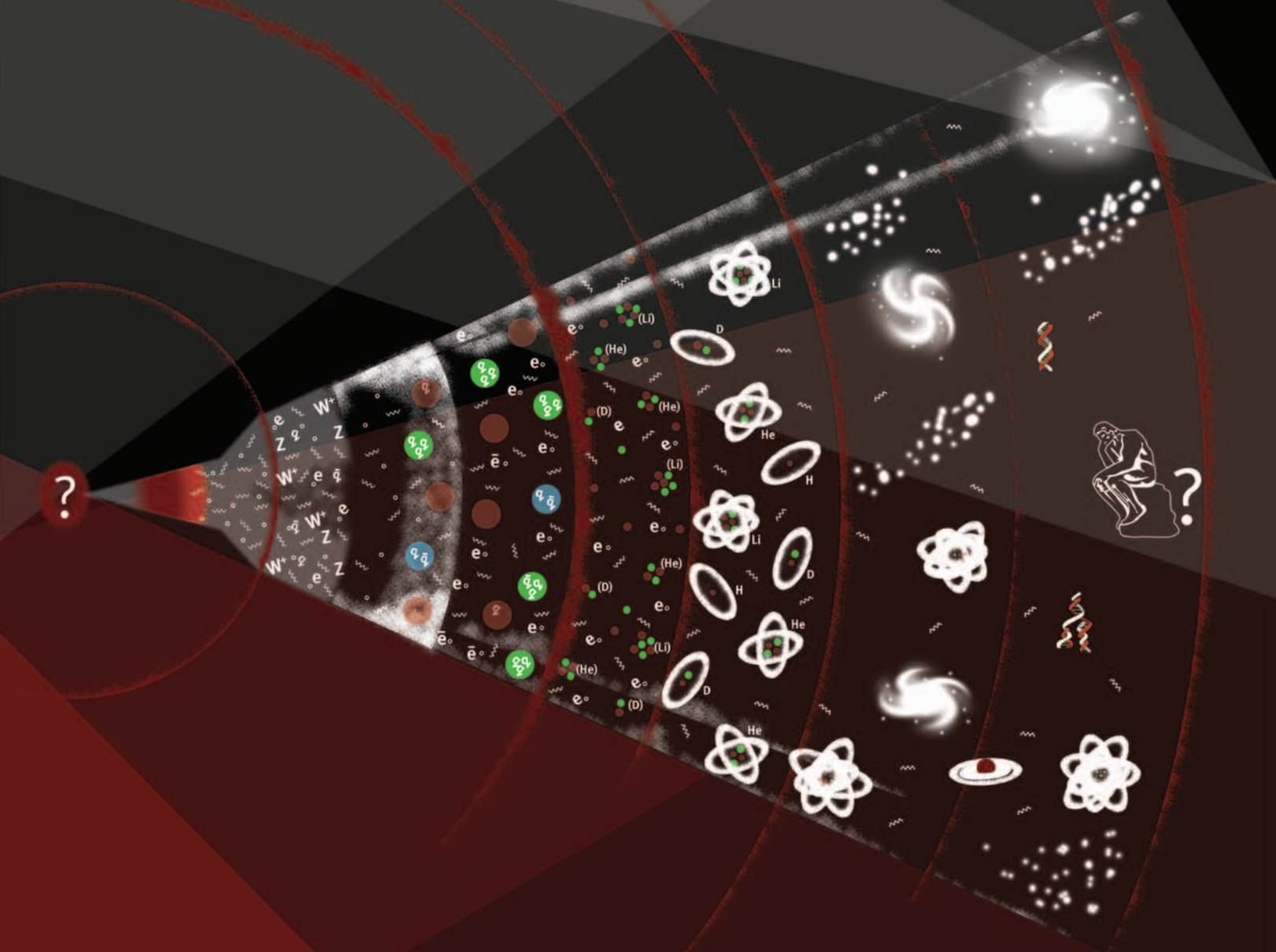
ICTS REPORT 2010-12



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ICTS | INTERNATIONAL CENTRE *for* THEORETICAL SCIENCES

TATA INSTITUTE OF FUNDAMENTAL RESEARCH

International Centre for Theoretical Sciences (ICTS)
TIFR Centre Building, IISc Campus
Subedarpalya, Malleshwaram
Bengaluru 560 012, India

ICTS Report (Oct 2009- Oct 2012)

Editors:
Prof. Gautam Mandal (TIFR, Mumbai)
Ms. Rachna Shah (Consultant - Publications)

Design: www.thefool.in

"The pursuit of science and its practical application are no longer subsidiary social activities today. Science forms the basis of our whole social structure without which life as we know it would be inconceivable. As Marx said, 'Man's power over nature lies at the root of history.'...Science has last opened up the possibility of freedom for all from long hours of manual drudgery and today we stand at the beginning of an age when every person will have the opportunity to develop himself spiritually to his fullest stature."

