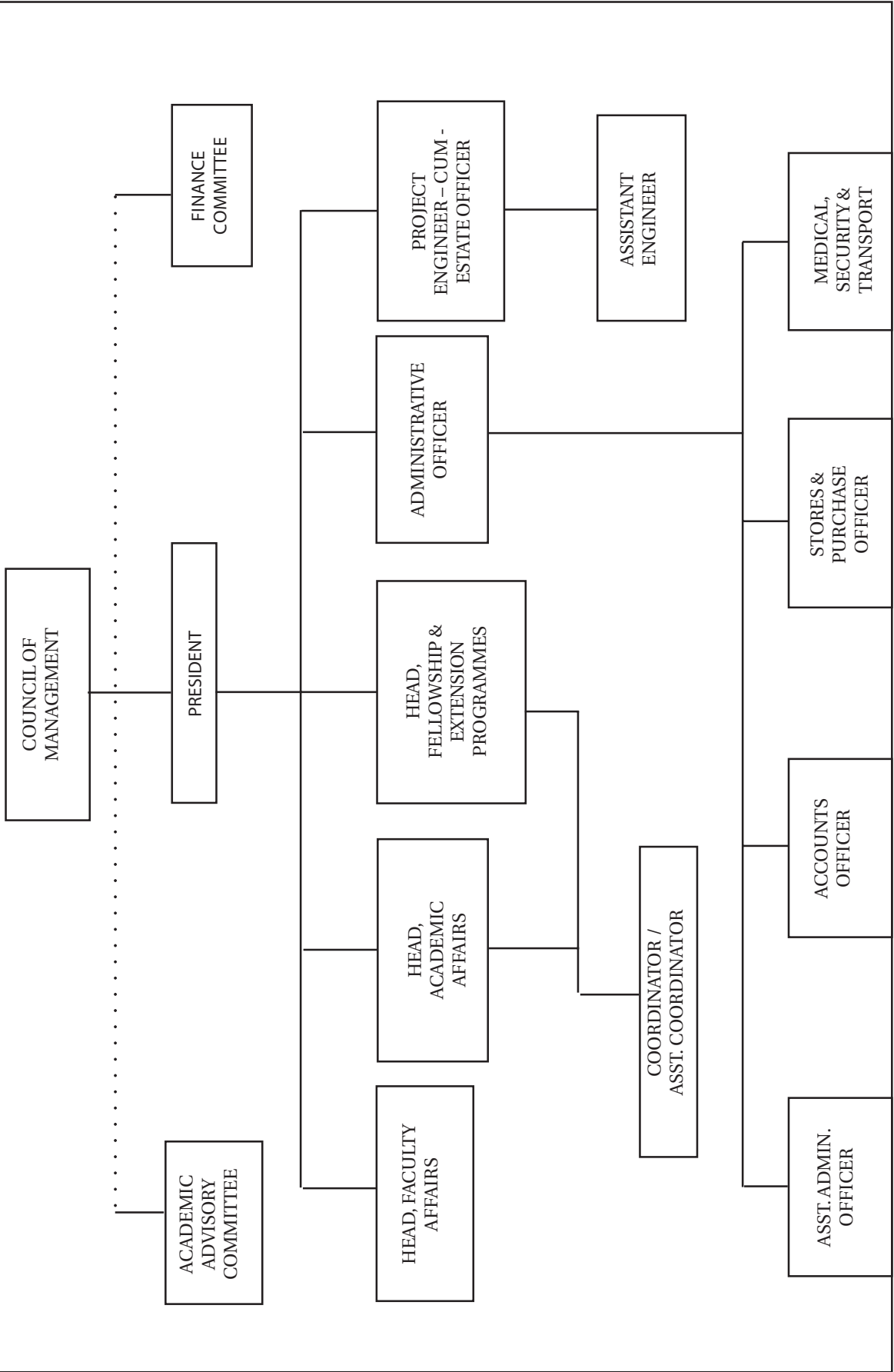
# ACTIVITIES CHART

## JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH





## ORGANISATION CHART



## THE ORGANISATION

### 1. Council of Management

The administration and management of the affairs and finances of the Centre are conducted by the Council of Management. The Council of Management of the Centre meets twice a year.

The following are the members of the Council.

<b>P Rama Rao</b> ISRO Brahm Prakash Distinguished Professor, ARCI, Hyderabad	Chairman
<b>M R S Rao</b> President, JNCASR	Member
<b>T Ramasami</b> Secretary Department of Science and Technology New Delhi	Member
<b>C N R Rao</b> Linus Pauling Research Professor JNCASR	Member
<b>S K Joshi</b> National Physical Laboratory New Delhi	Member
<b>K P Pandian</b> Joint Secretary & Financial Adviser Department of Science and Technology New Delhi	Member
<b>P Balaram</b> Director Indian Institute of Science, Bangalore	Member
<b>Sinha B</b> Director, VECC & Saha Institute of Nuclear Physics Kolkata	Member
<b>S Chandrasekaran</b> Indian Institute of Science Bangalore	Member
<b>A N Jayachandra</b> Administrative Officer, JNCASR	Secretary

## 2. The Finance Committee

The Finance Committee of the Centre scrutinizes all financial proposals, and makes recommendations to the Council of Management.

The constitution of the Finance Committee is as follows:

<b>M R S Rao</b> President, JNCASR	Chairman
<b>C N R Rao</b> Linus Pauling Research Professor JNCASR	Member
<b>K P Pandian</b> Joint Secretary & Financial Adviser Department of Science and Technology New Delhi	Member
<b>S Chandrasekaran</b> Indian Institute of Science Bangalore	Member
<b>Revathi Bedi</b> Finance Officer, JNU New Delhi	Member
<b>R S Gururaj</b> Accounts Officer, JNCASR	Member
<b>A N Jayachandra</b> Administrative Officer, JNCASR	Secretary



### 3. The Academic Advisory Committee

The functions of the AAC include planning, execution and coordination of research and other academic activities of the Centre. It also regulates the courses of study, procedure for admission of students, examination, etc. It meets at least twice a year. The Committee makes its recommendations to the Council of Management on all academic matters.

The members of the Academic Advisory Committee are:

<b>M R S Rao</b> President, JNCASR	Chairman
<b>C N R Rao</b> Linus Pauling Research Professor JNCASR	Member
<b>A K Raychaudhury</b> Director, SNB NCBS, Kolkata.	Member
<b>Dipankar Chatterji</b> IISc., Bangalore.	Member
<b>Rahul Pandit</b> IISc., Bangalore	Member
<b>P Ramachandra Rao</b> Director, Institute of Armament Technology Pune	Member
<b>K B Sinha</b> Head, Faculty Affairs, JNCASR	Member
<b>K VijayRaghavan</b> Director NCBS, Bangalore	Member
<b>K S Narayan</b> Head, Academic Affairs, JNCASR	Member
<b>Rama Govindarajan</b> Head, Fellowships & Extn. Programmes, JNCASR	Member
<b>A N Jayachandra</b> Administrative Officer, JNCASR	Secretary

### 4. Faculties

The faculties are involved in the academic activities of the Centre and assist the Academic Advisory Committee in discharging its functions. The last Annual Faculty Meeting was held in November 2007 which included lectures by the faculty on the advances made in various research areas. Local faculty meetings were held in August 2007 and February 2008 to review the progress and provide inputs wherever required.

## 5. Administration

<b>President</b> M R S Rao,	Ph D (IISc), F A Sc, F N A, F N A Sc, FTWAS
<b>Head, Faculty Affairs</b> K B Sinha,	Ph D (Univ. of Rochester), F A Sc, F N A, FTWAS
<b>Head, Academic Affairs</b> K S Narayan,	Ph D (Ohio State Univ.), F N A Sc
<b>Head, Fellowships and Extension Programmes</b> Rama Govindarajan	Ph D (IISc), F N A Sc
<b>Warden &amp; Student Counsellor</b> Umesh V Waghmare	Ph D (Yale Univ.)
<b>Associate Warden</b> Maneesha S Inamdar	Ph D (TIFR)
<b>Administrative Officer</b> A N Jayachandra	B Com (Mysore), ICWA (Inter)
<b>Assistant Administrative Officer</b> T S Vishwanath	B Sc (Bangalore)
<b>Consultant</b> G Jayaram	B Com (Bangalore)
<b>Assistant Coordinator</b> Princy Jaison Pereira	Ph D (Gujarat)
<b>Accounts Officer</b> R S Gururaj	B.Sc. (Mysore) M P Ed (Bangalore)
<b>Stores &amp; Purchase Officer</b> K Bhaskara Rao	M Sc (Hyderabad), M Phil (New Delhi)
<b>Senior P A to President</b> A Srinivasan	B A (Hyderabad)
<b>Project Engineer</b> S Chikkappa	B E (Mysore)
<b>Junior Engineer (Civil)</b> Nadiger Nagaraj	DCE
<b>Junior Engineer (Elec.)</b> Sujeeth Kumar S	
<b>Chief Medical Officer</b> B S Subba Rao	MBBS (Mysore)
<b>Consulting Lady Medical Officers</b> Kavitha Sridhar Archana, M L V	MBBS (Bangalore) MBBS (Bangalore)
<b>Honorary Medical Officers</b> G R Naghabhushan  L Sharada R K Nivedita C Satish Rao P K Raghupathy R Nirmala	MBBS (Mysore), FCCP, FCGP, P G Dip in M&CH MBBS (DGO (Madras)) MBBS (Mysore) MBBS (Mysore) MBBS MBBS
<b>Honorary Security Officer</b> M R Chandrasekhar	B Sc, LLB (Bangalore)





# UNITS, CENTRES, COMPUTER LABORATORY, LIBRARY AND ENDOWED RESEARCH PROFESSORS

## 1. Chemistry and Physics of Materials Unit

In the *Molecular Modelling Laboratory*, atomistic and coarse grained interaction models for ionic liquids, based on results obtained from our *ab initio* molecular dynamics simulations were developed. The atomistic simulation model considerably improves results on the dynamical properties of ionic liquids, compared to earlier works. The coarse grained MD simulations have demonstrated the microheterogeneous nature of ionic liquids, leading to nanoscale ordering of polar and non-polar domains.

The *Light Scattering Laboratory* (LSL) has successfully applied for two Indian patents and an international patent application under PCT. The LSL group has set up the first laboratory doing drug protein interactions on therapeutically important proteins such as p300 and CARM1 using surface enhanced Raman spectroscopy (SERS) and have developed the proof of principle for diagnostics using SERS in the HIV subtype detection without PCR amplification. The LSL group has now fully functional program on nano-biotechnology and many industrial collaborations are in the pipeline.

A state of the art Tip Enhanced Raman spectroscopy (TERS) is being developed for Raman imaging, which should be commissioned in 2009 under the Nano-Unit of Department of Science and Technology

In the *Ceramics Lab* it was discovered that the glass ceramics of composition  $\text{CaO-P}_2\text{O}_5\text{-SiO}_2\text{-MO}$  (M = Na, Mg, etc) are highly bioactive and can be successfully used as a tissue engineering material for bone and tooth reconstruction and substitution because of their ability to form hydroxyapatite (HA) when implanted. A hierarchically porous bioactive glass of composition 80 mol%  $\text{SiO}_2$  and 15 mol% CaO (MBGH) was synthesised using pluoronic P123 and glucose-derived amorphous carbon submicron spheres as templates. While the carbon spheres leave behind pores of 300 nm to a few  $\mu\text{m}$  after calcination, the walls of these pores contain orderly arranged mesopores of 3-5 nm orchestrated by the pluoronic polymer. The role of carbon spheres is not only to create pores but also to aid in increased growth rate of hydroxycarbonate apatite in simulated body fluid (SBF). The negatively charged carbon spheres favour the local enrichment of calcium ions and favours the formation of amorphous calcium phosphate around the surface. On calcination, the walls of the macropores contain a crystalline hydroxycarbonate apatite nuclei. MBGH also exhibits an accelerated growth of monoclinic-like apatite in SBF. The in vitro activity has been studied by XRD, FT-IR, FESEM and TEM.

Nanorod brushes of  $\alpha\text{-Al}_2\text{O}_3$ ,  $\text{MoO}_3$  and ZnO have been synthesized using amorphous carbon nanotube ( $\alpha\text{-CNT}$ ) brushes as the starting material. The brushes of  $\alpha\text{-Al}_2\text{O}_3$  and  $\text{MoO}_3$  are made up of single crystalline nanorods. In the case of ZnO brushes, the nanorod bristles are made by the fusion of 15 to 25 nm size nanoparticles and are porous in nature. Metal oxide nanorod brushes thus obtained have been characterized by XRD, FESEM, TEM and Raman spectroscopy. Single crystalline ruby nanorods were obtained by introducing chromium ions during the synthesis of alumina rods.

In the *Nano Materials Laboratory* innovative methods to pattern nanomaterials at the nanoscale were developed. Highlights from this laboratory include direct write patterning of Pd nanowires by electron beam lithography and their electrical characterization, creating nanotrenches in polymeric films using an electrically biased AFM tip and entrapping metal nanoparticles and fullerenes in such trenches, fabrication of biochip consisting of micron sized morphology controlled nanocrystalline metal substrates and large area patterning of metal nanostructures using soft lithography techniques. The above activities are aimed towards fabricating devices from functional nanomaterials.

A collaborative project related to inexpensive SERS substrates has been taken up along with an industry partner, Yashnanotech, Mumbai.

The *Molecular Electronics Laboratory* has recently established an interesting approach to gauge the transport length scales; more specifically electron vs. hole transport length scales – an important parameter in ambipolar devices such as solar cells and FETs. The approach is based on photocurrent scanning of a device with asymmetric electrodes and examining the photo-induced current decay outside the overlapping-electrode region (negligible field). The method is also useful to study the order parameter in anisotropic systems, ex.: nematic liquid crystalline films. Narayan and co-researchers have developed the capability to routinely fabricate polymer solar cells with efficiencies up-to 4% (energy conversion efficiency under AM 1.5). A critical bottleneck for the reduced fill factor in organic cells was found to arise from the cathode-polymer interfacial factors. A recent finding in the laboratory points to use of low-melting temperature

liquid metal alloy systems which can be printed (the method utilizes the deformation of the liquid- drop via an external field) on these semiconducting organic films, paving the way for facile and vacuum-free fabrication of polymer solar cells. The research team has also recently found that events such as dipole moment fluctuations and proton-transport introduced by photoexcitation in a membrane protein system (bacteriorhodopsin) in form of a monolayer film can be quantitatively followed by studying the transport behaviour of the conducting polymer substrate on which the protein is anchored.

*Nano Materials Laboratory:* Prof C N R Rao's interests include novel synthetic strategies, development of new tools of characterization, phase transformations, transition metal oxide systems, open-framework materials and nanomaterials. Of special interest are the phenomena of metal-insulator transitions, high-temperature superconductivity, colossal magnetoresistance, and biferroicity. In the last few years, extensive studies have been carried out to understand charge ordering and electronic phase separation in rare earth manganates and cobaltates. New biferroic materials such as  $\text{BiMnO}_3$  and  $\text{YCrO}_3$  have been discovered. Multiferroic properties of charge ordered manganites are being explored.

In the area of nanomaterials, zero-dimensional nanocrystals, one-dimensional nanowires and nanotubes as well as two-dimensional nanowalls and nanofilms have been explored. Thus, nanocrystals of materials such as CdS, transition metal oxides, III and V nitrides such as GaN have been synthesized by employing novel chemical strategies and characterized by various means. Magnetic properties of nanoparticles of CoO, MnO and NiO have been investigated. Metallic  $\text{ReO}_3$  nanoparticles have been prepared for the first time and characterized by their plasmon resonance. Nanowires of various metal oxides, chalcogenides, nitrides and carbides have been prepared by carbothermal means and also by soft chemistry. Typical of the inorganic nanowires studied include  $\text{Ga}_2\text{O}_3$ ,  $\text{SiO}_2$ , Si, SiC, GaN, InN, CdS and ZnS. Several properties (e.g. optical, magnetic, gas sensing) have been investigated. Growth of nanomaterials is being investigated by x-ray scattering and other techniques.

Epitaxial SiC overlayer was formed on Si(111) substrate. 2 ML carbon was deposited by ion-induced deposition into a Si(111)  $7 \times 7$  surface. This interface was exposed to  $\text{Ar}^+$  ion of varying energies, and it was found that at a threshold energy of 600 eV, a SiC interface is formed at room temperature. In-situ XPS including core-level, valence level and angular dependence study were used to monitor the effects. Experiments were also carried out for the GaAs/GaN epitaxy. The top layers of GaAs were converted into GaN by  $\text{N}^+$  ion bombardment. Ga rich GaAs(001) surface was formed by  $\text{Ar}^+$  ion bombardment by observing core-level XPS, to follow the evolution of the GaN surface. Incident ion energy and flux were varied to find the optimal condition for this room temperature conversion of GaAs into GaN.

#### **New programmes launched:**

Establishing a heteroepitaxy laboratory for growth and characterization of GaN and related materials at ICMS, JNCASR. Under this a state-of-the art Molecular Beam Epitaxy system is being procured.

Setting up of a "National facility of ultra high resolution electron microscopy at JNCASR" under the aegis of DST. Under this an aberration corrected TEM with accessories is being procured.

*Carbon Laboratory:* Besides finding new methods of preparing different types of carbon nanotubes (including junction nanotubes), nanotubes of various inorganic materials have been synthesized for the first time by employing novel strategies. Properties of some of these materials are being investigated (e.g. supercapacitance, photovoltaic properties). Another unique material being investigated is nanographene. Functionalization and solubilization of nanostructures are being pursued.

*Frame Work Laboratory:* Organically templated open-frame inorganic materials are an important class of hybrid materials. Major contributions from here have been on open-framework metal phosphates and carboxylates. The use of oxyanions such as sulfate, selenate and selenite to design open-framework structures has been successfully explored. The mechanism of formation of these complex architectures has been another important aspect of study. Magnetic properties of Kagome structures are being investigated to understand their relation to the spin states of the transition metal ions.

*Super Conductivity Laboratory:* Thin films of superconducting  $(\text{Cu,C})\text{Ba}_2\text{CuO}_{4\pm y}$  was fabricated by rf magnetron sputtering. The superconducting onset temperature ranges between 25 – 40 K. A high critical current density was obtained for Bi-2212 thin films ( $T_c = 95$  K) prepared by pulsed laser deposition. Large ferroelectric polarization ( $16\text{mC/cm}^2$ ) was observed in  $\text{BiAlO}_3$  prepared under high pressure and high



temperature. It was established that oxygen plays an important role in determining the structure and properties of  $\text{BiMnO}_3$ . The stoichiometric compound is canted antiferromagnet whereas the oxygen deficient compounds are ferromagnet. Following the observation of universal ferromagnetism in oxide nanoparticles, GaN and CdS nanoparticles have been shown to be ferromagnetic. The ferromagnetism originates from point defects at the surface of the nanoparticles. It appears that ferromagnetism is universal feature of inorganic nanomaterials.

An Indo-Japan program has been initiated to work on multi-order parameter systems such as superconductor and multiferroics under Department of Science and Technology, India and Japan Science and Technology, Japan.

The following are the members of the Unit:

**Chair**

C N R Rao  
Ph D, D Sc, F A Sc, F N A, F R S,  
F T W A S, Hon. F R S C

**Professors**

K S Narayan  
G U Kulkarni  
S M Shivaprasad  
Ph D, F N A Sc.  
Ph D  
Ph D

**Associate Professors**

S Balasubramanian  
N Chandrabhas  
Ph D  
Ph D

**Faculty Fellows**

M Eswaramoorthy  
A Sundaresan  
Tapas Kumar Maji  
Ph D  
Ph D  
Ph D

**Fellows**

N S Kini  
K Ramesha  
Ph D  
Ph D

**Technical Officers**

V Sreenath (BE), S Srinivas (BE), Usha Govind Tumkurkar (M Phil)

**Lab Assistants**

J Anil Kumar (DEE), B S Vasudev (BE), Basavraj Devaramani (BE)  
Alla Srinivasa Rao (BE)

**Research Associates**

Prabhakar Rao K

**Application Scientist**

Kiran Ashokrao Kulkarni

**Technical Assistant**

N R Selvi

**R & D Assistants**

Ande C Krishna, Aniket Arvind Kulkarni,  
Gurunatha K L, Jasmeet Singh Chawla, Kavitha G,  
Madhu C, Manu Hegde, Narayanaih Cheedarla, Pearl  
Loraine Saldanha, Pramod Vincent Menezes,  
Rajashekarayya, Sameer Y Vyasamudri, Satish Shetty,  
Shashikiran B S, Sonia B, Suman Majumdar,  
Thirumurugan.

**Junior R & D Assistants**

Shruthi Badhwar,  
Mune Gowda A.

## 2. Education Technology Unit

The Unit is actively involved in the concept, production and development of multimedia CD-ROM's especially for school students and teachers in various disciplines of science. The Unit has been involved in developing and producing CD-ROMs and books in vernacular Indian languages. The project from DST 'Nanoworld – A CD-ROM on Nanoscience and technology for school children' was taken up by ETU. The Unit has organized many science popularization programs in various parts of the country.

The CD-ROM on Nanoscience & technology was developed and produced for students of high school and Pre-university levels. The interactive CD-ROM has nine topics and serves as an introduction to Nanoscience and technology. The script and narration was provided by Prof. C. N. R. Rao. In the CD-ROM some basic aspects of nanoscience and technology are presented. Various types of nanomaterials with examples and some of their properties are explained. A few simple experiments are performed to demonstrate the preparation and characterization of nanomaterials. It also deals with applications of nanomaterials. The CD-ROM also contains interesting information given in the form of Hottext. The inlay card describing briefly the objective of the CD-ROM, the contents, and a brief write-up about the author was designed and printed.

The CD-ROM 'Nanoworld' was released at the function 'Children's Nano' as part of 'Bangalore Nano-2007' held on December 7, 2007. 2000 CD-ROM's were procured by the Department of Information Technology, Biotechnology and Science & Technology, Government of Karnataka for distribution to the participants at the above function.

ETU presented a 30-minute multimedia demonstration of excerpts from the CD-ROM 'Nanoworld' at the above function. As part of the release function, ETU designed, printed and displayed attractive and informative posters, pamphlets highlighting the features of the CD-ROM.

Hindi translation and production of the **Learning Science** series both as CD-ROMs and books were taken up. The work on the translation, development of the CD-ROM and design and formatting for the print-ready copies of the books is being done simultaneously.

The Part 1: **Universe, Solar System and Earth** and The Part 2 titled **The world of physics and energy: Learning physical principles** comprising topics in Physics and energy have been completed. Part 3 comprising topics in **Chemistry, Air and Water** with over thirteen topics and subtopics is currently being translated and will be completed shortly. ETU is actively involved in popularizing science through its programs like 'A celebration of chemistry', 'Learning Science' and 'Vignyana Kaliyona'.

### *Programs*

ETU has organised science popularization programs for school children and teachers in collaboration with many institutes across the country.

The science popularization program 'A Celebration of Chemistry' was conducted on April 26, 2007 in association with the University of Kalyani, Kalyani, West Bengal. In this program Prof. C.N.R. Rao gave a lecture titled Celebration of chemistry to high school students and teachers. This was followed by a 30 minutes multimedia presentation of excerpts from the CD-ROM titled 'Understanding chemistry'.

In the program on Project Oriented Chemical Education, for undergraduate college students, a multimedia presentation from the CD-ROM '*Understanding Chemistry*' was presented by the Unit in May-June 2007.

The science popularisation program "**Vignyana Kaliyona**" in Kannada was organized at the University of Mysore, Manasagangotri, Mysore on 7<sup>th</sup> July 2007 and at Bellary on 15<sup>th</sup> December 2007. Prof. C.N.R. Rao gave the theme lecture in Kannada followed by a multimedia presentation of the excerpts from the Kannada CD-ROMs titled 'Vignyana Kaliyona' `Samputa 1, 2, 3 & 4' developed and produced by Education Technology Unit, JNCASR. Around 600 students and 120 school teachers attended the program in Mysore and 1500 students attended the program at Bellary.

The programme '**Learning Science**' is organised by JNCASR in association with different institutes for students and teachers from various schools. It was conducted on 24<sup>th</sup> September 2007 at Sikkim Manipal Institute of Medical Sciences (SMIMS), Sikkim, at Guru Nanak Dev University, Amritsar, on 24<sup>th</sup> October 2007, and on 2<sup>nd</sup> January 2008 in association with National Institute of Oceanography, Goa. At all the above



programs Prof. C.N.R. Rao gave the theme lecture 'Learning Science' followed by a multimedia presentation using excerpts from the CD-ROMs "Learning Science Vol. 1 & 2" developed and produced by Education Technology Unit, JNCASR.

National Book Trust, New Delhi has taken up the printing, publication and distribution of the 'Learning Science' books in English and other Indian languages. The Kannada version of the books titled 'Vignayana Kaliyona' 'Samputa – 1 to 4' was released at a function held on 18<sup>th</sup> August 2007 at Bangalore.

The unit presented a multimedia program "India @ sixty" as part of the Centre's program to celebrate 60 years of our independence. It was highly appreciated. This will be used as part of our various programs for school children.

On 27<sup>th</sup> November 2007, as part of Children's Science Congress-2007 organised at JNCASR, ETU presented a 35 minute multimedia presentation of excerpts from the CD-ROM 'Nanoworld'. ETU also screened a short film titled 'CNR Rao - A Life time Professor' to students and teachers participating from various Navodaya Vidyalaya Schools. ETU presented the participating teachers with the books 'Learning Science' and 'Understanding Chemistry'.

JNCASR celebrated National Science Day on Monday 25<sup>th</sup> February 2008. ETU presented excerpts from the multimedia CD-ROM "Nanoworld" developed and produced by ETU. About 250 students and teachers attended the program. ETU presented a thirty minute multimedia presentation from the CD-ROM "Nanoworld" for school and college students participating at ICONSAT-2008 held at Chennai Trade Centre, Chennai on February 28<sup>th</sup> 2008 as part of an awareness program on Nanoscience and Technology.

The following are the members of the Unit:

<b>Incharge</b> V Krishnan	Ph D, F A Sc, F N A, F T W A S
<b>Coordinator (Hon)</b> Indumati Rao	M A, M S, C E
<b>Technical Officer</b> Jatinder Kaur	M Sc
<b>Multimedia Asst. (Hon)</b> Sanjay Rao	B Sc, Cert. Multimedia

### 3. Engineering Mechanics Unit

#### *Aerospace Fluid Dynamics*

In the kinetic mesh-free method for solving problems in CFD, inner iterations were used successfully to enhance the accuracy of Least Squares Kinetic Upwind Method (LSKUM). For the modified KFVS adjoint method, the m-KFVS-AD code was developed to solve 2D and 3D inviscid flows with minimal numerical dissipation. Lambda-shocks over Onera M6 wing, fish tail shock at the trailing edge of airfoils were captured very crisply and accurately by m-KFVS-AD method.

*Flapping flight:* We are exploring various wing kinematics and wing flexibility to enhance the efficiency of lift generation in flapping flight. This study has helped in getting a grant from US-AFOSR.

#### *Geophysical Fluid Dynamics*

In connection with flows of geophysical interest, a new 'buoyancy-driven' instability mode has been discovered in a high Prandtl-number plane thermal plume. It has been found that the scaling of critical Rayleigh number with Prandtl number differs in high and low Prandtl number limits. In supersonic Couette flows, it has been shown that the viscosity-stratification leads to a 'delayed' transition in terms of both modal and non-modal stability. Our ongoing work on secondary instability of acoustic modes unveiled a few unexpected results for sub-harmonic disturbances.

A review of recent experimental and computational studies on the fluid dynamics of clouds was presented as an invited lecture at an IUTAM symposium at Nogoya. As part of the review, a new analysis of entrainment and entrainment coefficients in different experiments has been presented.

Wavelet techniques have been used to detect periodicities in Indian monsoon rainfall and to test them for statistical significance. This work has led to the discovery of several new significant periodicities. Using new test procedures involving Monte Carlo methods, we have established strong regional differentiation in multidecadal connections between monsoon rainfall and solar activity. The results suggest that solar activity displaces and/or alters the strength of large coherent systems in the tropical atmosphere, like the Hadley and Walker cells. A comprehensive review of field experiments on the Indian monsoons carried out during the last 20 years has been published during the year.

In a new project on data assimilation for application in a general circulation model, a 3D Lorenz model has been chosen for applying 'ensemble Kalman filter' and the coding has been completed.

An experimental setup has been designed to study convection in the limit of very high Rayleigh ( $\sim 3 \times 10^{11}$ ) and Schmidt (proxy to Prandtl number,  $\sim 5 \times 10^5$ ) numbers to mimic mantle convection.

Effect of radiation on convection in the participating medium: This study involved both field and laboratory experiments and resulted in one MS thesis and one PhD thesis is under evaluation.

An ongoing analytical-cum-numerical study with an MS student (V.K. Ponnulakshmi) seeks to determine the effect of radiation on an otherwise convectively unstable temperature profile. The study is expected to yield insight into the stability of the well-known Ramdas layer.

#### *Complex Fluids*

An ongoing analytical study with an MS student (Vivekanand Dabade) aims to determine the competing effects of inertia and viscoelasticity on the orientation of axisymmetric particles (ranging from slender fibres to disk-shaped particles) sedimenting in an otherwise quiescent fluid, and in presence of an ambient shearing flow.

An ongoing analytical study with a pair of summer research fellows (Lavanya Mohan and Vivek Raja) of the heat transfer from neutrally buoyant drops immersed in an ambient shearing flow. The viscosity ratio of the drop was found to play a crucial role in determining the existence of closed streamlines, and thence, rate of heat transfer from the drop to the surrounding fluid. For dilute emulsions, it was shown that inertial



effects at the micro-scale reverse the sign of the normal stress differences even at very small volume fractions, thereby having a significant effect on the viscoelastic behavior.

An analytical-cum-numerical study to investigate pair-particle interactions in the shearing flow of a viscoelastic suspending fluid has been undertaken. This study is expected to yield useful insights into the well-known phenomenon of particle-chaining in viscoelastic suspensions. An analytical study of clusters of sedimenting particles at both low and high Reynolds numbers was undertaken. A physical mechanism for the self-similar expansion of such clusters was identified. The mechanism relies on far-field repulsive Oseen interactions, and is therefore independent of the Reynolds number. The theoretical predictions were confirmed via experiments.

### ***Granular Matter***

A universal criterion for the onset of shear-banding transition in sheared granular fluid has been discovered. This shear-banding criterion also holds in atomistic fluids as well as in other complex fluids. Using weakly nonlinear stability theory, a Landau equation has been derived that describes the onset of shear-banding in granular Couette flow. This work clearly showed that there are sub-critical shear-banding solutions in dilute flows, a prediction that agrees with previous numerical simulations.

Using particle dynamics simulations, it has been shown that the translational and rotational velocities are strongly correlated in a sheared granular flow; however, there is no orientational-correlation induced singularity at perfectly smooth limit which is at variance with some recent work on freely cooling granular gas. It has been shown that the density and Coulomb friction have non-trivial signatures on both orientational correlation and velocity distribution functions. The validity of a possible 'multipolar' description of rough granular materials is currently being probed.

Using large-scale particle simulations of granular Poiseuille flow, new vortical structures have been identified in three-dimensions. Our current work is focused on explaining these structures from the linear stability theory.

In connection with Max-Planck-India Partner Group (funded by Max-Planck Society Germany), a simple model has been developed for pattern formation in an oscillatory fluid-particle suspension. It is shown that the fluid-particle drag drives a new traveling-wave instability in this flow.

### ***Stability***

Continuing earlier studies on the mixing layer, it has been shown that the stability or otherwise of the flow depends strongly on the norm chosen for describing disturbance kinetic energy in the non-parallel flow.

Over the past several years this group has been studying the stability of flows which change slowly downstream. One of our objectives last year was to study general two-dimensional flows without the restriction of "slowly changing". A two-dimensional eigenvalue solver has been developed for this, and we are obtaining interesting preliminary results. Transient growth is being studied from a more basic point of view. A numerical method for interface problems is being developed to study the hydraulic jump. In the presence of density stratification it was shown that vortex merger is delayed. An inviscid study leads to some understanding of why.

This research deals with the equations of motion for  $N$  point vortices moving on an  $S^2$  sphere. This system, which is referred to as the PVS (Point Vortices on Sphere) system, is shown to be related to some other physical systems like the pendulum system, spring mass system and the geometry of the chemical molecules, through analogies.

An analytical-cum-numerical study was undertaken to characterize a novel instability in a bacterial (active) suspension. The eigenspectrum has been determined both in the presence and absence of chemoattractants, and the underlying physical mechanisms for the existence of unstable modes have been identified. This instability is expected to play an important role in determining the level of velocity fluctuations in these systems.

## ***Turbulent flows***

The use of wavelet techniques in the study of turbulent flow (e.g. jet) has led to measurements related to the life cycle of a coherent structure as it passes through a test section in the apparatus in which the jet is produced. A review of wavelet methods has been published.

An analytical study of the structure of elastic vortices at high Reynolds number is being carried out with a PhD student (Anubhab Roy) in order to understand the structure of high speed vortical flows of dilute polymer solutions including polymer turbulence. The study also led to the rather serendipitous discovery of the continuous spectrum of the well-known Rankine vortex. The new family of modes, which render the eigenspectrum complete, and play a crucial role in the interaction of vortices with ambient turbulence, have been labeled as the '*non-Kelvin modes*'.

To study of wakes in stratified medium, we established a facility to study the dynamics of wake and looked into the effect of stratification on the growth and collapse of wakes and its characteristic time and length scales.

The following are the members of the Unit:

### **Chair**

Roddam Narasimha

Ph D, F A Sc, F N A, FTW A S, F R S

### **Associate Professor**

Rama Govindarajan

Ph D, F N A Sc

K R Sreenivas

Ph D

### **Faculty Fellows**

Meheboob Alam

Ph D

Ganesh Subramanian

Ph D

Bharat Khushalani

Ph D

### **Senior Associate**

S M Deshpande

Ph D, F A Sc

### **Research Associate**

Konark Arora, Soumyajit Mukherjee,

Vinod N, Sarita Azad (RA (P))

### **R & D Assistants**

Ashish Malik, Keshva Shrinivas, Mallappa Achanur,

Mukund Vasudeva Ponnulakshmi V K, Rajaram

Lakkaraju, Vineetha Mukundan, Sikata Samantaray





## 4. Evolutionary and Organismal Biology Unit

The EOBU is one of the most active research and teaching groups in India interested in the broad fields of evolution, ecology and behaviour. The Unit has extensive and state-of-the-art facilities for routine and specialised researches on *Drosophila*, as well as computational, physiological, behavioural and molecular investigations of fundamental questions in organismal and functional biology.

The faculty of the Unit with their research students continued their ongoing research in the broad areas of chronobiology, life-history evolution and population dynamics. In particular, significant publications during the academic year focused on the neuronal and molecular aspects of circadian rhythm phenotypes and the independent evolution of different stability attributes of populations as a by-product of life history evolution. The researches have appeared in publications in top journals of ecology and neurobiology.

### *Chronobiology*

- a. *Genetic and molecular basis of egg-laying and mating rhythms in Drosophila melanogaster.* We have demonstrated that individual females of the fruit fly exhibit robust circadian rhythms in egg-laying behaviour. We also made the significant discovery that the circadian pacemakers in ventral lateral neurons, which control the emergence and locomotor activity rhythms, are not required for the persistence of circadian egg-laying rhythm. We now know that the egg-laying rhythm is not controlled by the set of genes that control eclosion and locomotor activity rhythms.
- b. *Genetic and ecological basis of circadian rhythms in the ant species Camponotus compressus.* The circadian organization of the *Camponotus* ants is adaptively plastic, and assumes appropriate configurations depending on their roles in the colony.
- c. *Light-mediated developmental plasticity and seasonality in pre-adult development of ants.* In a recent study, we have shown that the pre-adult development of two sympatric species of ants (*C. compressus* and *C. paria*) is speeded-up by ~46% under constant light conditions of the laboratory. These two ant species have evolved different developmental strategies to deal with seasonal changes in photoperiod. The day active species (*C. paria*) develops faster under longer days, while the night active species (*C. compressus*) develops faster under longer nights.
- d. *Evolution of circadian clocks in D. melanogaster.* We have created populations of fruit flies *D. melanogaster* for the purpose of understanding how circadian clocks evolve, and how the molecular genetic architecture of underlying clock mechanisms responds to selection pressures present in the environment. In a series of recent studies we have been able to show that selection for “morning” and “evening” adult emergence yields populations of flies having morning and evening preference for behaviour. Further, we have shown that circadian clocks and life history traits in these flies undergo correlated changes; morning populations develop faster, and have faster running clocks, while evening populations develop slower, and have slower running clocks. Preliminary studies have also shown that the molecular clock mechanisms in such selected populations are also significantly different.

### *Evolutionary biology and Population Ecology*

Theoretical studies have suggested constant mortality in the pre-reproductive phase should have a major stabilizing effect on population dynamics. Experimentally, however, *Drosophila* populations maintained on a destabilizing food regime were shown to exhibit stabilization of the dynamics, relative to controls, at 20% and 40% imposed adult mortality. It has been hypothesized that this somewhat counter-intuitive result is due to an interaction of the pattern of extinction in these small populations with mortality rate, and further theoretical investigations are underway. Extensive computer simulation studies on the effects of migration on metapopulation dynamics and stability, revealed that intermediate levels of migration (5 - 10% per generation) promote stability of metapopulations via asynchrony among subpopulations, whereas higher migration rates promote synchrony and hence unstable metapopulation dynamics. This pattern of results was shown to be robust to a variety of assumptions about the nature of migration (density-dependent, density-independent or stochastic), as well as different spatial arrangements of

demographically heterogeneous or even empty patches, results that are reassuring because they suggest that much realistic spatial detail can safely be ignored while modeling metapopulation dynamics. An interesting result is that if migration does not occur every generation, the stabilizing effects of intermediate levels of migration are lost. Experiments with *Drosophila* metapopulations verified that 10% migration promoted stability via asynchrony, whereas 30% migration led to synchrony and hence instability at the metapopulation level.

The following are the members of the Unit:

**Chair**

M K Chandrashekar Ph D, DSc, FASc, FNA, FTWAS

**Honorary Professors**

Raghavendra Gadagkar Ph D, F A Sc, FNA., FTWAS  
Vidyanand Nanjundiah Ph D, F A Sc, FNA

**Professor**

Amitabh Joshi Ph D, F A Sc, F N A Sc

**Associate Professor**

Vijay Kumar Sharma Ph D

**Research Associate**

Punyathirth Dey

**Fellow (DBT)**

B M Prakash

**R & D Assistants:**

Ananda T, Balaka Mondal, Joy Bose, Madhumala KS,  
Purvi Jain, Sajith V S, Shanaz Rahman Lone,  
Sudarshan R Chari, Vijay Vrajan.

**R & D Assistants (Jr):**

Deepak Chowdhury  
Lalwani Pankaj Omprakash



## 5. Geodynamics Unit

The Researches carried out in the Unit were : Intensive field work in the Jadhganga valley, the main branch of the Bhagirathi Ganga, in district Uttarkashi, Garhwal Himalaya, was carried out in early June 2007 in collaboration with Prof K Pande at IIT, Mumbai. Considerable critical data on structure, petrotectonics and geomorphology were collected.

### *The Unit proposes:*

- (i) Research in collaboration with Prof K Pande, IIT, Mumbai on “The basic Intrusives in the Deoban succession in eastern Kumaun Himalaya”
- (ii) Hindi work on “The river Saraswati that vanished in the Late Holocene time”

#### **Chair**

K S Valdiya

Ph D, F A Sc, F N A, F N A Sc, FTWAS

## 6. Molecular Biology and Genetics Unit

Eukaryotic genome is packaged into nucleo-histone complex called as chromatin in the interphase nucleus. Male germ cell differentiation in the testis is one of the most fascinating differentiating model systems wherein there is extensive chromatin remodeling both during meiotic prophase and during the spermiogenesis process. Mammalian spermiogenesis is characterized by a unique chromatin remodeling process in which histones are replaced by transition proteins (TP1), TP2 and TP4 which are further replaced by protamines. The *Cancer Biology Lab* has shown previously that the import of TP2 into haploid spermatid nucleus requires the components of cytosol and ATP. The lab has now carried out a detailed analysis to characterize the molecular components underlying the nuclear translocation of TP2. Real time PCR analysis of the expression of different importins in testicular germ cells reveal that importin-4 and importin  $\beta$ 3 are significantly up-regulated in tetraploid and haploid germ cells. They also carried out physical interaction studies as well as *in vitro* nuclear transport assay using recombinant TP2 and the nuclear localization signal of TP2 (TP2-NLS) fused to glutathione S-transferase in digitonin permeabilized haploid round spermatids and identified importin-4 to be involved in the import of TP2. A three dimensional model of importin-4 protein was generated using the crystal structure of importin  $\beta$ -1 as the template. Molecular docking simulations of TP2-NLS with importin-4 structure led to the identification of a TP2-NLS binding pocket spanning the three helices (helices 21-23) of importin-4, which was experimentally confirmed by *in vitro* interaction and import studies with different deletion mutants of importin-4. In contrast to TP2, TP1 import was through a passive diffusion process.

Non coding RNAs constitute a huge repertoire of gene regulatory molecules. Their previous, fine resolution characterization of a mouse meiotic recombination hotspot from chromosome 8 resulted in identification of a 2.4 kb unspliced and polyadenylated non coding *mrhl* RNA. The gene is expressed in multiple tissues and is also present in rat but not in humans. This lab has shown that the *mrhl* RNA gets processed to a small 80nt RNA species and is mediated by Drosha complex. They have also observed that the 80nt Drosha product could be processed further to a 22nt small RNA by Dicer in an *in vitro* reaction. However, this 22nt product was not detected *in vivo*. The 80nt as well as the 2.4kb full length RNA are nuclear localized showing distinct punctuate nuclear signal. The colocalization of the non-coding RNA with Drosha and Nucleolin suggest nucleolus as the site of processing of the 2.4kb primary transcript. Additional foci of processed 80nt RNA was also observed outside the nucleolus suggesting its role in some specific chromatin domain(s).

Considerable progress has been made in identifying several differentially regulated genes in primary and secondary gliomas. The *Cancer Biology Lab* is presently investigating on the role of AEBP1 in the biology of Glioma progression. They have also used Systems Biology approach to understand the networking of the key pathways that are perturbed in Primary and Secondary GBM

The *Molecular Parasitology Lab* has initiated a 'Systems Biology' approach to decipher the interactome of various metabolic pathways of the *Plasmodium* apicoplast for complete understanding of the biological network of the parasite, needed to develop more effective therapeutics. They demonstrated that the trafficking of the apicoplast proteins is a good target for developing antimalarials.

In order to understand the kinetochore architecture of *C. albicans*, *Molecular Mycology Lab* identified and characterized two kinetochore proteins: CaMtw1 and CaDad2p. The genes, coding for these proteins, are shown to be essential for viability and required for chromosome segregation during mitosis.

Dr. Sanyal has obtained a research grant for a period of 3 years from DST to work on a project entitled "Characterization of factors required for determining centromere identity using human pathogenic yeast *Candida albicans* as a model system".

The *Molecular Virology Lab* at MBGU has made significant progress in evaluating the Siddha medicine in the first ever human clinical trial of India for HIV/AIDS management. The volunteer recruitment has been completed and sample collection and clinical evaluation are presently in progress.

Prof Uday has initiated work on generating and optimizing Tat DNA vaccines for HIV. The unique strategy we used seems to generate strong immune responses.

The *Vascular biology Lab* has established protocols for human embryonic stem cell derivation, propagation, cryo-preservation and characterization under stringent quality control. They have derived two new hES cell lines, *BJNhem19* and *BJNhem20* from discarded grade III human embryos that were not suitable for *in vitro* fertility treatment. The cell lines have been characterized for their pluripotent properties both *in vitro* and *in vivo*. They have also established protocols to differentiate these cells to the cardiac lineage- they



can be cultured to purity, propagated, frozen and thawed successfully. These cell lines have been accepted for deposit by the UK Stem Cell Bank. In addition they are continuing the characterization of novel genes *asrij* and *rudhira* in human ES cells, mouse and *Drosophila*.

*Transcription and Disease Lab* at MBGU has employed glucose derived carbon nanospheres for introducing *cell impermeable*, only known HAT activator into the cells as well as animals. This could induce hyperacetylation in the living system thus providing an impetus to the field of direct HAT activation in basic biology as well as therapeutics.

A new line of research in the area of Nano biotechnology has been introduced to understand the interactions of nanomaterials with the dynamic human genome and its functional consequences. They are focusing to understand the interactions of nanomaterials with the dynamic human genome (chromatin) and its functional consequences. This project is being funded by DBT.