-Homi Bhabha

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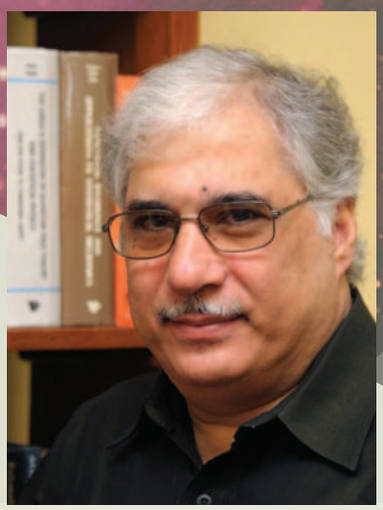
DIRECTOR'S NOTE

01



The last five years have seen ICTS grow from a fledgling institution to a global centre of activity in various areas of science. The theme of the Centre, as conceived in its inception, was epitomized by the title of its formal inaugural event "Science without boundaries". This conference, which marked the unveiling of the foundation 'stone' was held on December 28, 2009, discussed science as a mélange of creative ideas from classical and modern disciplines, while emphasizing the need to remain strong in each of these areas. At the ICTS, we plan to realize this ideal by establishing in-house research areas and carrying out collaborative visitor driven programmes.

The in-house research areas in ICTS are growing in disciplines like statistical physics and complex systems, physics of gravity waves and numerical relativity, string theory and quantum gravity, and cross-disciplinary biology. We have succeeded in attracting some of the best available young talent in these areas; they include P. Ajith, Pallab Basu, Abhishek Dhar, Arvind Kumar and Suvrat Raju in Faculty positions and Samriddhi Ray in a five-year Junior Faculty position. The choice of these areas is dictated not only by the fact that they are probing fundamental questions at the frontiers of science, but also that potentially excellent scientists, working in these areas, are excited to be part of the inter-disciplinary and vibrant environment of ICTS. With the faculty in place, ICTS plans to formally initiate a vigorous Ph.D. students' programme from the next academic year. ICTS students will all be stationed in Bangalore and their course requirements for a degree from TIFR will be fulfilled by arrangements with various institutions in Bangalore. A strong post-doctoral programme is also being developed on a priority basis at ICTS.

The visitor driven activities are centered on organization of Programmes, which is an essential component of the mandate of ICTS. Many of the programmes include workshops and conferences. A primary goal here is to provide a platform and resources for researchers to congregate over extended periods of time. ICTS encourages cross-disciplinary collaborations and interactions between theorists and experimentalists, and fosters research areas of importance to India. As an example of this, the programme "Scientific Discovery through Intensive Data Exploration" explored the interplay between data, theories and models in various disciplines like computer science, mathematics, high-energy physics, astronomy, materials science and earth sciences. The programme also had two panel discussions "Development and Deployment of Infrastructure for Scientific Computing in India," and "Computational Genomics". They brought to focus various issues concerning existing infrastructure for computational sciences in India.

In order to focus intensely on exciting and important current research topics ICTS has established three named lecture series in honor of Subrahmanyan Chandrasekhar, Srinivasa Ramanujan and Alan Turing. Distinguished leaders from various areas of science are invited to deliver these sets of lectures; each set of lectures begins with a colloquium for a general scientific audience and is followed by more specialized talks. There is usually also a short workshop organized around the theme of these lectures. There have so far been eight sets of Chandrasekhar lectures covering a range of topics that include the birth of the universe,

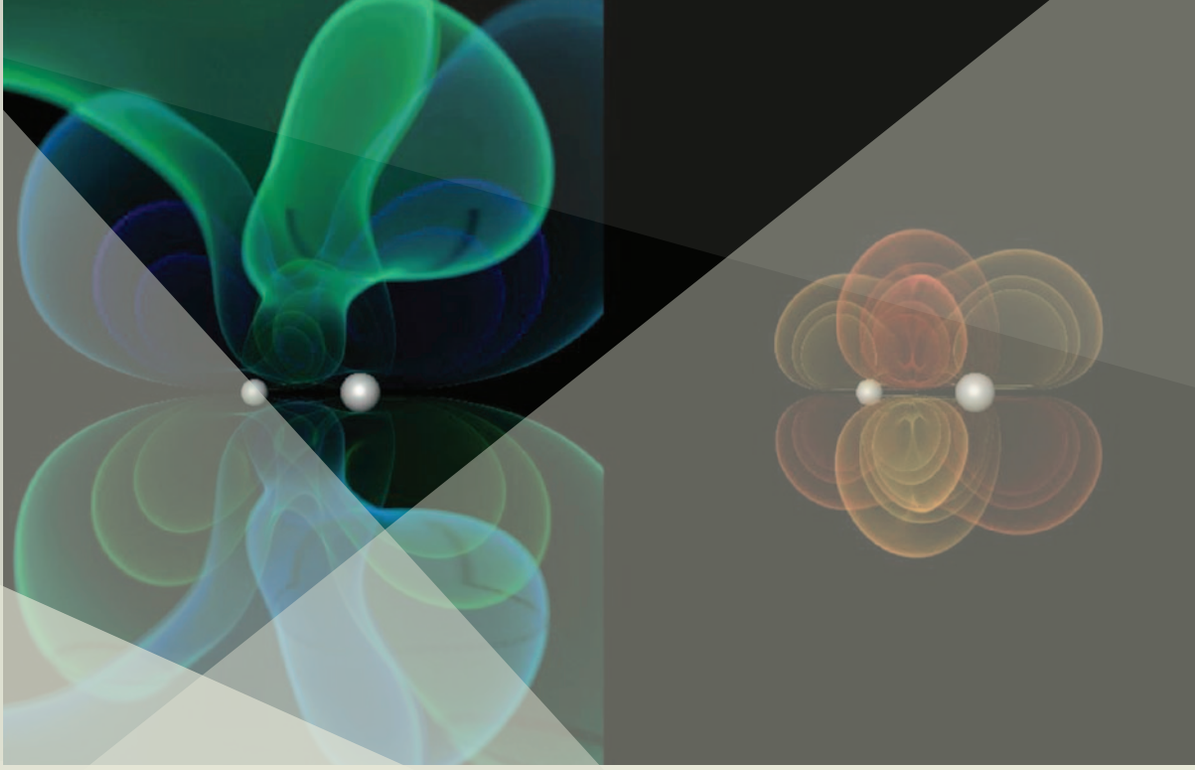
DIRECTOR'S NOTE 01

black holes, fluid turbulence, cold atoms and random matrix theory. The enormous success of this series, which is concerned primarily with topics in the physical sciences, encouraged us to initiate the Ramanujan lectures for mathematics and the Turing lectures for the areas of biology and engineering. While the first set of Ramanujan lectures discussed the generalized Ramanujan conjectures and applications, the first set of Turing lectures will be in the area of cross-disciplinary biology. Recently, we celebrated the 100th birth anniversary of Alan Turing with the ICTS Turing Centenary Lecture, 'The Architecture of Biological Complexity'.

Over the next one and a half years, ICTS plans to hold Programmes with international collaborations on several areas dealing with complex systems. The first of these, to be jointly held with ICTP (Trieste, Italy) involves a joint school with an embedded conference on cross-disciplinary biology. Biology, in a strict sense, is the most complex system to have evolved on planet Earth, and not surprisingly, very different disciplines, such as networks and control systems in electrical engineering, artificial intelligence in computer science and mathematics, and the more traditional interface areas of physics and chemistry, approach this system in their unique ingenious ways. The idea of the ICTS-ICTP programme is to create awareness in India about such multi-disciplinary quantitative approaches to a variety of questions in biology. Two other upcoming international collaborations, dealing with other areas of complexity, are: (a) 'Fundamental ideas on equilibration in complex systems', to be organized jointly by ICTS and Brandeis University next year in Bangalore and (b) a collaboration between the Mathematics and Climate Research Network (MCRN) and ICTS / TIFR-CAM through the SAVI programme of the National Science Foundation (NSF) of USA.

Another central activity of ICTS is Outreach, a crucial component of which consists of organizing Public Lectures by outstanding scientists. There have been seventeen Public Lectures to date on diverse topics, including The Role of Theory in Science, The Origin of Life, P vs. NP problem, Black Holes and the structure of Space-Time, The Universe Unraveled, Structure and Randomness in the Prime numbers, The Ramanujan Conjecture and so on.

As part of its continuing effort to interface with the public, ICTS has agreed to be the Indian participant for international activities in 2013 under the umbrella of the international programme "Mathematics of Planet Earth". Under this banner, besides organizing some programmes in mathematics, ICTS and TIFR-CAM are planning to create an exhibition that illustrates the ubiquitous role played by mathematics in the natural and social sciences.



Besides its regular scientific activities, ICTS provides a platform for new science initiatives in India. Thus, ICTS is working closely with LIGO-India that proposes to install a gravity wave detector in India that can form a component of long baseline worldwide linked gravity wave detectors. We believe that gravitational wave astronomy is at an exciting stage where it is on the verge of opening a new window into our universe beyond the electro-magnetic spectrum. ICTS has also initiated the Indian Open Light path Exchange Facility at Bangalore (BIxLight) for the Data Intensive Sciences. BIxLight was conceived to provide Indian researchers an opportunity to share and access large scientific data with the global scientific community through the GLORIAD (Global Optical Ring Network for Advanced Applications Development) network. This is a collaboration of ICTS with TIFR-CAM, IISc, JNCASR, Strand Life Sciences in Bangalore, the Observer Research Foundation in Mumbai and the NSF supported GLORIAD of USA. This high-speed 1 Gbps network link was lit on June 9, 2012 and is currently being used by scientists working in biology and in the earth sciences.

Although ICTS has already become a vibrant centre of activity in its distributed existence, work on building its own spacious Campus has begun. The firm of Venkatramanan and Associates from Bangalore has created the architectural plan of the ICTS campus, in close consultation with the academic members of ICTS and the project management group from the Department of Atomic Energy. The campus is planned to be self-contained and includes academic, housing and recreational facilities. The architectural design provides space for maximum academic interactions. It contains lecture halls with enough capacity for meetings with hundred plus participants, an auditorium, recreation spaces and comfortable living quarters for staff and visitors. The construction company has been identified and construction will begin shortly.