The following are the members of the Unit:

**Chair**

M R S Rao

Ph D, F A Sc, F N A, F N A Sc,  
F T W A S

**Honorary Professors**

Dipankar Chatterji

Ph D, F N A Sc, F A Sc, F N A

H Sharat Chandra

Ph D, F A Sc, F N A

**Associate Professors**

Anuranjan Anand

Ph D

Hemalatha Balaram

Ph D

Maneesha Inamdar

Ph D

Namita Surolia

Ph D, F A Sc, F N A Sc

Ranga Uday Kumar

Ph D

Tapas Kumar Kundu

Ph D, F N A Sc

**Faculty Fellow**

Kaustuv Sanyal

Ph D

**Research Associates**

Anil Mukund Limayee, Chandrima Das, Jayashree  
Ladha, Kiran Batta, Mantelingu K, Rohman Nashiour,  
Ravindra K C, Shritapa Dutta Sunitha S N (P).

**Fellows (DBT)**

Mylarappa, B N

Chethana, S

**R & D Assistants**

Ajeesh B R, Ananad KK, Anil Babu, MHKH,  
Anitha C A, Antony Augustin, Arunima Chatterjee,  
Ashok Reddy, Avinash, Balasiddiah A, Badi Sri  
Shailaja, Benaka Prasad, Bharath GN, Bindu KM,  
Bopanna, Chincy Thankachan, Divya Bharati,  
Geddam M Chowdhuri, Imitiaz Nisar Lone,  
Jinal Shukla, Keerthi Nambiar T C, Manasa R,  
Manjunath S, Meenakshi Sharma, Mohan V, Museer  
Ahmad Lone, Naga Shankar G, Nandasree,  
Parvathy V, Prashanta Kumar Dash, Rahul MG,  
Rajaguru Aradhya, Rajesh Abraham Jacob, Rajesh VM,  
Ramesh Reddy, Ramesh Chowdhury V, Rekha  
Rituparna Mandal, Roopa, Roshen Elsa Rajan,  
Sainitin, D, Sanjukta Chakraborty, Satish V, Sayali  
Mukherjee, Senthil Kumar T, Shivashankar TV,  
Siddhartha Paul, Sonali Mehrotra, Sowmya Prabhu,  
Sreedevi P, Sriram S, Srivatsa MS, Sujay T M,  
Suresh Babu V, Thanuja G R, Tariq Ahmad Najar,  
Uttara Chakraborty, Veda Murthy B M.

## 7. Theoretical Sciences Unit

Several studies have been carried out in the general field of the statistical mechanics of turbulence. In particular, a comprehensive numerical study has been used to examine the effects of polymer additives on homogeneous, isotropic turbulence; a detailed study of the bottleneck in the energy spectrum in fluid turbulence has been carried out and its relation to hyperviscosity and Galerkin-truncated inviscid hydrodynamical equations has been elucidated; the interaction of turbulent spiral waves with inhomogeneities in mathematical models of cardiac tissue has been studied by using state-of-the-art simulations for realistic ionic models. The statistical mechanics of bosons in a confining potential with an optical lattice has been studied by using an inhomogeneous mean-field theory; the results of this theory are in very good agreement with numerical simulations and experiments

The research group dealing with theory and limitations of low dimensional system in the past year has included the following topics (i) adsorption and dissociation of NO on Rh surfaces (ii) Rh nanocatalysts (iii) ab initio design of magnetic surface alloys (iv) adsorption of methane on graphene and graphite (v) the relationship between ionic and electronic transport in reduced ceria for solid oxide fuel cell applications. Significant results elucidate the finding that the simple criterion for the stability of surface alloys does not work; the adsorption of energies on a variety of hypothetical and realistic surfaces scale linearly with effective coordination number; and the magnetism of Rh clusters interferes with their chemical reactivity.

Grants obtained the Unit include an Indo-French grant (together with the group of Sylvie Rousset, University of Paris), and an Indo-Swedish planning grant (together with Anna Delin, KTH, Stockholm).

Prasenjit Ghosh obtained his PhD, and is now a postdoc at ICTP, Trieste, Italy. Visitors to the group included Brandon Wood from the Massachusetts Institute of Technology, and Yann Girard from the University of Paris.

During the year 2007-08 the research group has focused on the following topics: (i) the role of dynamical length scales in determining slow relaxation in glass forming liquids, (ii) crystal nucleation in supercooled liquid silicon and other systems, (iii) the role of crystal polymorphism in determining glass forming ability, (iv) gelation in model fluids, (v) modeling protein aggregation. The significant accomplishments are the successful vitrification of germanium in high pressure experiments, employing lessons from earlier simulation work conducted in the group. Another significant result has been the demonstration of the relationship between dynamical heterogeneity and relaxation times which are more complex than previously assumed.

The final review of a grant from the Indo-French Centre for the Promotion of Science lead to an “excellent” ranking by IFCPAR.

The School on Biomolecular Simulations Nov 6 - 16, 2007 was organized. A workshop in KITE, Santa Barbara, on “The physics of glasses” was sponsored proposed and approved for April - July 2010.

The following are the members of the Unit:

<b>Chair</b>	
Rahul Pandit	Ph D, F A Sc, F N A
<b>CSIR Bhatnagar Fellow and Hon. Professor</b>	
Kalyan B Sinha	Ph D (Univ. of Rochester), F A Sc, F N A, FTWAS
<b>Associate Professors</b>	
Shobhana Narasimhan	Ph D
Srikanth Sastry	Ph D
Swapan K Pati	Ph D
Umesh V Waghmare	Ph D
<b>Faculty Fellows</b>	
N S Vidhyadhiraja	Ph D
Kavita Jain	Ph D
Subir K Das	Ph D
<b>Research Associates</b>	
Lakshmi Sankaran, Mousumi Upadhyay Kahaly, Anasuya Kundu (P)	
<b>R &amp; D Assistants</b>	
Debabrata Parihari, Gargi Dutta, Nirat Ray (Jr. R&D), Rajavarman K.	



## 8. International Centre for Material Sciences

ICMS is the first international centre of its kind devoted to research, education and extension in materials science, established in the confines of a scientific cum educational institution. The Centre was envisaged by the Department of Science and Technology (DST), Government of India.

The plan to establish the Centre got crystallized in 2007, with the Jawaharlal Nehru Centre for Advanced Scientific Research taking the lead and necessary steps to establish it.

An important and unique activity of ICMS is to provide global research opportunities and to support international exchange programmes.

ICMS is establishing major scientific user facilities to serve both in-house researchers and researchers from other universities. This facility will house specialized instrumentation maintained and run by experts.

The research facilities include: Ultra High Resolution Electron Microscope, Pulse Laser Deposition. Molecular Beam Epitaxy System, X-ray Diffractometer and others

The Centre for Computational Materials Science (CCMS), a constituent of ICMS, is one of the most powerful academic computing resources in the country.

**The ICMS building** design houses several well ventilated offices, well planned Labs, spacious meeting rooms with video conferencing facilities and huge foyer and luxurious halls for the researchers to relax and contemplate.

**An international Visitors' House** is also being established to accommodate visitors especially from abroad.

Although, the building is still coming up, ICMS has already started to carry out the research activities.

### *Fellowship programme*

Sheik Saud RAK-CAM Fellowship : Prof. K. S. Narayan (Senior Fellowship ) and S.R.C. Vivek Chand (Junior Fellowship)

### *Schools and Workshops*

#### *Past:*

1. ICMS-ICMR International Winter School – 2007, Dec 6-13, 2007
2. A joint India-US workshop on Scalable Nanomaterials for enhanced Energy Transport, convenience and Efficiency August 19-21, 2008 (with Purdue University)

#### *Future:*

1. International Winter school – 2008, Dec 8-13, 2008 with ICMR, UC Santa Barbara
2. Chemistry of Materials meeting arranged in collaboration with Swedish Academy of Sciences Feb 2-3, 2009

The following are the members of the Unit:

#### **Professors**

C.N.R. Rao

S. M. Shivaprasad

F.R.S. , Hon. F. R. S.C., Hon. F. Inst. P.,  
Director  
Ph.D. (Karnataka)

**Associate Faculty from CCMS**

Balasubramanian Sundaram

Shobhana Narasimhan

Swapan K Pati

Srikanth Sastry

Umesh V Waghmare

Ph D (IISc), Associate Professor,  
also with CPMU

Ph D (Harvard), Associate Professor

Ph D (IISc), Associate Professor

Ph D (Boston), Associate Professor

Ph D (Yale), F A Sc, F N A Sc,

Associate Professor

**Associate Faculty from CPMU**

Chandrabhas Narayana

M Eswaramoorthy

G U Kulkarni

K S Narayan

A Sundaresan

Tapas Kumar Maji

Ph D (IISc), Associate Professor

Ph D (Anna), Faculty Fellow

Ph D (IISc), Professor

Ph D (Ohio State), F N A Sc, Professor

Ph D (IITB), Faculty Fellow

Ph D (IACS), Faculty Fellow

**Honorary Faculty**

A K Sood

A Govindaraj

F A Sc, F N A, F T W A S

Ph D (Mysore), of SSCU, IISc

**Incharge-Coordinator**

Aruna V Mahendarkar





## 9. Centre for Computational Materials Science

A new interatomic potential model for atomistic simulations of a room temperature ionic liquid, [bmim][PF6] has been developed based on our results from ab initio MD simulations as well as physical property data from experiments. Clusters of this ionic liquid have been studied at varying sizes, ranging between 1-5 nm in order to identify the reasons for their stability. Comparisons are made against water and Lennard-Jones clusters of similar dimensions, to provide reasons for enhanced stability of the liquid phase under confined conditions, even at temperatures below the bulk freezing point.

The faculty members of this Unit have investigated the use of Rh as a nanocatalyst for NO reduction. The size dependence of the elastic and thermal properties of small atomic clusters has also been studied during this year. A step formation energies and interactions on Au(111) surface has been obtained. The stability and magnetic properties of novel surface alloys were also studied. Some new scaling relations for how interatomic bonds depend on coordination number were found.

The major observations, innovations and applications of the studies include:

- (i) All-metal finite clusters have been proposed for the first time and their stability and possible synthetic routes have been discussed.
- (ii) Modified DNA with magnetic ions has been shown to exhibit spintronics behavior with odd and even magnetic interactions.
- (iii) Low-dimensional Graphene nano-ribbons are shown to be magnetic due to edge passivation, with application in photoconduction.
- (iv) A new method based on Kinetic equation approach coupled with Quantum Many Body theory has been developed for calculations of dynamical quantities in electronics applications.
- (v) Porphyrin and related systems in Plants and Bacterial species are thoroughly analyzed for structure-function relationship; and
- (vi) Several organic systems are being analyzed for possible Hydrogen storage materials.

The full phonon dispersions of various carbon nanotubes that are used in estimation of thermal properties have been determined. During our study the size dependence of negative thermal expansion of carbon nano-tubes and its origin was established. Our research has also unfolded the size dependence of structure and physical properties of Se and Te nano-wires. The effects of C-doping in BN nanotubes and B, N doping in carbon nanotubes on their electronic properties are one of our major research findings.

The faculty members of this Unit have a total of 84 publications to their credit during the year 2007-08.

Following were the visitors under Visiting Scientist Programme

Dr. Kirit N Lad, M.S University of Baroda from 16.05.2007 to 08.06.2007, hosted by Prof. Srikanth Sastry.

Dr. Pushpa Raghani, Condensed Matter Sector, SISSA, Trieste, Italy from 15.10.2007 to 29.10.2007, hosted by Prof. Shobhana Narasimhan

Dr. Bhabadyuti Sinha, Lecturer, B.S College, Bankura from 22.10.2007 to 14.11.2007, hosted by Prof. Swapan K Pati

Dr. Prashant Shevgaonkar, Chemical Engineering Department, Vishwakarma Institute of Technology from 03.12.2007 to 14.12.2007, hosted by Prof. Umesh V Waghmare.

Dr. Sudip Roy, Theoretical and Physical Chemistry Department, Darmstadt from 15.02.2008 to 10.03.2008, hosted by Prof. S. Balasubramanian.

Several students have visited the Unit under Visiting Students Programme. Following are the students under this programme:

Mr. Subhrodeep Pathak, SNBNCBS from 28.05.2007 to 20.07.2007 under Prof. Umesh V Waghmare.

Ms. Jayee Bhattacharya, SNBNCBS from 22.07.2007 to 27.07.2007 under Prof. Srikanth Sastry.

Mr. Shuvrajyothi Bhattacharjee, School of Materials Science and Technology, IT-BHU from 24.09.2007 to 09.11.2007 under Prof. Umesh VWaghmare.

Mr. Jun Hee Lee, Department of Physics and Astronomy, Seoul National University from 04.12.2007 to 27.12.2007 under Prof. Umesh VWaghmare.

Ms. Hena Das, Department of Material Science, SNBNCBS from 05.12.2007 to 21.12.2007 under Prof. Umesh VWaghmare

Ms. Nirat Ray, IIT Delhi from 10.12.2007 to 24.12.2007 under Prof. Umesh VWaghmare.

### ***Meetings/Conference/Schools***

A School on “Biomolecular simulations” was held during November 6 – 16, 2007 organized by Prof. S. Balasubramanian, Prof. Srikanth Sastry, Prof. Prabal Maiti and Prof. Satyavani Vemparala.

Workshops and Discussion Meetings were held are as follow:

- (a) ICMS-ICMR winter school on “Chemistry of Physics of Inorganic materials” during December 6-13, 2007 at JNCASR.
- (b) CCMS school on “Numerical Quantum Many-Body Methods in Physics and Chemistry” during October 29 –November 3, 2007 at JNCASR.
- (c) Organized a joint discussion meeting between Colorado State University and JNCASR on January 2008, at JNCASR
- (d) Organized a joint workshop at Evanston, USA between JNCASR and Northwestern University, USA on March 31-April 1, 2008.
- (e) Organized a joint workshop at Colorado, USA between JNCASR and Colorado State University, USA on April 2-April 4, 2008.

The following are the members of the Unit:

#### **Coordinator**

Balasubramanian Sundaram

#### **Members**

Shobhana Narasimhan

Srikanth Sastry

Swapn Pati

Umesh Waghmare

#### **Technical Assistants**

Ershaad Ahamed

Amit Kumar Patel

#### **Programme Assistant**

Venkatesh



## 10. Chemical Biology Unit

### *Stereochemical Criteria for Prediction of the Effects of Proline Mutations on Protein Stability*

When incorporated into a polypeptide chain, Proline (Pro) differs from all other naturally occurring amino acid residues in two important respects. The phi dihedral angle of Pro is constrained to values close to  $-65^\circ$  and Pro lacks an amide hydrogen. Consequently, mutations which result in introduction of Pro can significantly affect protein stability. In the present work, we describe a procedure to accurately predict the effect of Pro introduction on protein thermodynamic stability. 77 of the 97 non-Pro amino acid residues in the model protein, CcdB, were individually mutated to Pro and the *in vivo* activity of each mutant was characterized. A decision tree to classify the mutation as perturbing or non-perturbing was created by correlating stereochemical properties of mutants to activity data. The stereochemical properties including main chain dihedral angle  $\phi$  and main chain amide H-bonds (hydrogen bonds) were determined from 3D models of the mutant proteins built using MODELLER. We assessed the performance of the decision tree on a large dataset of 163 single-site Pro mutations of T4 lysozyme, 74 nsSNPs and 52 other Pro substitutions from the literature. The overall accuracy of this algorithm was found to be 81% in the case of CcdB, 77% in the case of lysozyme, 76% in the case of nsSNPs and 71% in the case of other Pro substitution data. The accuracy of Pro scanning mutagenesis for secondary structure assignment was also assessed and found to be at best 69%. Our prediction procedure will be useful in annotating uncharacterized nsSNPs of disease-associated proteins and for protein engineering and design.

### *Isolation of fungal peptides*

Ten new cyclic hexadepsipeptides, six isariins and four isaridins, from the fungus *Isaria* have been identified and characterized by high-performance liquid chromatography, coupled to tandem electrospray ionization mass spectrometry (LC-ESIMS/MS). The isariins possess a  $\hat{\alpha}$ -hydroxy acid residue and five  $\hat{\alpha}$ -amino acids, while isaridins contain a  $\hat{\alpha}$ -amino acid, an  $\hat{\alpha}$ -hydroxy acid, and four  $\hat{\alpha}$ -amino acids. One- and two-dimensional NMR spectroscopy confirmed the chemical identity of some of the isariin fractions. Mass spectral fragmentation patterns of  $[M + H]^+$  ions reveal clear diagnostic fragment ions for the isariins and isaridins. Previously described cyclic depsipeptides, isarfelins from *Isaria felina* (Guo, Y. X.; Liu, Q. H.; Ng, T. B.; Wang H. X. *Peptides* 2005, 26, 2384), are now reassigned as members of the isaridin family. Examination of isaridin sequences revealed significant similarities with cyclic hexadepsipeptides such as destruxins and roseotoxins. The structure of an isariin (isariin A) investigated by NMR spectroscopy indicated the presence of a hybrid  $\hat{\alpha}$   $C_{11}$  turn, formed by the  $\hat{\alpha}$ -hydroxy acid and glycine residues and a  $^D\text{Leu}$ - $^L\text{Ala}$  type II'  $\hat{\alpha}$ -turn. Additionally, the inhibitory effect of isariins and an isaridin on the intra-erythrocytic growth of *Plasmodium falciparum* is presented.

### *Cationic lipids*

Several novel Cationic lipids have been synthesized. Investigation of aggregation properties of many of these cationic lipids has been performed using various spectroscopy techniques and their biophysical properties after membrane formation was investigated by high sensitivity calorimetry, gel electrophoresis, DNA complexation ability etc. Finally their potential as Gene transfer agents toward a number of mammalian cell lines have been assessed. These studies provided useful structure-function relationship.

### *DNA binding ligands*

Using novel strategy several benzimidazole based DNA binding ligands have been developed that show specific recognition of chosen sequences. Their ability to stabilize and target duplex structure formation and related physical characterization has been completed. Synthesis, DNA binding and *Leishmania* Topoisomerase inhibition activities of a novel series of Anthra[1,2-d]imidazole-6,11,dione derivatives have been completed.

## *Soft/nano materials*

In the area of soft nanomaterials design, novel gelators have been developed. The precise relation of gelation by low molecular mass gelators in binary hydrocarbon solvent systems (aromatic and aliphatic) has been examined.

A number of new dimeric bile acid derived gelators have been developed. Relationship between molecular chirality and macroscopic chirality has been extensively studied using chirally doped organogelator systems.

## *Synthesis of bioactive molecules*

The total synthesis of a number of complex bioactive molecules has been achieved.

The following are the members of the Unit:

### **Chair**

Uday Maitra Ph D, F A Sc.

### **Professor**

V Krishnan Ph D, F A Sc, F N A, F T W A S  
(Hindustan Lever Research Professor)

### **Honourary Professors**

P Balaram Ph D, F A Sc, F N A, F T W A S  
G Mehta Ph D, F A Sc, F N A, F T W A S

### **Honourary Faculty**

Raghavan Varadarajan Ph D, F A Sc, F N A  
Santanu Bhattacharya Ph D, F A Sc

### **Research Associates**

Dhanabal T, Prithwiraj De,  
Ramakrishna Basak, Uday Kumar Kundu



## 11. Condensed Matter Theory Unit

The members of the Condensed Matter Theory Unit (CMTU) have continued their theoretical research on a wide variety of topics in the general area of Condensed Matter Science. They achieved significant progress on several problems in this area in which support from JNCASR has been acknowledged, and these are summarized below.

Growth of nanoparticles in solution; translational dynamics of water molecules in carbon nanotubes; dynamical heterogeneity in glass-forming liquids; vortex matter in high-temperature superconductors with random pinning.

In a collaboration involving Nandan Pakira and Prof. T V Ramakrishnan studied the consequences of including the hybridization between polarons and mobile electrons in the two fluid model of manganites. This leads to novel, interesting de-coherence to coherence crossover effects which explain many of the low temperature features seen in Manganites.

In a collaboration involving Srijan Kumar Saha and Profs. U. V Waghmare and Ajay Sood, the Unit carried out ab-initio, state of the art, LDA calculations of phonons in single and multilayer graphene, with and without doping.

Starting in October 2007, during sabbatical leave in UC Davis, Prof H R Krishnamurthy collaborated with G. G. Batrouni, K. W. Mahmud, V. G. Rousseau, and R. T. Scalettar to analyze the Canonical trajectories and critical coupling of the Bose-Hubbard Hamiltonian in a harmonic trap. This is of relevance for understanding cold atom systems.

The principal result of research was summarized in the Feature Article by Prof Yashonath in the J. Phys. Chem. B. This suggests that the Levitation Effect is a highly generic, ubiquitous and universal behaviour seen in liquids, porous solids, dense solids, ions in polar solvents, impurity atoms in close-packed crystalline solids as well as in disordered amorphous solids.

The following are the members of the Unit:

### Chair

H R Krishnamurthy Ph D, F A Sc, F N A

### Hon. Professors

Biman Bagchi Ph D, F A Sc, F N A, F T W A S

Chandan Dasgupta Ph D, F A Sc, F N A

N Kumar Ph D, F A Sc, F N A, F T W A S

S Ramasesha Ph D, F A Sc.

D D Sarma Ph D, F A Sc, F N A

### Hon Faculty

G Ananthakrishna Ph D, F A Sc

Binny J Cherayil Ph D

Diptiman Sen Ph D, F A Sc

Rahul Pandit Ph D, F A Sc, F N A

K L Sebastian Ph D, F A Sc

Sriram Ramaswamy Ph D, F A Sc

S Yashonath Ph D, F A Sc

### Research Associate

Arul Murugan N, Madhavan Unni P K (P)

### R & D Assistants

Nandan Pakhira, Subra Sen Gupta

## 12. Computer Laboratory

During the year 2007-2008 complab was involved in upgrading and enhancing IT infrastructure in the campus. Two DELL new servers with Intel Xeon processors for hosting centre's website and Identity Management services were procured.

The lab team has extended technical support to the Web Development Team with which has enhanced features to JNCASR website like jncdesktop, clockroom, etc, Jncdesktop allows users to post the notice, setting up personal reminders, with 250MB storage space.

Complab and the web committee have jointly implemented Identity Management service to integrate many applications like Mail, Procurement, Account and Website. Identity Manager is the product from Sun Microsystems based on the latest cutting edge technology which provides session management and authentication of all the above mentioned applications. Through a single sign-in a user can access all the above services.

Proxy server has been upgraded with 2GB memory and high speed Intel based processors to provide efficient service. This ensures secured Internet browsing and access to Web resources within the LAN.

Complab has helped in setting up a separate web server for Academic Section to host the online application system. This facility will facilitate the submission of online applications for admissions and checking the status of submitted applications later. This facility allows faculty and academic staff to easily short list the applicants of various programmes.