The range of activities reported here at once underlines and justifies the need for an institution like ICTS. This has been further corroborated by the overwhelming participation and support it has received from the science community in India and abroad. All this, combined with the outstanding new Faculty who have joined us, and the new and modern campus which is coming up in a couple of years, promise a great future for ICTS.
An effort of this magnitude would have been impossible to undertake and carry on without help, encouragement and contribution from many Institutions and individuals. We would like to express our sincere thanks to IISc for offering ICTS a temporary home in the IISc campus and the use of the TIFR Centre Building in its campus. We greatly appreciate the support and partnership of the Physics Department of IISc in various activities of the ICTS. We are grateful to NCBS of TIFR for their invaluable help and advice in various matters and to TIFR-CAM for partnering with us in various initiatives in the Mathematical Sciences.

It has only been a short five years since the idea of ICTS began taking a concrete shape. We have traveled a long way since then. The path has not been smooth, often not even visible. As the Spanish poet Antonio Machado said, “Traveller, there is no road, the road is made by walking.” We are treading and creating our

$$\Delta(z) = \sum_{n>0} \tau(n) q^n$$

$$= q \prod_{n>0} (1 - q^n)^{24}$$

$$= q - 24q^2 + 252q^3 + \cdots$$

road, encountering sharp falls and steep climbs, as in any unknown terrain. This, however, has not deterred us from pursuing our mission. Indeed, our resolve only gets strengthened as the months pass by, and we will remain on course to our destination.

- Spenta R Wadia
Director ICTS-TIFR
23rd October, 2012

> *"The ultimate product of science is the understanding of nature – a successful* THEORY*"*
>
> - David Gross

"We are driven by the usual insatiable curiosity of the scientist, and our work is a delightful game. I am frequently astonished that it so often results in correct predictions of experimental results. How can it be that writing down a few simple and elegant formulae, like short poems governed by strict rules such as those of the sonnet or the waka, can predict universal regularities of Nature? Perhaps we see equations as simple because they are easily expressed in terms of mathematical notation already invented at an earlier stage of development of the science, and thus what appears to us as elegance of description really reflects the interconnectedness of Nature's laws at different levels."

- Murray Gell-Mann

VISION

02

VISION 02

ICTS is a multi- and inter-disciplinary effort with a mandate to take new initiatives on the frontiers of science, and catalyze and promote collaboration in research. It is also involved in high level education and training and in reaching out to the larger society by serving as a node for scientific information and values.

RESEARCH

ICTS contributes to research excellence in science in various ways. It provides a platform along with the resources for researchers to congregate during high quality programmes of varying durations with embedded conferences. In this way it strives to incubate new and emerging areas of research. Cross-disciplinary immersions are encouraged at ICTS keeping in mind that strength in traditional disciplines lends to fruitful cross-disciplinary interactions. ICTS is a 'science theory centre' and hence by its very definition it includes involvement of experimentalists in its activities.

Currently, ICTS faculty is engaged in research, in areas that include statistical physics, complex systems, cross-disciplinary biology, gravity waves and numerical relativity, and in the areas of string theory, particle physics and cosmology. Post-doctoral fellows, visiting scientists and adjunct faculty augment research at ICTS. They also complement research in areas that are not currently pursued by ICTS faculty.

STUDENTS

A vigorous Ph.D. students' programme is set to take-off from the academic year 2013. ICTS students will be awarded doctoral degrees from TIFR, a deemed university. They will credit courses at the Indian Institute of Science, National Centre for Biological Sciences and other institutions in Bangalore depending on their requirements.

EDUCATION & TRAINING

Beside its Ph.D. Programme, the Centre contributes to the education and training of students and researchers by organizing interactive meetings of students (and their professors) with visiting scientists and scholars. In order to enable young participants to make the best use of the programmes, schools or instructional

workshops precede some of the research level activities of the Centre. Students at the right stage of their career and young researchers are encouraged to spend some time at the Centre to benefit from its ongoing activities and in the presence of leading researchers from all over the world.

OUTREACH

There is an acute need in India today to create its future scientific human resource. The two key ingredients in bringing this about are awareness among students of the fascinating questions science asks and tries to find answers to, and active engagement and support for its activities from society. Public lectures by eminent scientists contribute to this process by acting as sources of inspiration and by fostering an active interest in basic sciences in society. Another aspect that contributes to ICTS outreach is to make freely available the proceedings of its activities in various formats. To facilitate this, the Centre maintains a Service Infomatique. Access to video recordings of lectures and other audio-visual material is made available on the ICTS web site and on DVDs and CDs.

“The effort to understand the universe is one of the very few things that lifts human life a little above the level of farce, and gives it some of the grace of tragedy.”

- Steven Weinberg

“The most incomprehensible thing about the world is that it is comprehensible.”