A new High speed printer from HP has also been installed which provides 24 hours high quality printer service to the JNC community

A great deal of effort has been invested to upgrade the speed and data accuracy of the Local Area Network of the Centre. The LAN has now been upgraded with Cisco catalyst Gigabit switches and optical fiber cable. This upgradation has made possible highspeed errorfree data transmission, flexibility, and manageable network connectivity. The OFC links connect all the existing buildings in JNCASR campus to the Cisco Core switch located in the computer lab server room.

The flat LAN is upgraded to Virtual Local Area Network (VLAN) which provides better management and flexibility of the network. VLAN provides better network security by segmenting the network into different parts and restricting the broadcast to reduce the network traffic. Thus preventing intrusion of viruses on the network

The network cabling standards have been enhanced from cat 5, and cat5e to cat6 cabling which are of the frontier technology.

Complab has also procured a network rack to accommodate all the network components. A new server rack was purchased to accommodate different individual servers, leading to efficient use of space available. Upgradation of the Internet access speed to 4Mbps has been commissioned. Two HPC nodes (16 CPU Cores) have been purchased to serve the requirements of computational scientists.

The following are the members of the Laboratory:

### Head

Umesh V Waghmare

Ph D

### R & D Assistants

Ravi Kumar, Vikas Mohan Bajpai (Jr.R&D)



### 13. Library

The library continued to acquire, organize and disseminate information resources to render need based information services to Faculty/Students/Staff and others. Apart from the standard on-site services and a document delivery service, the library provides an inter-library loan facility with neighbouring institutes such as IISc, RRI, NCBS and NIAS. The library also joins consortia for subscription of journals like Nature, Scientific American Online Archive, etc.

#### *Collection Development*

The library has acquired books, journals and various e-resources as per the recommendations of faculty members. The documents and resources acquired during the year 2007-08 are following

Collection	Type of resources	Added during 2007-08	Total as on 31 <sup>st</sup> March 2008
Books		1016	5625
	Scientific and technical	932 (Purchased) 26 (Gratis)	
	Hindi	38	
Theses & Dissertation		20	
Bound Volumes of Journals		672	10449
CD Collection		5	
Subscription to Current Journals		6	134
	Print + online	-	12
	Online	5	105
	Print	1	13
	Subscription through consortium (Online)	-	4
Journals on Gratis		-	58
Online Journal Databases		2	
Abstracting & Indexing Database (SCOPUS)		-	1

#### *Digital Library Initiative*

The library has initiated the work of establishing JNCASR Institutional Repository during the year 2007-08. The repository aims to showcase the whole research output of the Centre (almost since its inception) to the world across. In this regard, digitization of JNCASR Memoirs has been started for those publications which are not available in digital format. HP Scanjet 8300 document scanner has been procured for scanning documents.

## ***Enhancing Library Facilities***

Two CD Stakkas were procured for CD storage and management. The LibSys (library automation software) updates were received and installed in the existing system. Book trolley, staff cubicals, Ceiling fans, Circulation Counter table, Centre table in Reader's area are among the major items purchased to further develop the library infrastructure. Library has also deployed with two PCs for Web browsing, accessing online library catalogue, e-journals, etc.

The following are the members of the Library:

### **Library In-Charge**

Y M Patil

Ph D

### **Library Assistants**

Nandakumari, Hadimani Nagesh

### **Library Trainee**

Jaiprakash H L

### **Helper**

Rajeeva J





## Endowed Research Professors

**D S Kothari Chair**

M M Sharma

F R S, F A Sc, F N A

**Hindustan Lever Chair**

V Krishnan

F A Sc, F N A, F T W A S

**Linus Pauling Research Professor**

C N R Rao

F A Sc, F N A, F R S, F T W A S, Hon. F R S C

**Vikram Sarabhai Research Professor**

B M Deb

F A Sc, F N A, F T W A S  
(upto 30.4.2007)

## ACADEMIC PROGRAMMES

### 1. Academic Activities

The Centre offers regular Ph D., Integrated Ph D, M S and M S (Engg.) degree programmes in Science and Engineering. The Integrated Ph D programme (Materials Science) is available to those with a B Sc degree. The regular Ph D programme is available to graduates and post-graduates in science and engineering, who have successfully completed GATE/UGC-CSIR-NET, JRF, ICMR JRF/JEST/equivalent examinations. The Centre selects candidates on an all-India basis, offers course work, provides research facilities, administers the programme and awards the degree.

#### *(a) Research Admissions*

During the year 2007-08, 50 students (10 Students for Integrated Ph.D, 25 Students for Ph.D, 13 Students for MS (Engg.) and one for MS degree were admitted as detailed below:

Sl. No	Units	Programme	Name of students
1	Chemistry & Physics of Materials	Int. Ph D	Ritu Gupta, Nitesh Kumar, Urmimala Maitra, Nisha Mariam Mammen, Bivas Saha, Soumik Siddhanta, Abhay Kumar Tiwari, SekharDondapti, Piyush Kumar Chaturbedy, Vini Gautam
		Ph D	Partha Pratim Kundu, Prakash Kanoo, Sudip Mohapatra, B. Radha, Jithesh K , Manoj Kesaria
		MS (Engg.)	Shruti Badhwar
2	Evolutionary & Organismal Biology	Ph D	Rajdeep Banerjee, Shahnaz Rahman Lone, Nisha N K
3	Molecular Biology & Genetics	Ph D	Raghunath N., Babhrubahan Roy, Varun Kumar, D Karthigeyan, Sujata Kumari, Abinith Saha, Sreyoshi Mitra, Manpreet Kaur, P K Raju Pedabaliyarasimhuni, G Venkateswaran, Sanjeev Kumar
		M S	Mohan Krishna DV
4	Theoretical Sciences	Ph D	Arup Chattopadhyay, Prakash Parida, Arun Kumar Manna, Suman Majumder
		MS (Engg.)	V Vishwas, Gayatri Das
5	Engineering Mechanics	Ph D	Sumesh PT , Dhiraj Kumar Singh
		MS (Engg.)	Ponnulakshmi V K, Vivek N Prakash, Konduri Aditya, S Sriharsha, Chandra Sekhar Kanuru, Snehalatha B, Kopal Arora, Dinesh Kumar, Rahul Bale, B R Rakshith

#### *(b) Degrees awarded*

Details of degrees awarded during the year are as given below

Sl. No	Units	Programme	Name of students
1	Chemistry & Physics of Materials	Ph D	Ayan Datta, Sowmya Dutta, Neena Susan John, Dinesh Kabra
		MS (Engg.)	A Gomathi
		MS (Int.Ph D)	Kumara Ramanatha Datta K
2	Evolutionary & Organismal Biology	Ph D	Shailesh Kumar, Sharmila Bharathi, Sutirth Dey
3	Molecular Biology & Genetics	Ph D	Chandrima Das, M. Ram Shankar, Kavitha Siva, Ashish Kapoor
4	Theoretical Sciences	Ph D	Joydeep Bhattacharjee, S Lakshmi
		MS (Engg.)	Tiju Thomas
5	Engineering Mechanics	Ph D	Kirti Chandra Sahu
		MS (Engg.)	Punit Tiwari, Rajaram Lakkaraju



## 2. Discussion Meetings/Workshops

The following discussion meetings/workshops were supported by the Centre during the year:

*31st Annual Conference of the Society along with a National Symposium on Women in Agriculture*, April 10-12, 2007, Dr Shakunthala Sridhara, University of Agricultural Sciences, Bangalore.

*National Conference on 'Parasitic Diseases- Emerging parasitic diseases and their control in new millennium'*, April 13-15, 2007, Prof N J Shetty, Janardhana Foundation, Bangalore.

*Symposium-cum-Workshop on 'AIDS/HIV'*, July 8-13, 2007, Prof Ranga Uday Kumar (JNCASR).

*International Conference 'Stochastic Processes and Application'*, July 16-21, 2007, Prof G Rangarajan (IISc)

*National Symposium on 'Electrochemical Science & Technology'*, NSEST-2007, July 20-21, 2007, Dr J R Mudakavi, Hon. General Secretary, ECSI, IISc.

*9th Annual CFD Symposium*, August 11-12, 2007, Dr Sekhar Majumdar, (NAL)

*International Symposium on 'Earthern Structures' (SES-2007)*, August 22-24, 2007, Prof P P Mujumdar (IISc)

*National Conference 'Millennium Energy Summit-2007'*, September 27 – 29, 2007, Dr R N Basu, CGCRI, Kolkata.

*National Seminar on 'Geotechnics for Infrastructure' (GEO INFRA – 07)*, September 28-29, 2007, Prof P V Sivapullaiah, IISc., Bangalore.

*JNC Research Conference on 'Chemistry of Materials'*, September 28 – October 1<sup>st</sup>, 2007, Dr M Eswaramoorthy (JNCASR)

*India-NIMS Workshop on 'Nano-materials'*, October 6-7, 2007, Prof C N R Rao (JNCASR) and Prof Terno Keshu NIMS, Japan.

*IUMRS International Conference on 'Advanced Materials' (IUMRS-ICAM 2007)*, October 8 – 13, 2007, CSIR/JNCASR.

*Frontier Lectures in Chemistry*, October 24 – 26, 2007, Prof V Krishnan, JNCASR

*CCMS School on 'Numerical Quantum Many-body methods in Physics & Chemistry' (NQM 2007 school)*, October 29- November 4, 2007, Prof Swapan K Pati and Dr N S Vidyadhiraja, JNCASR

*School on 'Biomolecular Simulation'*, November 6 -16, 2007, Prof S Balasubramanian, JNCASR.

*Symposium on 'Applied Aerodynamics and Design of Aerospace Vehicles'(SAROD-2007)*, November 22-23, 2007, Dr B N Suresh, Director, Vikram Sarabhai Space Centre, Trivandrum.

*7<sup>th</sup> Asian CFD Conference (ACFD-7)*, November 26-30, Dr Sekhar Majumdar, NAL, Bangalore.

*JNC Biomedical Sciences Meeting*, November 29-30, 2007, Prof Namita Surolia, JNCASR.

*JNCASR-FCBS Workshop for Postgraduate students in Trivandrum*, December 3-5, 2007, Prof S Chandrasekaran, IISc.

*International Winter School on 'Chemistry & Physics of Materials'* in collaboration with ICMR, Univ. of California, Santa Barbara, USA, December 6-13, 2007, Prof Swapan K Pati and Dr A Sundaresan, JNCASR

*Consortium of Students in Management Research (COSMAR-2007)*, An International Seminar, December 12-13, 2007, Prof K B Akhilesh, IISc.

*INDIA-NIMS Workshop on 'Advanced Materials'*, December 17-18, 2007, Dr A Sundaresan (JNCASR)

*The Theme of Phenotypic & Developmental Plasticity*, December 17-21, 2007, Prof V Nanjundaiah, IISc.

*High School Science Teachers Programme*, December 21-30, 2007, Prof Arun M Umarji and Prof S Ramakumar, IISc.

*International Symposium on 'Fluid Days'*, December 31, 2007 and January 1, 2008, Prof R Narasimha

*'Indo-US Advanced Study Institute on Nano Scale Science & Engineering'*, January 9-19, 2008, Convener: Dr. T. Pradeep, IIT Madras.

*International Symposium on 'Atomic, Molecular and Optical Sciences & High Performance Computing: A Seamless Frontier'*, January 10-12, 2008, Convener: Prof. D. Mukherjee, IACS, Kolkata.

Workshop on 'Physics and Chemistry of Materials', January 11-12, 2008, Convener: Prof. N. Chandrabhas, JNCASR.

Asian Conference on 'Transcription-X', January 13-16, 2008, Convener: Prof. Dipankar Chatterji, IISc.

UGC-Sponsored Orientation Course – 'Frontier Areas of Research & Education: The Role of Universities', January 16-February 5, 2008, Convener: Dr. K. Kasturirangan, NIAS.

8<sup>th</sup> International Symposium on 'Biochemical Roles of Eukaryotic Cell Surface Macromolecules', January 21-25, 2008, Convener: Dr. Amit Chattopadhyay, CCMB.

Mahabaleshwar Seminar 2007 in Modern Biology on 'Laws of Intracellular Transport: Motors, Tracks & Traffic Jams', January 27 – February 2, 2008, Convener: Dr. Krishanu Ray, TIFR.

National Symposium in Chemistry (NSC – 10), February 1-3, 2008, Convener: Prof. A.G. Samuelson, IISc.

International Conference on 'Advanced Materials', February 18-21, Convener: Dr. Suresh Mathew, Mahatma Gandhi University, Kottayam.

15<sup>th</sup> Annual Conference of Principals of Colleges, March 14-16, 2008, Principal, Poornaprajna College, Udupi.

### 3. Colloquia

The following JNCASR Colloquia were held during the period under the series:

- > *Some recent results in the Chemistry of Nanomaterials*, Prof C N R Rao, National Research Professor and Linus Pauling Research Professor, February 19, 2008.
- > *The Mysterious Glass Transition*, Prof James Langer, University of California, Santa Barbara, USA, February 26, 2008
- > *Genomic approaches to understand the biology and clinical management of Glioma*, Prof M R S Rao, March 11, 2008.

The following **colloquia** were held during the period :

#### **Fluid Dynamics :**

- > *Stability of viscoelastic flows past deformable solid walls*, Dr V Shankar, IIT Kanpur, April 11, 2007.
- > *Interfacial instability of two-fluid flow, through a channel*, Dr Kirti Sahu, Department of Chemical Engineering, Imperial College, London, April 13, 2007.
- > *Determination of temperature wall functions for high Rayleigh number flows using asymptotics*, Dr C Balaji, Dept. of Mechanical Engg., IIT Madras, July 4, 2007.
- > *Transient growth in shear flows: possible origin of hydrodynamic turbulence and its application to astrophysics*, Dr Banibrata Mukhopadhyay, Assistant Professor, Dept of Physics, IISc, Bangalore, October 3, 2007.
- > *Thermoacoustic instability without eigenvalues*, Dr R I Sujith, Department of Aerospace Engineering, IIT Madras, October 10, 2007.
- > *In Silico design of drug formulation for dry powder inhalers: Issues and challenges*, Dr Pankaj Doshi, Glaxo Smith Kline Inc. USA, January 3, 2008.
- > *On the impact of liquid droplets onto solid substrates*, Dr Shamit Bakshi, Assistant Professor, Department of Mechanical Engineering, IIT Madras, January 23, 2008.
- > *Kelvin's Vortex Atoms — Not Such a Bad Idea After All ?*, Keith Moffatt, Department of Applied Mathematics and Theoretical Physics, Cambridge, UK, January 30, 2008.
- > *Dynamics of turbulence in shear flows*, Prof D Viswanath, University of Michigan, Ann Arbor, Visiting faculty, Indian Institute of Science, Bangalore, March 12, 2008.

#### **Others:**

- > *Extreme elasto-hydrodynamics: of flags, flying carpets and flytraps*, Prof. L. Mahadevan, Harvard University, Cambridge, MA, USA, August 10, 2007.



- *Heavy Fermion Systems: a challenge for the crystal grower and for our understanding of magnetism and superconductivity*, Dr. Christoph Geibel, Max Planck Institute for Chemical Physics of Solids, Dresden, Germany, December 3, 2007.
- *Modern Mass Spectrometry in Cancer Research*, Dr Vadiraja B Bhat, Scott & White Memorial Hospital, Texas, USA, February 4, 2008.

## 4. Endowment Lectures

### AV Rama Rao Foundation Lectures in Chemistry:

*Editing PNA structures for DNA/ RNA Binding selectivity*, Prof K N Ganesh, Director, IISER, NCL Innovation Park, Pune;

*A decade of tinkering with bile acids* (Prize Lecture), Prof Uday Maitra, Indian Institute of Science, Bangalore, May 22, 2007.

### Prof V Ramalingaswami Memorial Lecture

*Our Footprints in the sands of time – A Statistical - Genetic Traceback*, Prof Partha P Majumdar, Indian Statistical Institute, Kolkata, July 30, 2007.

### C N R Rao Oration Award Lecture:

*Does One Size Fit All* by Prof Shobhana Narasimhan, August 6, 2007 followed by welcome to new students.

### DAE Raja Ramanna Lectures in Physics:

*The Inconstant Sun*, Prof S M Chitre, Visiting Professor, Dept. of Physics, University of Mumbai;

Prize Lecture: *The Mathematical Modelling of Cardiac Arrhythmias*, Prof Rahul Pandit, Chairman, TSU, Dept. of Physics, Indian Institute of Science, Bangalore, August 14, 2007.

**ISRO-Satish Dhawan Lecture:** *Practicing Conservation Science in the Tiger's World*, Dr. K. Ullas Karanth, Director-India Program & Technical Director – Tigers Forever Wildlife Conservation Society, Bangalore, December 5, 2007.

## 5. General Lecture

### Guest Lectures

*Characterization of SEVA TBES-31 antigen- a mycobacterial secretory metallo serine protease of interest in serodiagnosis with potential as drug target*, Prof B C Harinath, Director, Mahatma Gandhi Institute of Medical Sciences, Sewagram, Wardha, Maharashtra, January 28, 2008.

*Molecular Signatures Predicting NeuroAIDS and Prevention of HIV/AIDS*, Dr Brian Wigdahl, Professor and Chair, Department of Microbiology and Immunology, Director, Institute for Molecular Medicine and Infectious Disease, and Director, Center for Molecular Virology & Neuroimmunology, Drexel University College of Medicine, Philadelphia, USA, February 21, 2008.

## 6. Lectures delivered at the Annual Faculty Meeting by Faculty/

### Hon. Faculty

*Surprising Transport and Magnetotransport Anomalies in some Rare-earth Intermetallic compounds* by Prof EV Sampathkumaran

*Hierarchical Integration of Molecules and Nanomaterials* by Dr George Thomas

*Novel Functional Materials Based on Metal-Organic Hybrid Framework* by Dr Tapas Kumar Maji

*Staying Together or Getting Separated : A Tale of Two Sisters* by Dr Kaustuv Sanyal

*Downstream of Hox Genes* by Dr L S Sashidhara

## 7. Seminars

The following seminars were held during 2007-2008:

*C → U = A/t Mutations: Understanding the spread of mutations during antibody diversification*, Dr Shyam Unniraman, Yale University School of Medicine, USA, April 4, 2007.

*Receptor Tyrosine Phosphatases in Neuronal Development*, Dr. Aurnab Ghose, Harvard Medical School, USA, May 7, 2007.

*The DNA Damage Surveillance Pathway in Human Pathologies*, Dr. Mayurika Lahiri, Harvard Medical School, Massachusetts General Hospital Cancer Center, USA, May 8, 2007.

*Molecular modeling of crystal nucleation and adsorption*, Dr Sudeep Punnathanam, Northwestern University, May 25, 2007.

*Regulation of Mammalian DNA Replication*, Dr. Maloy Ghosh, Terry Fox Laboratory, BC Cancer Agency, Canada, May 28, 2007.

*Determination of temperature wall functions for high Rayleigh number flows using asymptotics*, Dr C Balaji, IIT Madras, June 13, 2007.

*Hydrodynamics of an oscillating foil with a long flexible trailing edge*, Mr Sachin Y Shinde, IISc, Bangalore, July 12, 2007.

*Nanotechnology at King Fahd University of Petroleum & Minerals (KFUPM) : An Introduction*, Mr Mohammed Ahsan, ME Department, KFUPM, Saudi Arabia, July 13, 2007.

*Structure-property relationships in thin film metal-oxides*, Dr Shriram Ramanathan, School of Engineering and Applied Sciences, Harvard University, USA, July 31, 2007.

*Precession magnetic sensor*, Dr Srinu Krishnamurthy, SRI International, Menlo Park, USA, July 18, 2007.

*Two Bullets One Target- A Novel and Promising Approach to Treat HIV* Dr Surya Sankuratri, Associate Director, Virology DBA, Roche Pharmaceuticals, USA, August 1, 2007.

*Nanoparticles in Supercritical Fluids: Solvation, Solvent-mediated Interactions and Solvent Quality*, Prof Moti Lal, Dept of Chemistry and Liverpool Institute for Nano Science, Univ of Liverpool, August 6, 2007.

*Sculpture and novel properties of nanostructures and their assemblies for applications*, Prof G Ramanath, Dept of Materials Science and Engineering, Nanotechnology Center, and Center for Integrated Electronics, Rensselaer Polytechnic Institute, Troy, NY, USA, August 7, 2007.

*Iron-Sulfur World and Iron-Sulfur Proteins*, Dr Nisanth N Nair, Ruhr-Universitat, Bochum, Germany, August 13, 2007.

*Quantum Complexity in Graphene*, Prof G Baskaran, Institute of Mathematical Science, Chennai, August 14, 2007.

*Tuning of size, shape and conformation of polymeric nano-materials through selective templating approach*, Dr Jayakannan, National Institute of Interdisciplinary Science and Technology, Thiruvananthapuram, August 21, 2007.

*Heat Transfer with Nanofluids*, Prof Stephan R Kabelac, Helmut Schmidt Universitat, Hamburg, Germany, August 23, 2007.

*The potential of "G9", a novel HIV regulatory protein, as a antiviral drug candidate and correlate (Biomarker) of protective immunity to HIV*, Dr Anna Vyakarnam, Department of Infectious Diseases, King's College, London, August 24, 2007.

*Random Oriented Trees and Forest*, Prof Siva Athreya, Indian Statistical Institute, Bangalore, September 18, 2007.

*Solution processing of complex nano-materials from molecules to materials*, Prof Gunnar Westin, Materials Chemistry, Ångström Laboratory, Uppsala University, Sweden, October 20, 2007.



CCMS NQM School, *Numerical Quantum Many-body Methods in Physics and Chemistry*, October 29 November 4, 2007.

*Superconducting Quantum Dots*, Dr Sujit Sarkar, Purna Pragnya Institute of Higher Learning, Bangalore, November 26, 2007.

*Thermal Transport in Nanostructured Materials*, Prof Ravi Prasher, Adjunct Professor, Mech. & Aerospace Eng., Arizona State University, USA, November 28, 2007.

*Coarse Graining in Polymer Simulations*, Dr Hossein Ali Karimi, Department of Chemistry, Technical University, Darmstadt, November 29, 2007.

*Shear viscosity studies of an ionic liquid, [bmim][PF6]: Reverse non-equilibrium molecular dynamics simulations*, Dr Wei Zhao, Department of Chemistry, Technical University, Darmstadt, November 30, 2007.

*Dynamics of driven diffusive systems: finite-size effects*, Dr Shamik Gupta, Tata Institute of Fundamental Research, Mumbai, December 19, 2007.

*Computational studies of Natural and Synthetic Ion Channels of Pharmaceutical Interest*, Dr Ekta Khurana, Department of Chemistry, University of Pennsylvania, Philadelphia, December 19, 2007.

*Nanomaterials for biomedical applications: Designing anthrax toxin inhibitors and diagnostic tools for atherosclerosis*, Dr Kunal V Gujraty, Burnham Institute for Medical Research, December 31, 2007.

*The Escherichia coli genome revisited: A systems biology approach for adaptive evolution and other applications*, Dr Anu Raghunathan, Dept. of Infectious Diseases, Mount Sinai School of Medicine, January 3, 2008.

*Cellular vortex shedding in the wake of a tapered cylinder*, Dr Vagesh D Narasimha-murthy, Norwegian University of Science and Technology, January 4, 2008.

*Self-Assembly of Conjugated Oligomers: Towards functional materials*, Dr Subi George, Eindhoven University of Technology, The Netherlands, January 4, 2008.

*Recent developments in the active control of laminar boundary layer instabilities*, Prof Mike Gaster, Queen Mary & Westfield college, January 4, 2008.

*Escape pathways and (un)binding free energy of the phenolic ligands from the hexameric Insulin-phenol complex*, Mr Harish Vashisth, Chemical & Biological Engg., Drexel Univ., January 7, 2008.

*Network models of evolving phage-bacteria ecologies*, Dr Sandeep Krishna, Niels Bohr Institute, Copenhagen, Denmark, January 16, 2008.

*Modifying aquaporin for biotechnology applications*, Dr Himanshu Khandelia, MEMPHYS, University of Southern Denmark, Denmark, January 16, 2008.

*Theoretical studies of biomolecular complexes*, Dr Pekka Mark, Royal Institute of Technology, Stockholm, January 17, 2008.

*Regulation of cell cycle by mitochondrial signaling*, Dr Sudip Mandal, University of California, Los Angeles, January 18, 2008.

*Dynamics of axon fasciculation in the presence of neuronal turnover*, Dr Debasish Chaudhuri, Guest Scientist, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, January 23, 2008.

*Symmetry-adapted modelling of site disorder in solids*, Dr Ricardo Grau-Crespo, University College London, UK, January 24, 2008.

*An overview of Nano-research activities in his group and in the University*, Prof Timothy Fisher, Purdue University, January 29, 2008.

*Evolution, behaviour and diabetes*, Prof Milind Watve, Abasaheb Garware College, Pune, January 29, 2008.

*Intramolecular electron transfer: Mechanisms and models*, Prof Mark Ratner, Northwestern University, January 31, 2008.

*Supercritical antisolvent precipitation for the generation of nanoparticles*, Prof Richard N Zare, Professor, Department of Chemistry, Stanford University, USA, January 31, 2008.

*Leading at the edge: Role of the Fat tumor suppressor in planar cell migration*, Dr Pradip Sinha, Department of Biological Sciences and Bioengineering, Indian Institute of Technology, Kanpur, February 4, 2008.

*Nanofabrication - Pushing the limits and its use in creating novel functionality and probing what associated nanoscale physics may have to offer*, Dr K RV Subramanian, February 12, 2008.

*Social organization, population genetic structure and phylogeography of the Asian elephant*, Dr T N CVidya, Department of Botany and Zoology, Stellenbosch University, South Africa, February 13, 2008.

*Proton conductance mechanism and morphology of Phosphonic acid derived fuel cell membrane, from atomistic and mesoscale simulations*, Dr Sudip Roy, Department of Theoretical and Physical Chemistry, Technical University, Darmstadt, February 20, 2008.

*A Combinatorial and Distributed Approach for Solving the Problem of Solar Water Photoelectrolysis*, Prof B Parkinson, Department of Chemistry, Colorado State University, USA, February 22, 2008.

*Unimolecular Electronic Devices: Where Are We?*, Robert M Metzger, Department of Chemistry, University of Alabama, Tuscaloosa, USA, February 22, 2008.

*Sand in a Jam*, Prof. Anita Mehta, S N Bose National Centre for Basic Sciences, Kolkata, February 25, 2008.

*Mechanical regulation of cell contractility and spontaneous cell*, Dr Raja Paul, Department of Neurobiology, Physiology and Behavior, University of California, Davis, USA, February 29, 2008.

*Genetic association of Macular Degeneration with ELOVLA- a model approach*, Dr Goutam Karan, Howard Hughes Medical Institute, Univ. of Utah, USA, March 6, 2008.

*Ni-Mn-Ga: a ferromagnetic shape memory alloy*, Dr S R Barman, UGC-DAE Consortium for Scientific Research, Indore, March 11, 2008.

*Studies on complex oxides from density functional calculations*, Prof P Ravindran, Associate Professor, Department of Chemistry, Center for Materials Science and Nanotechnology, University of Oslo, Norway, March 12, 2008.

*New Methods for the Surface Immobilization and Detection of Biomolecules*, Dr T Govindaraju, Max Planck Institute of Molecular Physiology, Germany, March 12, 2008.

*Densityfunctional Studies on Spin- charge, and orbital -ordering in perovskite-like oxides*, Dr Vidya, University of Oslo, March 13, 2008.

*Soap: The Polymorphic Genie of Hierarchically Structured Soft Condensed Matter Products*, Dr Janhavi Raut, Corporate Research, Hindustan Unilever limited, March 25, 2008.

## **8. International Conferences/Workshops**

India-NIMS Workshop on *Nano-materials*, October 6-7, 2007, Prof C N R Rao (JNCASR) and Prof Teruo Kishi, NIMS, Japan.

IUMRS International Conference on *Advanced Materials*, October 8-13, 2007, JNCASR and CSIR

International Winter School on *Chemistry and Physics of Inorganic Materials*, December 6-13, 2007, Prof Swapan K Pati and Dr A Sundaresan.

India-NIMS Workshop on *Advanced Materials*, December 17-18, 2007, Dr A Sundaresan, JNCASR

*Cambridge University-JNCASR Nanotechnology Workshop*, January 8, 2008.

*JNC-Colarado State University Joint Workshop on Materials Initiatives*, January 14-15, 2008.

*Indo-Brazil Meeting on Infectious Diseases*, January 25-27, 2008.





## EXTENSION ACTIVITIES

### 1. Summer Research Fellowships/ Department of Science Technology Fellowships/ Rajiv Gandhi Science Talent Research Fellowships

The Centre offers summer fellowships for two summer months to bright undergraduate and M Sc students (renewable for a second year for selected students). This programme has proved to be popular and competitive; each year, about 5000 students from all over India apply for the 120 fellowships awarded. Fifty fellowships are supported by the Department of Science Technology, Government of India, fifteen by the Rajiv Gandhi Institute of Contemporary Studies, New Delhi and the rest by the Centre. Students are placed with research groups at the Centre or with scientists elsewhere in India. They are paid travel expenses and a monthly stipend of Rs. 5,000/-

The following is the list of institutions where students have been placed during the year 2007-08 :

Abasaheb Garware College, Pune  
Advanced Centre for Treatment, Research and Education in Cancer, Mumbai  
All India Institute of Medical Sciences, Delhi  
Dr B R Ambedkar Centre for Biomedical Research, Delhi  
Banaras Hindu University, Varanasi  
Bose Institute, Kolkata  
Central Drug Research Institute, Lucknow  
Centre for Mathematical Modelling and Computer Simulation, Bangalore  
C G S Indraprastha University, Delhi  
Indian Association for Cultivation of Science, Kolkata  
Indian Institute of Chemical Technology, Hyderabad  
Indian Institute of Science, Bangalore  
Indian Institute of Science Education and Research, Pune  
Indian Institute of Technology, Chennai  
Indian Institute of Technology, Delhi  
Indian Institute of Technology, Kanpur  
Indian Institute of Technology, Kharagpur  
Indian Institute of Technology, Mumbai  
Indian Statistical Institute, Bangalore  
Indian Statistical Institute, Delhi  
Institute of Genomics & Integrative Biology, Delhi  
Institute of Microbial Technology, Chandigarh  
Institute of Mathematical Sciences, Chennai  
Jawaharlal Nehru University, New Delhi  
Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore  
M S Ramaiah School of Advanced Studies, Bangalore  
National AIDS Research Institute, Pune  
National Brain Research Centre, Haryana  
National Centre for Biological Sciences, Bangalore  
National Centre for Cell Science, Pune  
National Centre for Plant Genome Research, New Delhi  
National Chemical Laboratory, Pune  
National Institute of Immunology, Delhi  
National Physical and Oceanic Laboratory, Kochi  
N R S Medical College, Kolkata  
Raman Research Institute, Bangalore  
Regional Research Laboratory, Thiruvananthapuram  
Saha Institute of Nuclear Physics, Kolkata  
S N Bose National Centre for Basic Sciences, Kolkata  
Tuberculosis Research Centre, Chennai  
University of Delhi, South Campus, Delhi  
University of Hyderabad, Hyderabad

## 2. JNC-TWAS-ROCASA-Summer Research Fellowships Programme

The JNCASR since its inception has been making rapid progress and has established itself as one of the important centres of higher learning and research. It has positioned itself globally as a Centre for Advanced Studies in many areas of science and engineering. The Centre has been the first one in the country to organize and run an innovative programme for the benefit of undergraduate and graduate students in science – Summer Research Fellowship Programme – SRFP (from 1990). This is a most successful programme and a large number of students in the country have been benefited over the past 18 years.

With the aim to make this programme globally visible by making it accessible to students in the developing countries of South, the Third World Academy of Sciences - Regional Office for Central and South Asia (TWAS-ROCASA) and JNCASR have come together to expose these young undergraduate students to the research culture in advanced areas of science and engineering by working with peers in many institutions in the country. The selected students are placed under a guide for three months and offered a fellowship of Rs.5,000/- per month and their airfare expenditure is met from the TWAS-ROCASA fund. Last year three students from different countries (Sri Lanka, Bangladesh and Uzbekistan) availed this fellowship. For the JNC-TWAS-ROCASA-SRFP-2008 fellowship, about 10 students have been selected.

## 3. Academic Exchange Programme

As part of the academic exchange programme, the following scientists/scholars carried out collaborative work with scientists of the Centre and of the Indian Institute of Science for varying periods during the year under report.

### Visiting Professor

Prof Timothy S Fisher  
Purdue University, USA

### Visiting Scientists

Dr Brandon Wood  
Massachusetts Institute of Technology, USA.

### Prof Noor Afzal

Aligarh Muslim University

### Prof C Balaji

IIT Madras

### Dr A Nagar

Korea Institute for Advanced Studies, Korea  
Dr Ricardo Grau-Crespo  
University College, London

### TWAS-UNESCO Associateship Scheme

Prof Ali El-Shekeil  
Sana'a University, Sana'a, Yemen

### TWOWS Post-graduate Fellow

Ms Hannah Ajoge  
Ahmadu Bello University, Zaria, Nigeria

### Visiting Research Fellow

Mr Seyed Jafar Hoseini  
Shiraz University, Shiraz, Iran.

### Visiting Scholars

Ms Nguyen Thi Mua  
International Training Institute for Materials Science, Hanoi, Vietnam



**TWAS – SRFP**

Ms N H Nilushi Priyanvada  
Institute of Fundamental Studies  
Kandy, Sri Lanka.

**Mr Taksin Ahmed**

Jahangirnagar University  
Dhaka, Bangladesh

**Mr Khudoyberdiyev Abror**

National University of Uzbekistan  
Tashkent, Uzbekistan.

## 4. Visiting Fellowships

The Centre offers Visiting Fellowships to research scientists in educational institutions and R&D laboratories, tenable for 2-3 months, to work with the faculty and honorary faculty of the Centre.

The following were offered Visiting Fellowships during 2007 - 2008 to work at the institutions as indicated below:

<b>Name and address of the visitors</b>	<b>Collaborating with</b>
Dr Golam Mostafa Department of Physics Jadavpur University Kolkata	Dr Tapas Kumar Maji CPMU, JNCASR
Dr Rajesh M Pednekar Lecturer in Chemistry DM's College of Arts, Science & Commerce (DMC) Assagao, Mapusa, Goa	Dr A Sundaresan CPMU, JNCASR
Dr Sarat Kumar Swain Reader, Department of Chemistry North Orissa University Sriranchandra Vihar Takatpur, Baripada, Orissa	Prof C N R Rao CPMU, JNCASR
Dr B P Harish Senior Lecturer Department of Electrical Engg. University Visvesvaraya College of Engineering Bangalore University	Prof K S Narayan CPMU, JNCASR
Dr Riffat Basharat Teacher, Govt. Boys Sec. School Quilmugam, Kashmir.	Prof. C.N.R. Rao, CPMU, JNCASR
Dr Subhankar Ghosh Department of Physics St. Xavier's College, Kolkata.	Prof Meheboob Alam EMU, JNCASR
Mr Rahul B Karyappa Lecturer Department of Chemical Engineering Vishwakarma Inst. of Technology, Pune.	Prof Rama Govindarajan, EMU, JNCASR

Dr Ashutosh Gupta  
Lecturer, Dept. of Chemistry  
Udai Pratap Autonomous College  
Varanasi.

Dr Ramesh V Pai  
Department of Physics  
Goa University, Goa.

Dr C Jairaj Kumar  
Department of Anatomy  
K S Hegde Medical Academy  
Mangalore

Dr Raja Naika  
Sr. Scale Lecturer  
Dept. of Applied Botany  
Kuvempu University, Shimoga.

Dr (Mrs.) B E Amitha Rani  
Scientist Gr. IV (2),  
CFTRI, Mysore.

Dr Subodh Kumar  
Professor, Department of Chemistry  
Guru Nanak Dev University  
Amritsar.

Dr Damanjit Kaur  
Reader, Dept. of Chemistry  
Guru Nanak Dev University  
Amritsar.

Mr Gautam Aditya  
Lecturer in Zoology  
The University of Burdwan  
Gopalbag, Burdwan  
West Bengal.

Prof Swapan K Pati  
TSU, JNCASR

Prof. Rahul Pandit  
Dept. of Physics, IISc

Prof Vijay Kumar Sharma  
EOBU, JNCASR

Prof. Hemalatha Balaram  
MBGU, JNCASR

Prof. M.R.S. Rao  
MBGU, JNCASR.

Dr. M. Eswaramoorthi  
CPMU, JNCASR

Prof. E.D. Jemmis  
Dept. of Inorganic and Physical  
Chemistry, IISc

Prof. Amitabh Joshi  
EOBU, JNCASR.

## 5. Project Oriented Chemical Education (POCE) -2008

In order to reach students, POCE had written to around 120 colleges (all over the country) about the activities of POCE (and the opportunities available in JNCASR to students studying in B. Sc. first year). The response was quite good. Ten students from 10 different states were selected for the POCE-2008 summer programme.

In all twenty-five students (of POCE-2006, POCE-2007 & POCE-2008) participated in this summer programme of 8 weeks.

Seven students of POCE-2006 have successfully completed/completing the programme. One POCE-2006 student has been selected for Integrated Ph D programme of JNCASR, whereas two have joined M Sc programmes of state universities.

A workshop on "Experiments using College Chemistry Kit" was conducted on February 27<sup>th</sup>, 29<sup>th</sup> & March 1<sup>st</sup> 2008 for PU Science students of Jawahar Navodaya Vidyalaya, Bagalur.

## 6. Project Oriented Biological Education (POBE) 2008

The Centre received 383 applications from 1st year B.Sc students for POBE-2008 and 9 bright students were selected. The students attended lectures by JNC faculty and special lectures by guest faculty from IISc, NCBS, IIHR, UAS and Mysore University. They also underwent practical training in modern methods in



experimental biology, ranging from molecular techniques to mathematical modelling and computer simulations.

In addition, students from POBE 2006 and 2007 batches returned for their training in 2008. They spent two months under the guidance of MBGU and EOBU faculty, in addition to attending special lectures and seminars at the Centre. The first batch of ten students (POBE 2006) has completed their three year training at the Centre and have received certificates for the same. Many of these students have been selected for Integrated Ph D or MS by Research programmes at NCBS, IISc, TIFR and MPI (Germany). The feedback from POBE 2006 students regarding the effects of this program on shaping their whole way of looking at science was excellent, as was the feedback regarding the quality of these students from our colleagues at the institutions where they interviewed.

## 7. Science Education Programme

**National Science Day:** The National Science Day was celebrated on February 25, 2008. About 190 students and 22 teachers from six schools participated. The programme included lectures by faculty of the Centre, and multimedia presentation on “Excerpts from Nano world” authored by Prof C N R Rao and developed and produced by Education Technology Unit. The students and teachers visited a few laboratories at the Centre and had an opportunity to take a look at current research activities.

## 8. Intellectual Property

The Intellectual Property Management Committee of JNCASR fosters IPR culture and addresses all issues concerned with securing, maintaining, protecting and valorizing the Intellectual Property. The Committee facilitates the scientific community in obtaining patents and also for post patent actions.

During this academic year, the Centre received four patents granted by the Indian Patent Office and the US Patent and Trademark Office for the inventions made by Prof. Tapas Kundu and his group. Most of our inventions are available to potential Entrepreneurs for licensing. A couple of inventions were licensed to Entrepreneurs in India, Switzerland and USA. Negotiations were made with several Companies to license our inventions.

The Centre registered trademark for JNCED Science Logo, and holds copyright over a number of educational monographs and multimedia packages on interesting areas in science, technology and engineering.

The IPM Committee met four times and reviewed thirteen inventions and approved filing of patent applications for ten inventions. Of which, the following nine national and international patent applications were filed.

### ***International Patent Applications under PCT***

- PCT/IN2007/000258 filed on 26/6/2007 for the invention ‘*Site-specific inhibitors of Histone Methyltransferase (HMTase) and process of preparation thereof*’, Inventors: Kundu TK, Selvi BR, Kishore AH, Mantelingu K.
- PCT/IN07/000543 filed on 19/11/2007 for the invention ‘*A High Sensitivity Assay for Molecular Typing of Biological Sample Using Surface-Enhanced Raman Scattering*’, Inventors: Ranga U, Chandrabhas N, Jayasuryan N; Applicants: JNCASR and M/s. Microtest Innovations Pvt. Ltd.

### ***National Phase Applications:***

#### ***India***

- *Inherently fluorescent Carbon nanospheres and a process thereof*, Inventors: Kundu TK, Eswaramoorthy M, Selvi BR, Dinesh J.
- *A metal embedded nanoparticles composition and a process thereof*, Inventor: Chandrabhas N.
- *A mirror adapted in microscope to perform Surface Enhanced Raman Spectroscopy, a microscope and methods thereof*, Inventors: Chandrabhas N, Pavan Kumar GV.

## **USA**

- > No.11/791,086 filed on 18/5/2007 for the invention '*Highly specific polyclonal antibodies of individual core histone and uses thereof*', Inventors: Kundu TK, Kulangara FK, Varier RA, Kundu TK, Das C.
- > Divisional Application No. 11/959,938 filed on 18/12/2007 for the parent invention '*Modulators (inhibitors/activators) of Histone Acetyltransferases*', Inventors: Kundu TK, Balasubramanyam K, Swaminathan V.

## **USA and Europe**

- > USA No. 12/065,952, filed on 6/03/2008 and European No.06809952.2, filed on 27/2/2008 for the invention '*Derivatives of 3,6-Disubstituted 1,2,4-Triazole-1,3,4-Thiadiazole, A Process and Uses Thereof*' Inventors: Kundu TK, Varier RA, Shivananju N, Basappa, Rangappa K S; Applicants: JNCASR and University of Mysore.

## **Patent Grant:**

- > US Patent No. 7,332,629 B2, Granted on February 19, 2008 and intimation received on 5/6/2007 from Indian Patent Office regarding grant (yet to receive the number) for the invention '*Modulators (inhibitors/activators) of Histone Acetyltransferases*' Inventors: Kundu TK, Balasubramanyam K, Swaminathan V.
- > The Indian Patent Office and the USPTO have communicated intimation of grant of patent for the invention '*Polyisoprenyl benzophenones as inhibitors of Histone acetyltransferases and uses thereof*', Inventors: Kundu TK, Balasubramanyam K, Mantelingu M, Mohammad A, Swaminathan V, Radhika AV.

To sensitize the scientific community on IPR issues, two lectures were held by inviting Experts during this period viz., (a) *Economics of Intellectual Property Protection in Hi Tech Sectors: The Case of IT and Biotech* by Prof A Damodaran, Indian Institute of Management, Bangalore on 18<sup>th</sup> December 2007 and (b) *Patenting Nanotechnology* by Mr Chandran Iyer, Patent Attorney, Sughrue Mion, USA on 5<sup>th</sup> March 2008.



# RESEARCH PROGRAMMES

## 1. Research Areas

There are ongoing research programmes in several frontier, interdisciplinary areas of science and engineering. The main areas of research interest at present are:

- Chemistry of Materials
- Molecular Modelling of Materials
- SERS, Raman Spectroscopy, Brillouin Scattering and High-Pressure Research
- Nanomaterials: Synthesis and Applications
- Experimental Nonoscillation, Electronic Charge Density from Molecular Crystals
- Organic Electronics and Optoelectronic Device
- Physics and Photophysics
- Solution processing and Patterning
- Soft Matter and Hard Properties
- Biophotonics
- Study of Novel Functional Oxide
- Magnetism, Superconductivity, and Ferroelectricity
- Surface Science, Heteroepitaxy and Nanostructures
- Self Assembled Molecular Materials based on Metal-Organic Coordination Networks
- Aerospace and Atmospheric Fluid Mechanics
- Complex Fluids : From 'Microscopic' to 'Hierarchical' Modelling
- Flow Instabilities and Discontinuities
- Transition to Turbulence
- Fluid Mechanics and Heat Transfer
- Dynamics and Rheology of Complex Fluids
- Hydrodynamic Stability
- Vortex Dynamics
- Nonlinear Dynamics and Electronic Circuits
- Computational Fluid Dynamics
- Chronobiology and Animal Behaviour
- Evolutionary Genetics and Population Ecology
- Circadian Rhythms in Fruit Flies, Ants and Mice
- Neotectonic and Environmental Geology
- Chromatin Biology and Genomic
- Molecular and Cellular Mechanisms of Human Genetic Disorders
- Protein Engineering and Molecular Parasitology
- Molecular, Genetic and Developmental Analysis of the Cardiovascular System
- Transcription Regulation in Humans by Histone Chaperones,
- Epigenetic Modifications
- Altered Chromatin Dynamics (by nonhistone chromatin proteins)
- Small Molecule Modulators of Chromatin Modifying Enzymes
- HIV-1 Subtype-C Strain: Success Story of the Fittest Viral Subtype
- Mechanism of Chromosome Segregation: A Molecular Approach
- *Plasmodium falciparum* : Functional Genomics of Metabolic Pathways
- Antimalarial Drug Development and Molecular Epidemiology Equilibrium and Nonequilibrium Statistical Mechanics of Condensed-Matter Systems
- Condensed Matter Theory : *Ab initio* Investigations of Low-Dimensional Systems
- Advanced Quantum Theory: From Molecules to Extended Materials
- Dynamics and Phase Transformations in Disordered Systems: Liquids, Glasses and Biomolecules
- Computational Materials Theory: From Electronic Motion to Macroscopic Properties of Materials

- Strongly Correlated Electron Systems
- Statistical Physics of Equilibrium and Nonequilibrium Condensed Matter Systems
- Nonequilibrium Statistical Mechanics
- Isolation and Structure Determination of Unusual Peptides from Fungal Sources
- Effect of Signal Peptide on the Stability and Folding Kinetics of Maltose Binding Protein
- Design of Temperature Sensitive Mutants
- Total Synthesis of Complex Bioactive Natural Products
- Cationic Surfactants, Novel Lipids and Nucleic Acid Analogs
- Bile Acid Chemistry
- Electronic Structure, Especially Strongly Correlated Electron Systems
- Equilibrium and Non-equilibrium Statistical Mechanics of Soft Condensed Matter and Other Complex Systems

## 2. Research Facilities

The Centre has procured the following research equipment/facilities during the year 2007-2008.