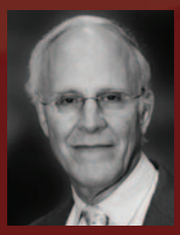
- Albert Einstein

ICTS ORGANIZATION

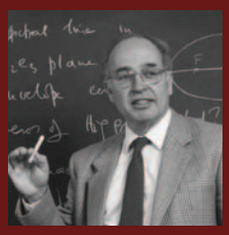
03

INTERNATIONAL ADVISORY BOARD

The International Advisory Board, Chaired by David Gross, has been a beacon since the inception of ICTS. It consists of distinguished scientists whose advice and guidance pertains to all aspects of ICTS. The ICTS Director submits a quarterly report to the Advisory Board about all the activities of ICTS.



David Gross
KITP, UC-Santa Barbara, USA (Chair)

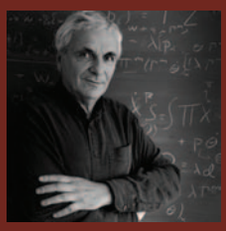


Michael Atiyah
University of Edinburgh, UK

Manjul Bhargava
Princeton University, USA

Roger Blandford
KIPAC, Standford University, USA

Edouard Brezin
École Normale Supérieure, Paris



Michael Green
Cambridge University, UK

M. S. Narasimhan
CAM-TIFR, Bangalore

Subir Sachdev
Harvard University, USA

Ashoke Sen
HRI, Allahabad

ICTS ORGANIZATION 03

T.V. Ramakrishnan
BHU, Banaras & IISc, Bangalore

K. R. Sreenivasan
Courant Institute, NYU, USA

Raman Sundrum
Johns Hopkins University, USA

S. R. S. Varadhan
Courant Institute, NYU, USA

MANAGEMENT BOARD

The Management Board and Director ICTS oversee the overall administration and scientific direction of the Centre.

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Director, TIFR (Chair)

Vivek S. Borkar
IIT-Powai, Mumbai

S.G. Dani
TIFR, Mumbai

Avinash Dhar
TIFR, Mumbai

H.R. Krishnamurthy
IISc, Bangalore

S.Ramakrishnan
TIFR, Mumbai

K. VijayRaghavan
Director, NCBS-TIFR

Spenta R. Wadia
Director, ICTS-TIFR

Uma Mahadevan
Member Secretary, ICTS-TIFR

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V. Sadasivam
Joint Secretary (Finance), DAE

J. Kayarkar
Registrar TIFR, Mumbai

PROGRAMME COMMITTEE (AUG 2010- JULY 2012)

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Siva Athreya, ISI, Bangalore
Gautam Bhattacharyya, SINP, Kolkata
Vivek Borkar, IIT, Bombay
Kedar Damle, TIFR, Mumbai
Siddhartha Gadgil, IISc, Bangalore
Arindam Ghosh, IISc, Bangalore
Rajesh Gopakumar, HRI, Allahabad
Neelima Gupte, IIT, Madras
Sanjay Jain, Delhi University, Delhi
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Rajeeva Karandikar, CMI, Chennai
Anurag Kumar, IISc, Bangalore
Mrinalini Puranik, NCBS-TIFR, Bangalore
Sriram Ramaswamy, IISc, Bangalore
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V. Srinivas, TIFR, Mumbai
Mukund Thattai, NCBS-TIFR, Bangalore
Sandip Trivedi, TIFR, Mumbai
Umesh Waghmare, JNCASR, Bangalore

(UNTIL JULY 2010)

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Avinash Dhar, TIFR, Mumbai
Deepak Dhar, TIFR, Mumbai
Nitin Nitsure, TIFR, Mumbai
Madan Rao, RRI, Bangalore
Sreerup Raychaudhuri, TIFR, Mumbai
Srikanth Sastry, JNCASR, Bangalore

FACULTY

ADJUNCT FACULTY

Rana Adhikari, Caltech, USA (Jun 2012 - May 2015)
Mayank Mehta, UCLA, USA (Jun 2012 - May 2015)
Krishnendu Sengupta, IACS, Kolkata (Mar 2012 - Feb 2015)
Bala Iyer, RRI, Bangalore (Nov 2011 - Oct 2014)
Satya Majumdar, LPTMS, France (Nov 2011 - Oct 2014)
Sanjoy Mitter, MIT, USA (Nov 2011 - Oct 2014)
Ravi Nanjundiah, IISc, Bangalore (Nov 2011 - Oct 2014)

Tarun Souradeep Ghosh, IUCAA, Pune (Aug 2011- July 2014)
Rukmini Dey, HRI, Allahabad (Aug 2010 - July 2013)
Rajesh Gopakumar, HRI, Allahabad (Aug 2010 - July 2013)
Hong Lui, MIT, USA (Aug 2010 – July 2013)
Vijay Chandru, Strand Life Sciences, Bangalore (Aug 2009 - July 2012)
Chandan Dasgupta, IISc, Bangalore (Aug 2009 -July 2012)
Rohini Godbole, IISc, Bangalore (Aug 2009 - July 2012)
Ravi Kannan, Microsoft Research Labs, Bangalore (Aug 2009 - July 2012)
Roddam Narasimha, JNCASR, Bangalore (Aug 2009 - July 2012)
Rahul Pandit, IISc, Bangalore (Aug 2009 - July 2012)
Sriram Ramaswamy, IISc, Bangalore (Aug 2009 -July 2012)
J. Srinivasan, IISc, Bangalore (Aug 2009 - July 2012)
Justin David, IISc, Bangalore (Oct 2008 - Sept 2011)
Abhishek Dhar, RRI, Bangalore (Oct 2008 - Sept 2011)
E. D. Jemmis, IISER, Thiruvananthapuram (Oct 2008 - Sept 2011)
Narendra Kumar, RRI, Bangalore (Oct 2008 - Sept 2011)
G. Rangarajan, IISc, Bangalore (Oct 2008 - Sept 2011)
Madan Rao, RRI, Bangalore (Oct 2008 - Sept 2011)
Srikanth Sastry, JNCASR, Bangalore (Oct 2008 - Sept 2011)
Vijay Shenoy, IISc, Bangalore (Oct 2008 - Sept 2011)
Ajay Sood, IISc, Bangalore (Oct 2008 - Sept 2011)

JOINT FACULTY (FROM OTHER CENTRES AND SCHOOLS OF TIFR)
Subhabrata Majumdar, TIFR, Mumbai (Jan 2012 - Dec 2015)
Sandip Trivedi, TIFR, Mumbai (Jan 2012 – Dec 2015)
Kedar Damle, TIFR, Mumbai (Feb 2010 - Jan 2013)
Amol Dighe, TIFR, Mumbai (Feb 2010 - Jan 2013)
Manoj Gopalkrishnan, TIFR, Mumbai (Feb 2010 - Jan 2013)
C.S. Rajan, TIFR, Mumbai (Feb 2010 - Jan 2013)
Shiraz Minwalla, TIFR, Mumbai (Feb 2010 - Jan 2013)
Jaikumar Radhakrishnan, TIFR, Mumbai (Feb 2010 - Jan 2013)
N. Raja, TIFR, Mumbai (Feb 2010 - Jan 2013)
V. Srinivas, School of Mathematics- TIFR, Mumbai (Feb 2010 - Jan 2013)
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P.N. Srikanth, CAM-TIFR, Bangalore (Aug 2009 - Jul 2012)
Adi Adimurthy, CAM-TIFR, Bangalore (Oct 2008 - Sept 2011)
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Amit Apte, CAM-TIFR, Bangalore (Sept 2008 - Aug 2011)
Upinder Bhalla, NCBS-TIFR, Bangalore (Sept 2008 - Aug 2011)
Yamuna Krishnan, NCBS-TIFR, Bangalore (Sept 2008 - Aug 2011)
Satyajit Mayor, NCBS-TIFR, Bangalore (Sept 2008 - Aug 2011)

Seema Nanda, CAM-TIFR, Bangalore (Sept 2008 - Aug 2011)
Mrinalini Puranik, NCBS-TIFR, Bangalore (Sept 2008 - Aug 2011)
Mukund Thattai, NCBS-TIFR, Bangalore (Sept 2008 - Aug 2011)
Avinash Dhar, TIFR, Mumbai
Spenta R. Wadia, TIFR, Mumbai & ICTS-TIFR, Bangalore

SUPPORT STAFF

Shobha B.N., Project Assistant (Programmes)
Paramita Das, Project Assistant (IT)
Abhijit De, Project Officer
Mukesh Dodain, Project Officer
Roushell Fernandes, Project Assistant (Administration)
Mohan Gowda, Engineer (Civil)
Rohan Jaitpal, Technical Support Engineer
Snehal Manjrekar, Project Assistant (Programmes)
Asha Pattanashetti, Project Accountant
Jayashree R, Project Assistant (Programmes)
Soumya Saji, Consultant ICTS (Pre Project activities)
Ajay Salve, Incharge-IT

HONORARY CONSULTANT (BIxLIGHT PROJECT)

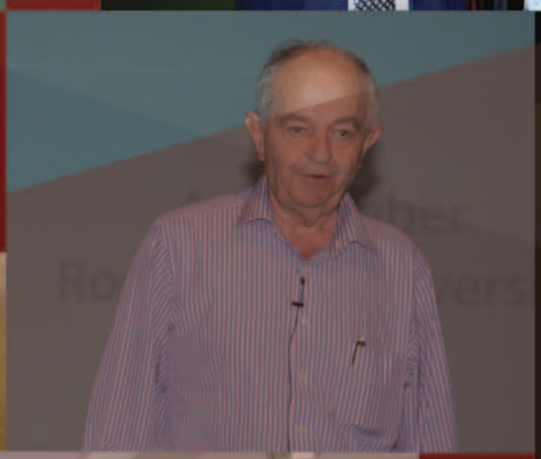
Leena Chandran-Wadia, Observer Research Foundation (ORF) Mumbai