- DIC Imaging, DIC Prisms, High Sensitive Image Analyzer
- Jasco UV-Visible Spectrophotometer with Accessories
- High Resolution Microscopy MC Camera, Accessories
- Akta Purifier 10 Core System
- Eppendorf Refrigerated Centrifuge 5810
- Air Jacketed Incubator, UV System Kit, Automatic CO<sub>2</sub> Switchover
- Icyler Base Module, Gel Doc XR System, Gene Pulser X Cell
- DNA Engine Tetrad 2 Thermal Cycler Single Alpha Unit
- Upgradation of 3100 to 3130XL, Analysis Installation Kit
- Drosophila Activity Monitor 32 Channels
- 2D Electrophoresis System
- Semiconductor Character System, Remote Preamp.Option
- Bruker Axis Highly Versatile X Ray Diffractometer D8 Discover
- Iii N Molecular Beam Epitaxy System Model N35-V-3
- Benchtop FACS Aria3 Laser System
- Optional L-90k Ultra Centrifuge with Accessories
- Belsorp HP 13.5mpa with Accessories & 220v with Accessories
- DNA Engine Thermal Cycler, Dual Alpha Unit, Electroporator
- Physical Vapor Deposition System Model PVD-300
- StepOne Plus Real Time PCR, TaqMan RNase, Power Sybr, Optical 96
- Trinocular Epi Fluorescence Inverted Microscope
- Fluorolog-3 Research Spectrofluorometer
- Varian Vacion Plus Combination Pump, Pumping Cart, Gauge Controller
- Berthold Detection System
- Olympus Live Cell Imaging System, Motorized Inverted Microscope





### 3. Sponsored Research

Sl. No.	Investigator	Title	Funding Agency	Duration
1.	Srikanth Sastry	Swarnajayanthi Fellowship	DST	5 years
2.	Anuranjan Anand	Deafness in India : A network mission towards understanding the genes and mutations and their clinical outcomes	DBT	3 years
3.	Srikanth Sastry	Understanding the landscape of glassforming systems	IFCPAR	3 years
4.	Ranga Uday Kumar	Efficacy and safety evaluation of siddha Medicines HIVS-2003 for HIV/AIDS	DST and Vedic Drugs Ltd.	2 years
5.	R Narasimha	Research Programme on Flow Instabilities	DRDO	3 years
6.	Umesh V Waghmare	Electroactive Polymers (EAP) and Composites – The DuPont Young Faculty Programme	DuPont	One year
7.	Co-ordinated by JNCASR	Postdoctoral Fellowship in Nano Science and Technology	DST	2 years
8.	Maneesha S Inamdar	Genome-wide transcriptional profiling and Pathway analysis in embryonic stem cells and the vasculature	DBT	3 years
9.	C N R Rao	The Science Outreach Programme	DAE/BRNS	3 years
10.	C N R Rao	Publication of series on Learning Science in English	INSA	
11.	Hemalatha Balaram	NMITLI Project on “Improved Genome Annotation through a combination of Machine learning and experimental methods: <i>Plasmodium falciparum</i> as a case study	CSIR	3 years
12.	Ranga Uday Kumar	Functional Analysis of the NF-kB Polymorphism in the terminal repeat of HIV-1 subtype-C viruses	DBT	3 years
13.	Hemalatha Balaram	Molecular dissection of the purine salvage Pathway in plasmodium falciparum: Essentially of HGPRT, IMPDH and ADSS in purine nucleotide synthesis	CSIR	3 years
14.	Ranga Uday Kumar	Immunological and molecular characterization of HIV-1 Tat and long terminal repeat (LTR) cloned from Indian patient with and without dementia and/or opportunistic infection	ICMR	3 years
15.	Amitabh Joshi	Towards a realistic model of insect population growth in the single and meta-population level: <i>Drosophila</i> as a model system	DST	3 years

16	M R S Rao	Nuclear Import Machinery of Male Haploid Germ Cells: A study with Transition proteins TP1 and TP2	DBT	3 years
17	Rama Govindarajan	An analysis of the vortical density stratified flows	NPOL	2 years
18	K R Sreenivas	Study of turbulent shear flows in Stratified medium	NPOL	2 years
19	S Balasubramanian	Computer simulation studies of room temperature ionic liquids	DST	3 years
20	R Narasimha	Novel Transition	DRDO/IDS	5 years
21	S Balasubramanian	Simulation studies of structure, Dynamics and solute-solvent interactions in super-critical carbon dioxide	CSIR	3 years
22	Maneesha S Inamdar	Expression and Functional analysis of the Drosophila HOMOLOG of rudhira, A Novel WD40 Protein involved in Hematopoiesis	CSIR	3 years
23	Tapas Kumar Kundu	Role of multifunctional human transcriptional coactivator PC4 in Chromatin Organization, cell cycle and apoptosis in vivo" National Bioscience Award 2004-05"	DBT	3 years
24	Tapas Kumar Kundu	Chromatin modifications (Methylation, Acetylation, Deacetylation) – a new target for Cancer therapy and diagnostics	DBT	3 years
25	Shobhana Narasimhan	Effect of Local Environment on Catalytic Activity – Indo-Italian Research project Under the AEGIS of Indo-Italian POC in S&T 2005-07	DST	3 years
26	Tapas Kumar Kundu	Functional genomics of Human Transcriptional cofactors and histone deacetylases-A special reference to cancer	ICMR	3 years
27	Ranga Udaykumar	Pathogenic relevance of Extracellular tat in the body fluids of HIV-I seropositive subjects to disease progression	DBT	3 years
28	Tapas Kumar Kundu	The Role of Anti-Cancer DNA Binding Drugs on Chromatin Organization and Function	DAE	3 years
29	Maneesha S Inamdar	Training and research facility for human embryonic stem and human embryonic carcinoma cells	DBT	3 years
30	Namita Surolia	X-ray Crystallographic Analysis of the Proteins involved in the Fatty Acid Biosynthesis of <i>Plasmodium falciparum</i>	DBT	3 years
31	A Sundaresan	Atomic Engineering of High to Super-conductors by layer-by-layer deposition of $\text{AcuO}_2$ (A=Ba, SR, Ca) infinite layers	CSIR	3 years
32	M R S Rao	NMITLI Project on "A prospective study to correlate gene signatures with clinical outcome of astrocytomas and identification of potential therapeutic target(s) under the New Millennium Indian Technology Leadership Initiative Scheme	CSIR	3 years



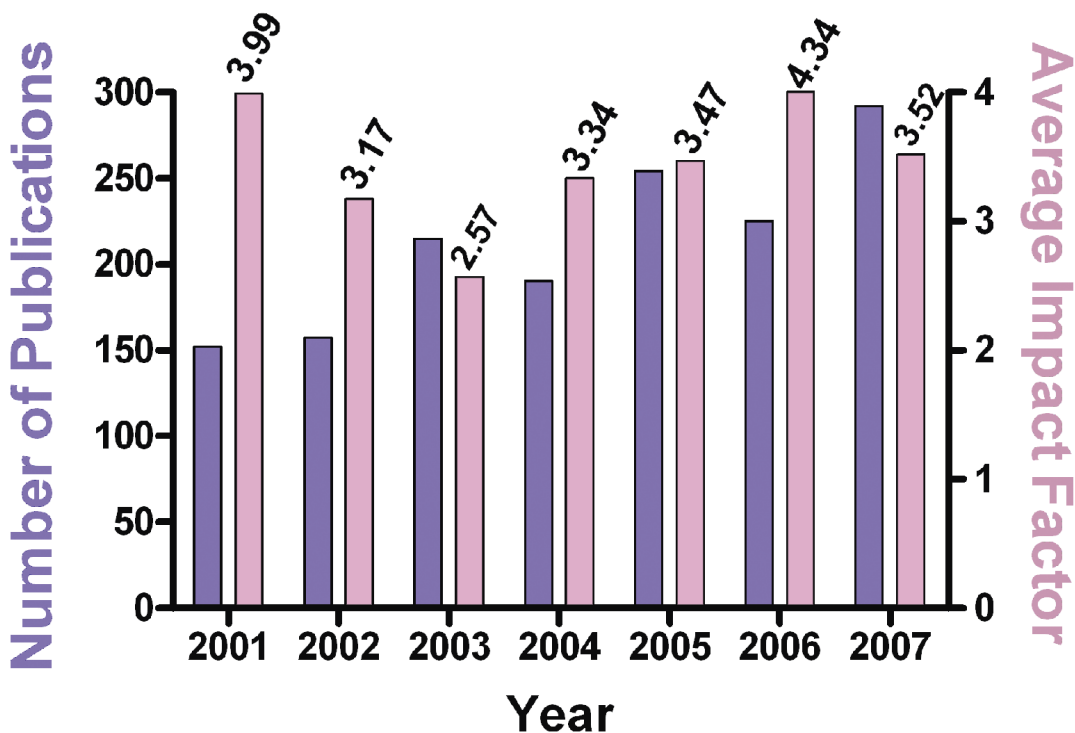
33	Anuranjan Anand	Whole Genome-based Studies to Identify Novel Molecular Genetic Pathways Causing Human Epilepsy Syndrome - DAE-SRC Outstanding Research Investigator Award	DAE	5 years
34	S Balasubramanian	Centre for Computational Materials Science	DST	5 years
35	C N R Rao	CSIR-COE	CSIR	5 years
36	C N R Rao	Collaborative projects between JNCASR and DRDO	DRDO	5 years
37	Namita Surolia	Genetic manipulations and apcoplast targeting studies with Plasmodium Type II FAS Proteins	DBT	3 years
38	Namita Surolia	National facility for screening drugs and their biological effects for Cancer, AIDS and Malaria	DBT	3 years
39	M R S Rao	J C Bose Fellowship to Prof M R S Rao	DST/JCB	5 years
40	C N R Rao	Spectroscopic Investigation of dip pennanolithography pattern – Indo-Italian Project	DRDO	3 years
41	Ranga Uday Kumar	Delineating viral determinants of HAD using SCID mice	AECOM	2 1/2 yrs
42	Ranga Uday Kumar	Design and characterization of stable folded fragments/derivatives of HIV env for use as Immunogens	DBT	3 years
43	Taps Kumar Kundu	Structure function analysis of Tumor suppressor, p53 interacting proteins: structural basis of p53 activation	DBT	3 years
44	Maneesha S Inamdar	Gene targeting of the mouse asrij locus to generate knockout mice for functional analysis	DST	3 years
45	Kaustuv Sanyal	Characterization of an evolutionarily conserved kinetochore protein Mtwlp: A tool to analyse kinetochore structure of the human fungal pathogen candida albicans	CSIR	3 years
46	Namita Surolia	Development of triclosan for treating human malaria and inhibitors of fatty acid synthesis especially enoyl-ACP reeducates of as anti-malarial agents	DBT	2 years
47	Swapan K Pati	Quantum magnetic mixing effects in fully frustrated magnets – India-Japan Cooperative Science Programme	DST	2 years
48	Namita Surolia	Structure-activity relationship of <i>Plasmodium falciparum</i> B-Ketoacyl-ACP reductase(FabGO)	DST	3 years
49	K B Sinha	Bhatnagar Fellowship – 2005 “Quantum mechanics – A Mathematical tool to study non-equilibrium Processes and dissipative systems in Physical Sciences, Geometry and Information Theory”	CSIR	5 years

50	K R Sreenivas	Investigation of Lift and Thrust in Asymmetric Flight	DST	3 years
51	Namita Surolia	Functional Genomics based approach to novel anti-malarial targets and agents	ICMR	3 years
52	S M Deshpande	NMITLI Project on “Mesoscale modeling for monsoon related weather predictions Phase II”	CSIR	2 ½ yrs
52	Shobhana Narasimhan	Self-organized nanostructures at surfaces	IFCPAR	3 years
53	Shobhana Narasimhan	MOU between MIPL & JNCASR - Consultancy and Research	MIPL	3 years
54	Umesh V Waghmare	MOU between MIPL & JNCASR Consultancy and Research	MIPL	3 years
55	S Balasubra-manian	Swarnajayanthi Fellowship	DST	5 years
56	Swapan K. Pati	Opto-Electronic Properties of conducting Polymers	CSIR	3 years
57	S.M. Deshpande	Development of TKFMG solver and its application to flutter prediction in turbo Machines	GTRE	3 years
58	S Balasubra-manian	DST-DAAD (German Academic Exchange Service) joint research Project entitled "Computer Simulation of Ionic liquids"	DST	2 years
59	Mehaboob Alam	Contract to establish a partner group of the MPI-MM “Partner Group for Topography Formation”	MPI	2 years
60	K S Narayan	Studies of organic FETs and 3-terminal structures for switching memory and imaging Applications	DST	3 years
61	Kaustuv Sanyal	Characterization of factors required for determining centromere identity using human pathogenic yeast candida <i>albicans</i> as a model system	DST	3 years
62	Tapas Kumar Kundu M Eswaramoorthy	Cellular Interaction of Nanoparticles; Effect on epigenetics and thereby its role in gene expression: Implications from Drug delivery to diagnosis	DBT	3 years
63	G U Kulkarni	Design fabrication of an injection system for patterning of metal cup structures	YNDYM	One year
64	Tapas Kumar Maji	Microporous metal-organic coordination networks(MOCNs): Application towards H <sub>2</sub> -storage – SERC fast track scheme	DST	3 years
65	K B Sinha	Evaluation of Impact of DST-FIST Scheme	DST	One year
66	Umesh V. Waghmare	Density functional theory calculations	Procter & Gamble	One year
67	Swapan K. Pati	Molecular Electronics and its Application (AOARD-08-4008)	US Airforce Lab, Dayton	One year
68	M R S Rao	Chromatin Biology: Epigenomics of chromatin and chromatin remodelling during male germ cell differentiations and glioma progression	DBT	3 years



## PUBLICATIONS

The Centre has registered a very good progress in its publications. A chart showing the year-wise publication and the impact factor thereof is appended below:



### 1. Research Publications of Units

#### (i) Chemistry and Physics of Materials Unit

1. Sahu JR, Serrao CR, Ray N, Waghmare UV, Rao CNR. Rare earth chromites: A new family of multiferroics. *J. Mater. Chem. (Commun.)*, 17, 42, 2007.
2. Ramesha K, Llobet A, Th. Proffen, Serrao CR, Rao CNR. Observation of local non-centrosymmetry in weakly biferroic YCrO<sub>3</sub>. *J. Phys: Condens. Matter (Letter)*, 19, 102202, 2007.
3. Kundu AK, Sarkar R, Pahari P, Ghoshray A, Rao CNR. A Comparative study of the magnetic properties and phase separation behavior of the rare earth cobaltates, Ln<sub>0.5</sub>Sr<sub>0.5</sub>CoO<sub>3</sub>. *J. Solid State Chem.* 180, 1318, 2007.
4. Kundu AK, Pocalong V, Caignert V, Rao CNR, Raveau B. Enhancement of ferromagnetism by Co and Ni substitution in the perovskite LaBiMn<sub>2</sub>O<sub>6+d</sub>. *J. Mater. Chem.*, 17, 3347, 2007.
5. Sahu JR, Rao CNR. Beneficial modification of the properties of multiferroic BiFeO<sub>3</sub> by cation substitution. *Solid State Sci.*, 9, 950, 2007.
6. Rao CNR, Serrao CR. New routes to multiferroics. *J. Mater. Chem. (High light)*, 17, 4931, 2007.
7. Serrao CR, Sundaresan A, Rao CNR. Multiferroic nature of charge-ordered rare earth manganates. *J. Phys. Condens. Matter (Letter)*, 9, 496217, 2007.
8. Thirumurugan A, Suchetan PA, Cheetham AK, Rao CNR. A three-dimensional lead, 2,6-dihydroxybenzoate with channels. *Z. Anorg. Allg. Chem.*, 633, 2742, 2007.
9. Rao KP, Thirumurugan A, Rao CNR. Lamellar and three-dimensional hybrid compounds formed by cyclohexene and cyclohexane-dicarboxylates of Pb, La and Cd. *Chem. Euro J.*, 13, 3193, 2007.

10. Behera JN, Rao CNR. Synthesis and magnetic properties of an amine-templated Mn<sup>2+</sup> (S = 5/2) sulfate with the Kagome structure. *Dalton Trans.*, 669, 2007.
11. Rao KP, Rao CNR. Coordination polymers and hybrid networks of different dimensionalities formed by metal sulfites. *Inorg. Chem.*, 46, 2511, 2007.
12. Cheetham AK, Rao CNR. There's room in the middle. *Science*, 318, 58, 2007.
13. Dinesh J, Eswaramoorthy M, Rao CNR. Fabrication of GaN nanotube brushes by using amorphous carbon nanotubes as templates. *J. Phys. Chem. B. (Letter)*, C111, 510, 2007.
14. Kamaraju N, Kumar S, Sood AK, Guha S, Krishnamurthy S, Rao CNR. Large non-linear absorption and refraction coefficients of carbon nanotubes estimated from femtosecond z-scan measurements. *Appl. Phys. Lett.* 91, 251103, 2007.
15. Varghese N, Panchakarla LS, Hanapi M, Govindaraj A, Rao CNR. Solvothermal synthesis of nanorods of ZnO, N-doped ZnO and CdO. *Mater. Res. Bull.*, 42, 2117, 2007.
16. Biswas K, Rao CNR. Use of ionic liquids in the synthesis of nanocrystals and nanorods of semiconducting metal chalcogenides. *Chem-Euro. J.* 13, 6123, 2007.
17. Biswas K, Bhat SV, Rao CNR. Surface-enhanced Raman spectra of aza aromatics on nanocrystals of metallic ReO<sub>3</sub>. *J. Phys. Chem. C*, 111, 5689, 2007.
18. Ghosh S, Biswas K, Rao CNR. Core-shell nanoparticles based on an oxide metal: ReO<sub>3</sub>@Au(Ag) and ReO<sub>3</sub>@SiO<sub>2</sub> (TiO<sub>2</sub>). *J. Mater. Chem.*, 17, 2412, 2007.
19. Biswas K, Rao CNR. Synthesis and characterization of nanocrystals of the oxide metal, RuO<sub>2</sub>, IrO<sub>2</sub>- and ReO<sub>3</sub>. *J. Nanosci. Nanotech.*, 7, 1969, 2007.
20. Kalyanikutty KP, Gautam U, Rao CNR. Ultra-thin films of CdSe and CuSe formed at the organic-aqueous interface. *J. Nanosci. Nanotech.*, 7, 1916, 2007.
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25. Rout CS, Hegde M, Govindaraj A, Rao CNR. Ammonia sensors based on metal oxide nanostructures. *Nanotechnology*, 18, 205504, 2007.
26. Voggu R, Suguna P, Chandrasekaran S, Rao CNR. Assembling covalently linked nanocrystals and nanotubes through click chemistry. *Chem. Phys. Lett.* 443, 118, 2007.
27. Shipra, Gomati A, Sundaresan A, Rao CNR. Room-temperature ferromagnetism in nanoparticles of superconducting materials. *Solid State Commun.*, 142, 685, 2007.
28. Biswas K, Muthu DWS, Sood AK, Kruger MB, Chen B, Rao CNR. A synchrotron x-ray diffraction study of the pressure induced phase transitions in nanocrystalline ReO<sub>3</sub>. *J. Phys: Condens. Matter.*, 19, 436214, 2007.
29. Panchakarla LS, Govindaraj A, Rao CNR. Formation of ZnO nanoparticles by the reaction of zinc metal with aliphatic alcohols. *J. Cluster Sci. (Fenske issue)*, 18, 660, 2007.
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33. Bhargava BL, Balasubramanian S. Nanoscale Organization in Room Temperature Ionic Liquids: A Coarse Grained Molecular Dynamics Simulation Study. *Chemical Physics Letters*, 444, 242-246, 2007.
34. Bhargava BL, Balasubramanian S. A refined potential model for atomistic simulations of an ionic liquid, [bmim][PF<sub>6</sub>]. *Journal of Chemical Physics* 127, 114510, 2007.
35. Kavitha G, Chandrabhas Narayana. Raman spectroscopic investigations of pressure-induced phase transitions in n-hexane. *Journal of Physical Chemistry B* 111(51); 14130-14135, 2007.
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### viii) Condensed Matter Theory Unit

1. Sarma DD, Ray S, Tanaka K, Kobayashi M, Fujimori A, Sanyal P, Krishnamurthy HR, Dasgupta C. Intergranular magnetoresistance in Sr<sub>2</sub>FeMoO<sub>6</sub> from a magnetic tunnel barrier mechanism across grain boundaries. *Phys. Rev. Lett.* 98, 157205, 2007.
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## 2. Research Publications of Honorary Faculty/Endowed Professors

1. Pucadyil TJ, Chattopadhyay A. Cholesterol: A Potential Therapeutic Target in Leishmanial Infection? *Trends Parasitol*, 23, 49-53, 2007
2. Pucadyil TJ, Chattopadhyay A. Cholesterol Depletion Induces Dynamic Confinement of the G-protein Coupled Serotonin<sub>1A</sub> Receptor in the Plasma Membrane of Living Cells. *Biochim. Biophys. Acta (Biomembranes)*, 1768, 655-668, 2007.
3. Shrivastava S, Chattopadhyay A. Influence of Cholesterol and Ergosterol on Membrane Dynamics using Different Fluorescent Reporter Probes. *Biochem. Biophys. Res. Commun.*, 356, 705-710, 2007.
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27. Saravanan M, Vasu K, Ghosh S, Nagaraja V. Dual Role for Zn<sup>2+</sup> in maintaining structural integrity and inducing DNA sequence specificity in a promiscuous endonuclease. *J. Biol. Chem.* 282, 32320-32326, 2007.
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31. Palaniyandi P, Rangarajan G. Critical lattice size limit for synchronized chaotic state in one- and two-dimensional diffusively coupled map lattices. *Physical Review E*, 76, 027202, 2007.
32. Nalatore H, Truccolo W, Rangarajan G. Fast robust pattern classification algorithms for real time neuro-motor prosthetic applications. *Journal of the Indian Institute of Science*, 87, 497, 2007.
33. Nanjundiah V. Alfred Russel Wallace – A Life: Book Review, *Resonance*, March 2008, 277-283, 2008.
34. Dhamala M, Rangarajan G, Ding M. Estimating Granger causality from Fourier and wavelet transforms of time series data. *Physical Review Letters*, 100, 018701, 2008.
35. Paila YD, Murty MRVS, Vairamani M, Chattopadhyay A. Signaling by the Human Serotonin<sub>1A</sub> Receptor is Impaired in Cellular Model of Smith-Lemli-Opitz Syndrome. *Biochim. Biophys. Acta (Biomembranes)*, 2008. (in press).
36. Shrivastava S, Paila, YD, Dutta A, Chattopadhyay A. Differential Effects of Cholesterol and its Immediate Biosynthetic Precursors on Membrane Organization. *Biochemistry*, 2008. (in press).
37. Ganguly S, Pucadyil TJ, Chattopadhyay A. Actin Cytoskeleton Dependent Dynamics of the Serotonin<sub>1A</sub> Receptor Correlates with Receptor Signaling. *Biophys. J.*, 2008. (in press).
38. Chattopadhyay A, Rawat SS, Greathouse DV, Kelkar DA, Koeppe RE. Role of Tryptophan Residues in Gramicidin Channel Organization and Function. *Biophys. J.*, 2008. (in press).
39. Vasu K, Saravanan M, Bujnicki JM, Nagaraja V. Structural integrity of the Beta Beta Alpha-Metal finger motif is required for DNA binding and stable protein–DNA complex formation in R.KpnI. *Biochim. Biophys. Acta.*, 2008. (in press)
40. Dhamala M, Rangarajan G, Ding M. Analyzing information flow in brain networks with nonparametric Granger causality. *NeuroImage* (accepted for publication) 2008.

#### **Books/Proceedings authored/edited by Faculty**

1. Narayan, KS. Special issue on Organic Electronics in The Proceedings of IEEE (A prestigious review journal published since 1913) co-editor along with J. Lewis, J. Burroughes, Y. Ohmori).
2. Chandrashekar M K, Sharma VK. Tidal rhythms. In: *Ultradian Rhythms*. Llyod D, Rossi E. (eds.). Springer-Verlag, Berlin, 2008.
3. Valdiya KS. The Making of India : Geodynamic Evolution, (953 pages and 382 illustrations), *Macmillan India Limited*, New Delhi. 2008. (submitted)
4. Valdiya KS. Facing Natural Hazards: Earthquakes and Landslides. *Gyanodaya Prakashan*, Nainital, 83 p, (Popular book), 2008.
5. Valdiya KS. Bhukamp Aur Bhusakhalan: Sankaton Kaa Saamana. *Gyanodaya Prakashan*, Nainital, (Popular book in Hindi), 2008.

#### **Books/Proceedings authored/edited by Hon. Faculty**

1. Vijay B. Shenoy, Krishnamurthy HR, Ramakrishnan TV. Electronic Inhomogenites in Complex Oxides: Effect of Long Ranged Coulomb Interactions in “Nanomaterials Chemistry: Recent developments and new directions” (Eds. C N R Rao, Achim Müller and Anthony K. Cheetham) Wiley-VCH, Aug 2007.
2. Kalipatnapu S, Pucadyil TJ, Chattopadhyay A. Membrane Organization and Dynamics of the Serotonin<sub>1A</sub> Receptor Monitored using Fluorescence Microscopic Approaches in *Serotonin Receptors in Neurobiology*, *New Frontiers in Neuroscience* series, Chattopadhyay A (Ed.), CRC Press, Boca Raton, Florida, 41-60, 2007.
3. Chattopadhyay A (Ed) Serotonin Receptors in Neurobiology *New Frontiers in Neuroscience* series (series editors: Simon, S.A., and Nicolelis, M.A.L.), CRC Press, 2007 (in press)





## AWARDS/DISTINCTIONS

The following faculty and honorary faculty members of the Centre have received various honors and awards both at the national and international level in recognition of their significant contributions to the progress of science and technology.

### Awards & Honours

#### Prof C N R Rao

- Distinguished Research Fellow, University of Cambridge and Member of Sidney Sussex College
- Knowledge Millennium Award, ASSOCHAM, (2007).
- D.Sc. (Honoris Causa) by IGNOU, New Delhi (2008).
- Bangalore Nano National Award 2007 by Government of Karnataka.
- Honorary Degree of Doctor of Science, Northwestern University, USA (2008).
- Laureate of the 21<sup>st</sup> Khwarizmi International Award by the Iranian Government (2008).
- Nikkei Asia Prize for Science, Technology and Innovation, Nihon Keizai Shimbun, Inc. (Nikkei), Japan (2008).

#### Prof M R S Rao

- Dr B R Ambedkar Centenary Award for the year 2005 jointly with Prof S K Brahmachari for their contributions in the field of bio-medical research.
- TWAS Medal Lecture Award 2008.

#### Prof K S Valdiya

- Athmaram Puraskar

#### Dr Amitabha Chattopadhyay

- Ranbaxy Research Award (Medical Sciences – Basic Research)

#### Prof M K Chandrashekar

- DST Ramanna Fellowship – 2008-2011

#### Dr Meheboob Alam

- Young Asian Fluid Dynamicist Award (Zhou-Sato-Narasimha Award, 2007, First Recipient)

#### Prof K S Narayan

- Materials Research Society of India, Superconductivity and Materials Science prize - medal during MRSI - AGM 2008

#### Prof Rama Govindarajan

- CSIR Shanti Swarup Bhatnagar Prize, 2007

#### Prof M M Sharma

- I I Che-Diamond Jubilee Award
- DIAMOND - A special issue of *Chemical Engineering Science* was taken out in his honour to coincide with the International Conference on Gas-Liquid and Gas-Liquid-Solid Reactor Engineering, Dec 2007.
- FEISHCRIFT in his Honour of Acs-Industrial Engineering Chemistry Research to coincide with his 70<sup>th</sup> Birthday, May, 2007

## FELLOWSHIPS

### **Prof Chandan Dasgupta**

Elected Fellow of the Academy of Sciences for the Developing World (TWAS), 2007

### **Prof Dipankar Chatterji**

Fellow, Third World Academy of Sciences

### **Dr K George Thomas**

Fellow, Indian Academy of Sciences

### **Prof V Nagaraja**

J C Bose Fellowship of Dept. Science and Technology, 2007  
Fellowship of National Academy of Sciences, India, Allahabad

### **Prof Raghavendra Gadagkar**

Elected Foundation Fellow, Entomology Academy of India, Chennai, 2007

### **Prof Swapan K Pati**

Swaranjayanti Fellowship for the year 2006-2007

### **Prof Tapas Kumar Kundu**

Elected as fellow of Indian Academy of Science, Bangalore, 2008

### **Prof Umesh V Waghmare**

Elected as a Fellow of National Academy of Sciences, Allahabad, 2007  
Elected as a Fellow of Indian Academy of Sciences, Bangalore, 2008

### **Prof R Varadarajan**

J C Bose Fellowship of Dept. of Science and Technology, 2007

## **EDITORIAL BOARDS**

### **Prof Amitabh Joshi**

Chief Editor, *Journal of Genetics*  
Member, Council of Editors, *Resonance*

### **Prof M K Chandrashekar**

Member, Council of Editors, *Resonance*

### **Prof K S Narayan**

Associate Editor, *Journal of Sensors*

### **Prof Srikanth Sastry**

Co-Editor, *Journal European Physical Journal E - Soft Matter*

### **Prof Vijay Kumar Sharma**

Member, Editorial Board of the *Journal of Circadian Rhythms*  
Member, Editorial Board of the *Journal of Genetics*



## **MEMBERSHIPS/APPOINTMENTS**

### **Prof C N R Rao**

Chairman, National Nano Initiative, Government of India.  
Distinguished Visiting Professor, University of California, Berkeley.  
Elected as Distinguished Research Fellow of University of Cambridge  
Elected to be a Member of the Sidney Sussex College at Cambridge.

### **Prof Amitabh Joshi**

Member, DST Project Advisory Committee for Animal Sciences.  
Member, Board of Studies (5 Yr Integrated MSc) in Life Sciences,  
Bangalore University.

### **Prof N Chandrabhas**

Member, American Chemical Society

### **Prof Dipankar Chatterji**

Distinguished Research Professor, Institute of Life Sciences, Hyderabad

### **Dr Ganesh Subramanian**

Young Associate of the Indian Academy of Sciences (2007-2010)

### **Prof G U Kulkarni**

Member, MRSI Council for 2008-2010

### **Prof H R Krishnamurthy**

Member, Management Board, International Centre for Theoretical Sciences

### **Dr M K Sanyal**

*“Eukaryotic Cell Outstanding Investigator Award”* for best poster in the 9th ASM meeting on Candida & Candidiasis held in New York, USA (March, 2008).

### **Prof Raghavendra Gadagkar**

Vice-President, Entomology Academy of India, Chennai, 2007-2010.  
Member, India-Elsevier Advisory Board, 2007 – 2009.  
Co-Chair, Organizing Committee, Indo-UK Frontiers of Science Symposium, 2007.  
Member, Scientific Committee, The Evolution of Cooperation and Trading (TECT),  
European Collaborative Research (EUROCORES), European Science Foundation (ESF),  
2007 - present .  
Member, National Organising Committee, Human Genome Meeting (HCM) 2008.  
Chairman, National Committee of International Union of Biological Sciences (IUBS), 2008-2011.

### **Prof Sharat Chandra**

Member, UNESCO's International Bioethics Committee (2008-2011).

### **Prof Srikanth Sastry**

Member, International Advisory Committee, “STATPHYS 23”, Genoa, Italy, 2007

### **Prof Shobo Bhattacharya**

Elected as a Visiting Fellow Commoner by the Council of Trinity College, Cambridge University,  
UK (2008-2009)  
Elected as the International Councilor for the American Physical Society (2008-2010)

### **Prof Swapan K Pati**

Representing JNC in I2CAM board of directors (established MoU between I2CAM, LANL/UCDavis and JNCASR) from 2007.

### **Prof M Vijayan**

Elected as President, Indian National Science Academy, New Delhi

### **Prof Vijaya Kumar Sharma**

Member, Planning Committee for SERC School on Chronobiology

### **Prof S Yashonath**

Visiting Professorship of University of Sassari, Italy

## **LECTURESHIPS**

### **Dr Amitabha Chattopadhyah**

Delivered Bimala Churn Law Memorial Lecture (IACS, Kolkata)

### **Prof V Nagaraja**

J D Das memorial lecture of Indian Society for Cell Biology

### **Prof Raghavendra Gadagkar**

10<sup>th</sup> Prof. S. P. Ray-Chaudhuri Memorial Lecture, Banaras Hindu University, Varanasi, 2 April 2007.

“Distinguished Lecture”, University of Hyderabad, Hyderabad, 4 April 2007.

Plenary Lecture delivered during the 31<sup>st</sup> Annual Conference of the Ethological Society of India, held at the University of Agricultural Sciences, GKVK Campus, Hebbal, April 10-12, 2007.

CSIR Foundation Day Lecture - CDRI, NBRI, ITRC & CAMP”, Industrial Toxicology Research Centre, Lucknow, 26 September 2007.

Shastra Lecture – Indian Institute of Technology, Chennai, 28 September 2007.

Diamond Jubilee Colloquium – Raman Research Institute, Bangalore, 4 April 2008.

### **Prof S Bhattacharya**

Nitya Anand Endowment Lecture

### **Prof A Surolia**

Founder's Day Lecture at Indian Institute of Chemical Technology, Hyderabad (2007)

Prof. BK Bachhawat Memorial Lecture at NCPGR (2007) Delhi

10<sup>th</sup> NIFER Foundation Day Lecture, Mohali (2008)

Prof. Anil Lala Memorial Lecture at IIT, Mumbai (2008)

8<sup>th</sup> Prof. BK Bachhawat Memorial Lecture at IMTECH, Chandigarh (2008).

Delivered Plenary Lectures at numerous National and International Conferences held in India

☆ ☆ ☆



# FINANCIAL STATEMENTS

**Name** : JAWAHARLAL NEHRU CENTRE FOR  
ADVANCED SCIENTIFIC RESEARCH

**Address** : JAKKUR POST, BANGALORE – 560 064

**Year Ended** : 31<sup>st</sup> MARCH 2008

**Assessment Year** : 2008-09

## Auditor's Report to the Members of the Governing Body of Jawaharlal Nehru Centre for Advanced Scientific Research

We have audited the attached Balance Sheet of **Jawaharlal Nehru Centre For Advanced Scientific Research** as at March 31, 2008 and also the Income & Expenditure Account for the year ended on that date and the Receipts and Payment account for the year ended on that date annexed thereto. These financial statements are the responsibility of the management of Jawaharlal Nehru Centre for Advanced Scientific Research. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with auditing standards generally accepted in India. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by Management as well as evaluating the overall financial statements presentation. We believe that our audit provides reasonable basis for our opinion.

### We report that:

1. We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our audit.
2. In our opinion proper books of accounts as required by law have been kept by Jawaharlal Nehru Centre For Advanced Scientific Research so far as it appears from our examination of those books.
3. The Balance Sheet, Income and Expenditure Account and Receipts and Payment account dealt with by this report are in agreement with the books of account.
4. The Balance Sheet and Income and Expenditure Account dealt with by this report are prepared in accordance with the Accounting Standards issued by the Institute of Chartered Accountants of India subject to the following observations:
  - (i) Non-Provisions of accrued liability in respect of leave encashment which is not in conformity with the Accounting Standard 15 [Accounting for retirement benefits in the financial statements of Employers] issued by the Institute of Chartered Accountants of India. [Refer Note No.3 of Schedule No.24]
  - (ii) The amount spent on acquisition of fixed assets has been deducted from the total grants/subsidies received in the Income & Expenditure account. This is not in conformity with the Accounting Standard- 5 issued by the Institute Of Chartered Accountants of India. It has been explained that this format has been consistently used to present the accounts before the authority who grant the funds.
5. In our opinion and to the best of our information and according to the explanations given to us and subject to notes on accounts and our qualifications in para 4 above, the said accounts give a true and fair view in conformity with the accounting principles generally accepted in India:
  - (a) in the case of Balance Sheet, of the state of affairs of the Jawaharlal Nehru Centre for Advanced Scientific Research as at March 31, 2008; and
  - (b) in the case of Income and Expenditure Account, of the excess of Income over Expenditure for the year ended on that date.

For M/s G R Venkatanarayana  
Chartered Accountants  
(G R Venkatanarayana)  
Partner  
Membership No. 18067

Place : Bangalore

Dated: 19.09.2008



**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
**BALANCE SHEET AS AT 31<sup>ST</sup> MARCH 2008**

Description	Schedule	Current year		Previous year	
		2007-08		2006-07	
		Rs.	Ps.	Rs.	Ps.
<b><u>LIABILITIES</u></b>					
Corpus/Capital Fund	1	912,811,821.54		783,814,248.54	
Reserves & Surpluses	2	62,612,039.99		44,897,975.61	
Earmarked and Endowment Funds	3	103,169,159.05		72,046,175.15	
Secured loans and Borrowings	4		0.00		0.00
Unsecured loans and Borrowings	5		0.00		0.00
Deferred Credit Liabilities	6		0.00		0.00
Current Liabilities and Provisions	7	22,397,147.14		4,929,765.45	
Other funds-Cluster Studies		39,541.00		39,541.00	
Scheme Balances		83,341,564.57		103,816,747.30	
<b>Total</b>		<b>1,184,371,273.29</b>		<b>1,009,544,453.05</b>	
<b><u>ASSETS</u></b>					
Fixed Assets (at gross)	8	912,811,821.54		783,814,248.54	
Investments-Endowment Funds	9	66,625,000.00		69,125,000.00	
Investment - Others	10	175,197,440.00		130,715,690.00	
Current Assets, Loans, Advances etc.	11	29,737,011.75		25,889,514.51	
<b>Total</b>		<b>1,184,371,273.29</b>		<b>1,009,544,453.05</b>	
Significant accounting policies(Enclosed)	24				
<b>Contingent Liabilities &amp; Notes on Accounts</b>	25				

Schedule 1 to 25 form integral part of Accounts

For Jawaharlal Nehru Centre for Advanced Scientific Research

This is the Balance sheet referred to in our report of even date.

for M/S G R Venkatanarayana  
Chartered Accountants  
Sd/-  
(G R Venkatanarayana)  
Partner  
Membership No. 018067

Sd/-  
R S Gururaj  
Accounts Officer

Sd/-  
Prof M R S Rao  
President

Place : Bangalore  
Date : 19.09.2008

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH  
INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31<sup>ST</sup> MARCH 2008**

Description	Schedule	Current year		Previous year	
		2007-08		2006-07	
		Rs.	Ps.	Rs.	Ps.
<b><u>INCOME</u></b>					
Income from services	12	962,200.68		0.00	
Grants/Subsidies received	13	280,037,595.00		235,297,523.00	
		280,999,795.68		235,297,523.00	
Less: Extent of fixed assests procured		128,997,573.00		105,610,081.10	
		<b>152,002,222.68</b>		<b>129,687,441.90</b>	
Income from Fees/Subscriptions etc	14	949,827.00		801,146.00	
Income from investments	15		0.00	0.00	
Royalty Income,Publication,Licence fee etc	16	380,775.51		133,667.01	
Interest earned	17	7,089,418.49		7,808,498.96	
Other income	18	16,319,415.00		12,503,722.00	
Increase/decrease in stocks	19		0.00	0.00	
		<b>176,741,658.68</b>		<b>150,934,475.87</b>	
<b><u>EXPENDITURE</u></b>					
Establishment expenses	20	64,847,130.00		46,232,113.00	
Other administrative expenses	21	86,171,691.52		65,302,038.00	
Expenditure on Grants,Subsidies etc	22		0.00	0.00	
Interest & bank charges	23	8,772.88		39,036.00	
		<b>151,027,594.40</b>		<b>111,573,187.00</b>	
Excess of Income over Expenditure		25,714,064.28		39,361,288.87	
Less: Transferred to Corpus Fund Account		8,000,000.00		3,796,916.00	
		<b>17,714,064.28</b>		<b>35,564,372.87</b>	
Balance brought forward		<b>44,897,975.71</b>		<b>9,333,602.74</b>	
Balance carried to Balance sheet		<b>62,612,039.99</b>		<b>44,897,975.61</b>	
<b>Significant accounting policies (Enclosed)</b>	24				
<b>Contingent Liabilities &amp; Notes on Accounts</b>	25				

Schedule 1 to 25 form an integral part of Accounts

For Jawaharlal Nehru Centre for Advanced Scientific Research

This is the Income and Expenditure account referred to in our report of even date.

for M/S G R Venkatanarayana  
Chartered Accountants  
Sd/-  
(G R Venkatanarayana)  
Partner  
Membership No. 018067

Sd/-  
RS Gururaj  
Accounts Officer

Sd/-  
Prof M R S Rao  
President

Place : Bangalore  
Date : 19.09.2008





**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH  
RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31.03.2008**

Opening Balances & Receipts	2007-08 Rs. Ps.	2006-07 Rs. Ps.	Payments & Closing Balances	2007-08 Rs. Ps.	2006-07 Rs. Ps.
<b>I. Opening Balances:</b>					
a. Cash in hand & Imprest at centre	274,063.00	69,616.00	I. Expenses:	64,847,130.00	42,245,417.55
b. Bank balances:			a. Establishment Expenses	86,059,786.52	65,131,974.00
<i>In savings bank Accounts:</i>			b. Administrative Expenses	929,819.00	900,748.11
At Canara bank	1,719,659.21	10,071,491.35	c. Expenditure of endowments	<b>151,836,735.52</b>	<b>108,278,139.66</b>
At Union Bank of India	4,967.00	0.00	II. Payment made against funds		
<i>In Deposit accounts:</i>			for various projects:	0.00	0.00
At IDBI bank	3,100,000.00	3,100,000.00	III. Investments and Deposits made:		
At HDFC trust	12,125,000.00	8,100,000.00	a. Out of earmarked /Endowment		
At ICICI Bank	0.00	800,000.00	funds	0.00	0.00
At Union Bank of India	5,000,000.00	0.00	b. Out of own funds	0.00	0.00
At Canara Bank	48,000,000.00	63,500,000.00	IV. Expenditure on Fixed assets and		
	<b>69,949,626.21</b>	<b>85,571,491.35</b>	Capital Work-in-progress:		
<b>II. Grants Received:</b>			a. Purchase of fixed assets	115,040,366.00	105,610,081.00
From DST travel grant	358,178.00	0.00	b. Out standing Creditors paid	0.00	63,011,273.45
From DST-Grant in aid	270,000,000.00	230,000,000.00	V. Refund of surplus money/Loans	0.00	0.00
From DST for Building	6,000,000.00	5,000,000.00	VI. Finance charges(Bank charges)	8,772.88	39,036.00
From DST for Meeting/Seminars	3,679,417.00	297,523.00			
On behalf of Endowments	2,058,450.00	87,618.00			
	<b>282,096,045.00</b>	<b>235,385,141.00</b>			
<b>III. Income on Investments from:</b>					
A. Interest on FD's:					
a. From Earmarked/Endowment Funds	4,724,408.00	5,241,797.00			
b. From Own funds	6,960,246.00	5,130,770.00			
	<b>11,684,654.00</b>	<b>10,372,567.00</b>			
<b>IV. Interest received:</b>					
a. On Bank S.B A/c	129,172.49	336,839.96			
<b>Balance Carried Over</b>	<b>364,133,560.70</b>	<b>331,735,655.31</b>	<b>Balance Carried Over</b>	<b>266,885,874.40</b>	<b>276,938,530.11</b>

Contd...)