ABBREVIATIONS

BHU: Banaras Hindu University
CAM: Centre for Applicable Mathematics
CMI: Chennai Mathematical Institute
DAE: Department of Atomic Energy
IACS: Indian Association for the Cultivation of Sciences
IIT: Indian Institute of Technology
ISI: Indian Statistical Institute
IMI: Institute of Mathematical Sciences
IUCAA: Inter-University Centre for Astronomy and Astrophyics
JNCASR: Jawaharlal Nehru Centre for Advanced Scientific Research
KIPAC: Kavli Institute of Particle Astrophysics and Cosmology
KITP: Kavli Institute for Theoretical Physics
HRI: Harish-Chandra Research Institute
NCBS: National Centre for Biological Sciences
RRI: Raman Research Institute
SINP: Saha Institute of Nuclear Physics
TIFR: Tata Institute of Fundamental Research

“In Alan Turing’s work there is much to guide us. Technology gives us the tools to analyse organisms at all scales, but we are drowning in a sea of data and thirsting for some theoretical framework with which to understand it. Although many believe that ‘more is better’, history tells us that ‘least is best’. We need theory and a firm grasp on the nature of the objects we study to predict the rest.”

- Sydney Brenner



PEOPLE

04

PEOPLE 04

ROLE OF PROGRAMME COMMITTEE MEMBERS

The Programme Committee of ICTS consists of acknowledged leaders in different areas of theoretical sciences and interdisciplinary areas. Programme proposals received by the Centre are circulated among its members for their views and their advice. They play an important role in scrutinizing the various programme proposals based on the guidelines ICTS has set to ensure the quality of schools and workshops organized by the Centre.

AMIT APTE | CAM-TIFR, Bangalore

Amit Apte is a faculty at TIFR Centre for Applicable Mathematics, Bangalore. He was a Postdoctoral Fellow at the Mathematical Sciences Research Institute (MSRI) at Berkeley from Jan-May 2007, and at the Statistical and Applied Mathematical Sciences Institute (SAMSI) from 2005-2006 and in Math at U. North Carolina Chapel Hill. He completed his Ph.D. in Physics at University of Texas at Austin in the year 2004 – under Philip Morrison and M.Sc. (Integrated) in Physics at Indian Institute of Technology (IIT) Kanpur (1996).

His research is focused on Dynamical systems and their applications to physical problems. One of the areas of great interest to him is that of data assimilation - the incorporation of noisy observations of a system into an incomplete dynamical model of that system. This problem is pertinent to a variety of applications, including weather and climate prediction. Amit works on applications of Bayesian Markov Chain Monte Carlo (MCMC) sampling methods to data assimilation and on understanding the interplay between nonlinearity and statistics in these problems. His other research interests are in Hamiltonian systems, specially, periodic orbit bifurcation phenomena and breakup of invariant circles in nontwist systems, such as the meandering jet of the gulf stream in the Atlantic ocean, and applications of renormalization group methods in these problems.

PROGRAMME COMMITTEE MEMBERS

SIVA ATHREYA | Indian Statistical Institute, Bangalore

Siva Athreya obtained his Ph.D. in Mathematics from University of Washington, U.S.A under the supervision of Professor K. Burdzy. He is currently at the Indian Statistical Institute, Bangalore.

His primary field of interest has been in Probability theory. He has been working with models that arose primarily in either statistical physics or population biology. Initially, the focus was on martingale problems connected with measure-valued branching processes. The tools involved were semi-linear partial differential equations, stochastic partial differential equations, and stochastic differential equations. He also worked on models in Statistical Physics (Abelian Sandpile Model) and in Population Biology (Branching-Coalescing systems). Recently, he has started studying Brownian motion on real trees and Random walk in Random environments.

GAUTAM BHATTACHARYYA | Saha Institute of Nuclear Physics, Kolkata

Gautam Bhattacharyya is a particle phenomenologist. He got his Ph.D. from Calcutta University in 1993, and held postdoctoral positions at CERN, Geneva, Switzerland (1994-95) and INFN Pisa, Italy (1996-97) before joining Saha Institute of Nuclear Physics as a faculty in 1998.

Gautam's main area of research is `Physics beyond the Standard Model'. He has worked extensively in the phenomenological aspects of Super symmetry and Extra Dimension and is currently investing most of his time in exploring the synergy between 'collider (mainly, LHC)' and 'flavor' physics. Of late, he has written an extensive review on different avenues of 'Electroweak Symmetry Breaking' by comparing and contrasting Supersymmetric Higgs, Little Higgs, Holographic Higgs and Higgsless models.

PROGRAMME COMMITTEE MEMBERS

VIVEK BORKAR | IIT-Bombay

Vivek Borkar did his B.Tech. in Electrical Engg. from IIT-Bombay, MS in Systems and Control Engg. from Case Western Reserve University and Ph.D. in Electrical Engg. and Computer Science from University of California, Berkeley. He was with the Centre for Applicable Mathematics of TIFR, Bangalore, IISc-Bangalore and then TIFR, Mumbai as a Distinguished Professor with the School of Technology and Computer Science, before joining IIT-Bombay. He has been a recipient of the 2010 TWAS Prize in Engineering Sciences, Homi Bhabha Fellowship, the S. S. Bhatnagar Award, the J. C. Bose Fellowship and the P. C. Mahalanobis Medal. He is a Fellow of IEEE, IAS, INSA and INSE.