**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH  
RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31.03.2008**

Opening Balances & Receipts	2007-08 Rs. Ps.	2006-07 Rs. Ps.	Payments & Closing Balances	2007-08 Rs. Ps.	2006-07 Rs. Ps.
<b>Balance Brought Forward</b>	364,133,560.70	331,735,655.31	<b>Balance Brought Forward</b>	266,885,874.40	276,938,530.11
<b>V. Other Income:</b>			<b>Other payments:</b>		
a. Royalty	1,171,074.51	10,386.01	Caution money deposit returned	20,000.00	14,000.00
b. Licence Fee	151,407.00	123,281.00	Staff advances		21,406.00
c. Collections from Visitors, Guest room etc	2,192,469.00	2,311,145.00	Dues paid to schemes	170,064.00	1,330,833.90
d. from fee, subscription etc	949,827.00	801,146.00	Statutory liability paid	59,894.00	0.00
e. CSIR fellowships, SRFP reimbursements	11,345,958.00	9,553,246.00	Contingent Advances paid	70,426.00	0.00
f. Donations	2,500,000.00	0.00	Other advances given		
g. From services	962,200.68	0.00			
h. From others	280,988.00	639,331.00			
	<b>19,553,924.19</b>	<b>13,438,535.01</b>	<b>VIII. Closing Balances:</b>	<b>320,384.00</b>	<b>1,366,239.90</b>
<b>VI. Amount borrowed</b>	<b>0.00</b>	<b>0.00</b>	a. Cash in hand & Imprest at centre	<b>273,565.00</b>	<b>274,063.00</b>
<b>VII. Other receipts:</b>			b. Bank balances:		
Amount transferred from schemes	15,898,236.00	2,000,000.00	<i>In savings bank accounts:</i>		
Dues received from schemes	2,000,000.00	0.00	Canara Bank	5,268,086.18	1,719,659.21
Earnest money received	3,530,612.00	372,618.00	Union Bank of India	756,295.00	4,967.00
Advances Returned back- staff	36,900.00	749,192.00	<i>In deposit accounts:</i>		
SRFP caution money	6,000.00	0.00	At canara bank	98,981,750.00	48,000,000.00
Unascertained receipts (NIMS-Sumitomo)	51,721.69	0.00	At IDBI bank	600,000.00	3,100,000.00
Contingency advances returned	0.00	232,459.00	At Union bank of India	20,000,000.00	5,000,000.00
	<b>21,523,469.69</b>	<b>3,354,269.00</b>	At HDFC trust	12,125,000.00	12,125,000.00
<b>TOTAL</b>	<b>405,210,954.58</b>	<b>348,528,459.32</b>	<b>TOTAL</b>	<b>137,731,131.18</b>	<b>69,949,626.21</b>
				<b>405,210,954.58</b>	<b>348,528,459.22</b>

For Jawaharlal Nehru Centre for Advanced  
Scientific Research

This is the Receipts and payments account  
referred to in our report of even date.

for M/s G.R.VENKATANARAYANA  
Chartered Accountants

Sd/-  
R.S.Gururaj  
Accounts Officer

Sd/-  
(G.R.VENKATANARAYANA)  
Partner

Membership No. 18067  
Place : Bangalore  
Date : 19.09.2008

Sd/-  
Prof.M.R.S.Rao  
President

## Schedule No. 24

### Accounting Policies for the Year 2007-08

1. The fixed assets are stated at cost. The Centre has identified depreciation on Fixed Assets, and since they are created out of Grant in Aid funds, they have been classified the same in the statement of affairs under Capital Fund and also under Fixed Assets schedule respectively.
2. Grants received and utilised for procurement of Fixed Assets have been reduced from the total grants received in the Income and Expenditure Account and the same have been included under the Capital Fund Account.
3. The leave encashment to the staff members is accounted as and when it is paid.
4. Investments of the Centre are stated at cost. The interest on investment is accounted on accrual basis.
5. The foreign currency transactions are translated at the rates prevailing on the date of transaction.
6. Previous years figures have been regrouped and reclassified to read in conformity with the current year's figures.
7. The Centre has put in to operation a system whereby the accounting standards with respect to the above are brought in conformity with the mandatory accounting standards recommended by the Institute of Chartered Accountants of India.
8. Royalty income has been accounted as and when received.
9. The Expenditure listed under Schedule 20 as Establishment Expenses include the salaries paid to Faculty, Scientific and Research Personnel. The Expenditure listed under the Schedule 21 as Administrative Expenses include the expenses towards Laboratory Consumables and Seminar/ Workshops/ Discussion meetings exclusively incurred for Research purposes.
10. No provision for income tax has been made as the Institution is exempt U/s 35 (1) (ii) of the Income Tax Act, 1961.

For M/s G R Venkatanarayana  
Chartered Accountants

Sd/-  
**R S Gururaj**  
Accounts Officer

Sd/-  
**(G R Venkatanarayana)**  
Partner  
Membership No.18067

Sd/-  
**Prof M R S Rao**  
President

Place: Bangalore  
Date : 19.09.2008

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**

**Schedule forming part of the accounts**

Description	2007-08		2006-07	
	Rs.	Ps.	Rs.	Ps.
<b>Schedule 1: Capital Fund</b>				
Balance as at the beginning of the year	737,066,209.54		631,456,128.44	
Carbon Nano Materials	34,182,430.00		34,182,430.00	
Physics and Chemistry of Materials	9,878,095.00		9,878,095.00	
Cluster Studies	2,687,514.00		2,687,514.00	
	<b>783,814,248.54</b>		<b>678,204,167.44</b>	
Less : Depreciation up to the end of previous year	193,295,837.00		161,610,525.00	
	<b>590,518,411.54</b>		<b>516,593,642.44</b>	
Add : Addition to Fixed Assets during the current year	128,997,573.00		105,610,081.10	
	<b>719,515,984.54</b>		<b>622,203,723.54</b>	
Less : Depreciation for the current year	37,080,398.00		31,685,312.00	
	<b>682,435,586.54</b>		<b>590,518,411.54</b>	
Add : Depreciation Reserve per contra	230,376,235.00		193,295,837.00	
<b>TOTAL</b>	<b>912,811,821.54</b>		<b>783,814,248.54</b>	
<b>Schedule 2- Reserves and Surpluses:</b>				
Surplus in Income and Expenditure Account	62,612,039.99		44,897,975.61	
	<b>62,612,039.99</b>		<b>44,897,975.61</b>	
<b>Schedule 3- Earmarked / Endowment Funds:</b>				
<b>A : Infrastructure Corpus Fund</b>				
Opening Balance	33,614,232.65		25,817,316.65	
Additions during the year	19,584,317.00		4,000,000.00	
Amount transferred from Income & Expenditure A/c	8,000,000.00		3,796,916.00	
	<b>61,198,549.65</b>		<b>33,614,232.65</b>	
<b>B : Other funds</b>				
Opening Balance of the Funds	38,431,942.50		36,168,312.61	
Add : Additions :				
Funds/Donations/Grants/Royalties	2,058,450.00		87,618.00	
Funds-Income from Investments made	2,410,036.00		3,076,760.00	
	<b>42,900,428.50</b>		<b>39,332,690.61</b>	
Less : Funds-utilisation/Expenditure incurred	929,819.10		900,748.11	
	<b>41,970,609.40</b>		<b>38,431,942.50</b>	
<b>TOTAL</b>	<b>103,169,159.05</b>		<b>72,046,175.15</b>	
<b>Schedule 7- Current liabilities and provisions</b>				
Sundry Creditors EMD	4,214,433.00		683,821.00	
Sundry Creditors CMD	69,185.00		89,185.00	
Sundry Creditors for others	18,077,843.14		3,986,695.45	
Statutory Liabilities	35,686.00		170,064.00	
<b>TOTAL</b>	<b>22,397,147.14</b>		<b>4,929,765.45</b>	

Sd/-

**RS Gururaj**  
Accounts Officer



**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
**Schedule forming part of the accounts**

Description	2007-08		2006-07	
	Rs.	Ps.	Rs.	Ps.
<b>Schedule 8: Fixed Assets</b>				
<b>Land - Free Hold</b>	<b>17,715,351.00</b>		<b>17,715,351.00</b>	
<b>Buildings :</b>				
General	79,658,165.26		79,658,165.26	
Hostel Building	15,570,835.00		15,570,835.00	
New Lab Building - AMRL	25,930,339.00		25,930,339.00	
Animal House	5,614,415.00		5,614,415.00	
Staff Housing	4,156,168.00		4,156,168.00	
ETU Building	2,048,814.00		2,048,814.00	
Engineering & Mechanical Unit Block	7,234,709.00		4,643,669.00	
Other buildings like extn to Hostel, College etc.,	11,883,626.00		11,883,626.00	
Nano Science Block	7,042,909.00		7,042,909.00	
Extention to Pauling Building - Biology Block	4,680,084.00		4,680,084.00	
Dining Hall & Kitchen Block	8,582,843.00		4,844,910.00	
Radio Active Lab	203,233.00		203,233.00	
International Centre for Material Science	24,577,230.00		4,606,948.00	
Lecture Hall & Academic Block	8,556,759.00		2,393,547.00	
Hostel Phase II	19,552,377.00		19,552,377.00	
STP Building	291,699.00		291,699.00	
Hostel Phase III	13,426,253.00		1,433,749.00	
International house	12,768,383.00		0.00	
CNR Rao Hall of Science	1,143,087.00		0.00	
Extention to HIV lab	703,054.00		0.00	
Security Office Block	90,373.00		90,373.00	
	<b>253,715,355.26</b>		<b>194,645,860.26</b>	
<b>Infrastructure Facilities:</b>				
Roads, Streetlights, Drinages, partitions etc	44,850,873.32		41,922,549.32	
Tubewells and water supply	248,912.00		248,912.00	
	<b>45,099,785.32</b>		<b>42,171,461.32</b>	
<b>Plant/Machinery/Equipment:</b>				
General	347,804,738.45		310,195,747.45	
Equipments Carbon & Nano Materials	34,182,430.00		34,182,430.00	
Equipments Physics and Chemistry of Materials	9,878,095.00		9,878,095.00	
Equipments Cluster Studies	2,687,514.00		2,687,514.00	
Equipments Advance Technology Lab	20,202,562.00		20,202,562.00	
Equipment Magnet	7,090,855.00		7,090,855.00	
	<b>421,846,194.45</b>		<b>384,237,203.45</b>	
<b>Vehicles</b>	<b>1,356,527.00</b>		<b>1,353,847.00</b>	
<b>Furniture and fixtures</b>	<b>31,154,628.87</b>		<b>28,031,306.87</b>	
<b>Office equipment</b>	<b>5,491,101.63</b>		<b>5,436,913.63</b>	
<b>Computer/peripherals</b>	<b>33,364,684.00</b>		<b>25,023,948.00</b>	
<b>Electrical installations</b>	<b>15,830,859.00</b>		<b>12,772,109.00</b>	
<b>Library Books</b>	<b>15,960,352.21</b>		<b>12,094,155.21</b>	
<b>Library Journals</b>	<b>71,276,982.80</b>		<b>60,332,092.80</b>	
	<b>912,811,821.54</b>		<b>783,814,248.54</b>	
<b>TOTAL</b>	<b>912,811,821.54</b>		<b>783,814,248.54</b>	
<b>Less - Depreciation up to the end of previous year</b>	193,295,837.00		161,610,525.00	
Depreciation for the current year	37,080,398.00		31,685,312.00	
Written down value of the assets as at the year end	682,435,586.54		590,518,411.54	
<b>Add - Depreciation reserve per contra</b>	230,376,235.00		193,295,837.00	
<b>TOTAL</b>	<b>912,811,821.54</b>		<b>783,814,248.54</b>	

Sd/-  
**RS Gururaj**  
Accounts Officer

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
**Schedule forming part of the accounts**

Description	2007-08		2006-07	
	Rs.	Ps.	Rs.	Ps.
<b>Schedule 9: Investments -Earmarked/Endowment Funds</b>				
<b>Long Term Deposits</b>				
Fixed Deposits and Bonds with IDBI Bank	600,000.00		3,100,000.00	
Fixed Deposits with HDFC Trust	12,125,000.00		12,125,000.00	
Govt of India 8% Savings Bonds 2003 [SHCIL & SBI]	47,900,000.00		47,900,000.00	
Fixed Deposits with Canara bank	6,000,000.00		6,000,000.00	
<b>TOTAL</b>	<b>66,625,000.00</b>		<b>69,125,000.00</b>	
<b>Schedule 10- Investments - Others</b>				
<b>Short Term Deposits</b>				
Fixed deposits with banks - Canara Bank	92,981,750.00		42,000,000.00	
Fixed deposits with banks - Canara Bank ( Schemes )	62,215,690.00		83,715,690.00	
Fixed Deposits of Union Bank of India	20,000,000.00		5,000,000.00	
<b>TOTAL</b>	<b>175,197,440.00</b>		<b>130,715,690.00</b>	
<b>Schedule 11 Current Assets, Loans, Advances etc.,</b>				
<b>Cash &amp; Bank Balances</b>				
Cash in hand at Centre	57,174.00		24,245.00	
Cash in hand with Schemes	82,319.00		125,460.00	
Imprest balance	36,652.00		24,472.00	
Imprest with Faculty	179,739.00		225,346.00	
Cash at bank :				
Centre - Canara Bank	5,268,086.18		1,719,659.21	
Centre-Union Bank of India	756,295.00		4,967.00	
Schemes - Canara Bank	14,422,023.74		954,924.47	
Schemes - State Bank of India	6,621,531.83		19,020,672.83	
Advances to staff	117,967.00		154,867.00	
Contingent Advances	123,320.00		63,426.00	
Other advances	655,926.00		585,500.00	
TDS receivable	314,978.00		314,978.00	
Due from Schemes on Account of Overhead recoveries	0.00		2,000,000.00	
Amount recoverable from Income Tax Department	461,473.00		461,473.00	
TDS receivable -Endowments	603,855.00		173,852.00	
Linus and CPF accounts	35,672.00		35,672.00	
<b>TOTAL</b>	<b>29,737,011.75</b>		<b>25,889,514.51</b>	
<b>SCHEDULE 12-Income from sales / services</b>				
Consultancy fee	60000.68		0.00	
DNA sequencing fee	902200.00		0.00	
<b>TOTAL</b>	<b>962200.68</b>		<b>0.00</b>	

Sd/-  
**RS Gururaj**  
Accounts Officer



**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**

**Schedule forming part of the accounts**

Description	2007-08		2006-07	
	Rs.	Ps.	Rs.	Ps.
<b>Schedule 13: Grants/subsidies :</b>				
Grants - DST	270,000,000.00		230,000,000.00	
Grants - Discussion meetings/Seminars	3,679,417.00		297,523.00	
Grants - Travel grants	358,178.00		0.00	
Grants- From DST for Building( Nano Science)	0.00		5,000,000.00	
Grant-Project specific grants from DST(Buildings)	6,000,000.00		0.00	
<b>TOTAL</b>	<b>280,037,595.00</b>		<b>235,297,523.00</b>	
<b>Schedule 14-Income from Fee/Subscriptions etc :</b>				
Income from fee, subscriptions,medical contribution etc.,	949,827.00		801,146.00	
<b>TOTAL</b>	<b>949,827.00</b>		<b>801,146.00</b>	
<b>Schedule 16-Royalty Income,Publication,Licence fee etc :</b>				
From Royalty	229,368.51		10,386.01	
Licence fee	151,407.00		123,281.00	
<b>TOTAL</b>	<b>380,775.51</b>		<b>133,667.01</b>	
<b>Schedule 17-Interest earned:</b>				
From Term deposits	6,960,246.00		5,130,770.00	
From SB accounts with nationalised banks	129,172.49		336,839.96	
From JNCASR reserve fund	0.00		2,340,889.00	
<b>TOTAL</b>	<b>7,089,418.49</b>		<b>7,808,498.96</b>	
<b>Schedule 18-Other income:</b>				
Donations received	2,500,000.00		0.00	
From Visitors house, Guest rooms, Students residence etc,	2,192,469.00		2,311,145.00	
CSIR Fellowships, SRFP reimbursement etc.,	11,345,958.00		9,553,246.00	
From others( tender fee & other fee collected)	280,988.00		639,331.00	
<b>TOTAL</b>	<b>16,319,415.00</b>		<b>12,503,722.00</b>	

Sd/-  
**R S Gururaj**  
 Accounts Officer

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**

**Schedule forming part of the accounts**

Description	2007-08		2006-07	
	Rs.	Ps.	Rs.	Ps.
<b>Schedule 20 Establishment Expenses:</b>				
Salaries & Scholarship to students	50,288,818.00		37,182,865.00	
Wages	10,289,252.00		5,695,703.00	
Allowances ( Medical reimbursements etc.,)	1,512,162.00		1,583,149.00	
Bonus	143,086.00		142,880.00	
Contribution to CPF	1,227,162.00		1,150,397.00	
Contribution to New Pension Scheme	350,925.00		0.00	
Contribution to retirement benefit Scheme	585,564.00		190,000.00	
Leave encashment benefits	369,107.00		0.00	
LTC	81,054.00		287,119.00	
<b>TOTAL</b>	<b>64,847,130.00</b>		<b>46,232,113.00</b>	
<b>Schedule 21- Other Administrative expenses</b>				
Electricity & Power	14,933,589.00		11,050,622.00	
Water charges	3,027,127.00		1,620,673.00	
Insurance	383,612.00		366,112.00	
Repairs & maintenance	9,079,550.00		6,037,299.00	
Rents,rates & taxes	958,832.00		1,226,289.00	
Vehicles running & maintenance	3,168,563.00		3,205,175.00	
Postage, telephone & communication	3,278,015.00		2,697,340.00	
Printing & stationery	1,965,855.52		2,491,310.00	
Travelling and conveyance	3,729,737.00		2,073,419.00	
Expneses on Seminars/workshops/discussion meetings	7,205,339.00		4,771,639.00	
Subscriptions	394,760.00		91,259.00	
Fees towards training etc.,	218,880.00		387,155.00	
Professional charges	5,949,779.00		4,730,086.00	
Laboratory Consumables	25,768,810.00		19,565,164.00	
Frighth Inwards	1,791,535.00		2,301,375.00	
Other consumables	951,106.00		516,458.00	
Advertisement & Publicity	1,213,886.00		981,388.00	
Other miscellaneous expenses	721,640.00		865,454.00	
Auditors remuneration:				
Statutory Audit fee	25,000.00		22,448.00	
Internal Audit fee	0.00		56,120.00	
POBE programme	220,413.00		0.00	
Student Research Fellowship Programme	1,185,663.00		245,253.00	
<b>TOTAL</b>	<b>86,171,691.52</b>		<b>65,302,038.00</b>	
<b>Schedule 23- Interest and Bank charges :</b>				
Bank charges & commission	8,772.88		39036.00	
<b>Schedule 25 - Contingent Liabilities &amp; Notes on Accounts :</b>				
<b>A. Contingent Liabilities :</b>				
1. Claims against the entity not acknowledged as debts				
2. Letter of credit outstanding				
<b>B. Notes on Accounts :</b>				
1. Estimated amount of contracts remaining to be executed on capital account and not provided for.				
a. In respect of Equipments	48,733,425.00		21,002,600.00	
b. In respect of Buildings ( Civil & Electrical )	22,591,770.00		25,500,000.00	
	<b>71,325,195.00</b>		<b>46,502,600.00</b>	

Sd/-  
R.S.Gururaj  
Accounts Officer





**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH  
CPF & NPS FUND STATEMENT OF AFFAIRS FOR THE YEAR ENDED 31.03.2008**

Particulars	Rs.	Ps.	Particulars	Rs.	Ps.
<b>CONTRIBUTORY PROVIDENT FUND</b>			<b>INVESTMENT OF FUNDS:</b>		
<b>Opening Balance</b>	2,111,271.00	14,148,201.55	<b>Investments in:</b>	12,500,000.00	
Add: Subscriptions received during the year	939,596.00		Government of India 8 % Bonds (SHCIL)	2,640,416.67	
Loan repayments	1,212,806.00	4,263,673.00	State Government Securities (25 lakhs)	10,000,000.00	
Interest on subscriptions		18,411,874.55	Fixed Deposits at Canara Bank	2,000,000.00	27,140,416.67
Less: Loans granted during the year	1,174,043.00		<b>Closing Cash and Bank Balance :</b>		
Less: Withdrawals on retirement/death	108,320.00	1,282,363.00	Cash at Bank:		
<b>Closing Balance</b>		<b>17,129,511.55</b>	SBA/C No.17513		2,194,229.10
			Canara Bank, IISc branch		
<b>CONTRIBUTION</b>			<b>Amounts recoverable :</b>		
<b>Opening balance</b>	1,227,341.00	10,135,323.00	TDS receivable for the year 2005-06	8,008.00	
Add : Contribution during the year	803,501.00	2,030,842.00	TDS receivable for the year 2006-07	10,140.00	
Interest on total contributions		12,166,165.00	TDS receivable for the year 2007-08	103,000.00	121,148.00
Less: Withdrawals on retirement/death		89,336.00	Contribution & subscription for March 08		
<b>Closing Balance</b>		<b>12,076,829.00</b>	credited to bank on 16.04.2008		426,361.00
			Refund of advance during 07-08		45,000.00
<b>NEW PENSION SCHEME</b>			credited on 16.04.2008		
<b>SUBSCRIPTION</b>			Due to be remitted to bank on account		179.00
<b>Opening Balance</b>	350,925.00	585,111.00	of short payment during 2007 08		
Add: Subscriptions received during the year	61,001.00		<b>Expenses incurred :</b>		
Interest on subscriptions			Bank Charges 2004-05	749.00	
<b>Closing Balance</b>		<b>997,037.00</b>	Bank Charges 2005-06	643.55	1,392.55
			<b>Accrued interest on Deposits :</b>		
<b>CONTRIBUTION</b>			On Fixed deposits with Canara Bank	32,762.00	
<b>Opening balance</b>	350,925.00	273,317.00	On Fixed deposits with Canara Bank	565,133.00	597,895.00
Add : Contribution during the year	21,866.00	372,791.00	<b>Deficit</b>		
Interest on total contributions		646,108.00			322,864.23
<b>Closing Balance</b>		<b>30,849,485.55</b>	<b>Total</b>		<b>30,849,485.55</b>

for Jawaharlal Nehru Centre for Advanced Scientific Research

for **M/s G R Venkatanarayana**  
Chartered Accountants

Sd/-  
**(G R Venkatanarayana)**  
Partner  
Membership No. 18067

Sd/-  
**R S Gururaj**  
Accounts Officer

Sd/-  
**Prof M R S Rao**  
President, JNCASR





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