He is interested in Markov decision processes, controlled diffusions, stochastic algorithms, stochastic games and distributed estimation.

KEDAR DAMLE | TIFR, Mumbai

Kedar Damle, a B.Tech. in Engineering Physics from IIT-Bombay, earned his Ph.D. in Physics from Yale University. He held Postdoctoral positions at Princeton University and Harvard University and was Assistant Professor at Rice University before joining the Department of Theoretical Physics, TIFR where he currently holds the position of Associate Professor.

Kedar's research is centered around low temperature phases and transitions in strongly correlated low dimensional quantum systems. The interplay of strong inter-particle interactions, quantum fluctuations, and low temperature can lead to many interesting phenomena in condensed matter systems. Many of these are now well-understood in terms of standard theoretical paradigms such as Landau's Fermi Liquid Theory, the Bogoliubov description of superfluids, the BCS theory of superconductivity, spin-wave theory for magnetically ordered systems, and the scaling theory of localization in disordered electronic systems. However, there are many examples that do not fall into any of these known paradigms, and are therefore very poorly understood - examples include the unusual normal state of high-Tc superconductors, heavy fermion materials on the verge of a transition to a spin-density wave state and frustrated magnets with unusual spin-liquid ground states.

Over the last three years, Kedar's work has focused on computational and analytical studies of the properties of frustrated magnets in which competing interactions lead to unusual `spin-liquid' ground states which can exhibit exotic properties, such as excitations with fractional quantum numbers.

SIDDHARTHA GADGIL | Indian Institute of Science, Bangalore

Siddhartha Gadgil is on the Faculty of the Department of Mathematics at the Indian Institute of Science. His primary area of research is low-dimensional topology and related fields such as Riemannian Geometry and Geometric Group theory. He obtained his Bachelors of Statistics from Indian Statistical Institute, Calcutta and Ph.D. from the California Institute of Technology. He was Simons Instructor at the SUNY, Stony Brook before being an Associate Professor at the Indian Institute of Science.

His research is primarily in Low-dimensional Topology and related fields such as Riemannian Geometry and Geometric Group theory. He also works in other areas,

especially applications of geometry in the natural sciences. A specific focus of his recent research is the use of holomorphic objects and related constructions, including Heegaard Floer theory, to study the topology and geometry of spaces. This involves the study of Moduli spaces of Riemann surfaces and holomorphic maps (as well as their analogues in terms of laminations) especially using relations to Teichmuller theory, Mapping class groups, Knot theory, Geometric Topology and String topology.

ARINDAM GHOSH | Indian Institute of Science, Bangalore

Arindam Ghosh is an experimental physicist with research interest in several fields in classical and quantum solid state physics. He completed his Ph.D. from the Indian Institute of Science in 2000, following which he was employed at the Cavendish Laboratory, University of Cambridge, UK, as a postdoctoral research associate. At the IISc, Bangalore, where he has been an Assistant Professor since Dec 2005, Dr. Ghosh researches on electronic properties of carbon and metallic nanosystems, quantum information processing with semiconductor nanostructures, sensing with micro and nano-electromechanical devices, and so on. He has published over 50 international papers, and registered as a recognized researcher at the Engineering and Physical Sciences Research Council (EPSRC), UK, in 2005. He has also received the UK-India Education and Research Initiative award in 2006, the IBM Nanotechnology Fellowship in 2008, and the Swarnajayanti Fellowship from the Government of India in 2009.

The research of Arindam centers around electrical transport in a wide variety of nanoscale systems. Apart from patterned two-dimensional electron systems in graphene, GaAs/AlGaAs heterostructures and phosphorus-doped silicon, his research group is also working on transport properties of ultra-thin metallic nanowires, layered semiconductors, smart materials and micro/nano-electromechanical systems. Experimentally, he specializes in measuring very low-level fluctuations in electrical properties, or noise, which is an extremely sensitive probe for disorder kinetics, electronic and structural phase transitions, to charge and statistics of quasiparticles in solid state systems. This has paved way to several new concepts and phenomena from Arindam's research, such as the topological excitations in strongly interacting 2D electron systems, global instability in nonequilibrium first order phase transitions, microscopic origin of noise in graphene, to diffusive kinetics of domain walls in magnetic nanosystems.

RAJESH GOPAKUMAR | Harish Chandra Research Institute, Allahabad

Rajesh Gopakumar completed his undergraduation in Physics from IIT-Kanpur and went on to do his Ph.D. at Princeton University. After a postdoc at Harvard University, he moved to Harish-Chandra Research Institute in 2001 as Associate Professor and then Professor. He was also a visiting long-term member at the Institute for Advanced Study, Princeton from 2001-2004. He was the recipient of the Wick Prize of the ICTP (2006), the S.S. Bhatnagar Award (2009) and the Swarnajayanti Fellowship (2006). He is also a Fellow of the Indian Academy of Sciences, the Indian National Science Academy and the Global Young Academy.

His research interests are in theoretical physics, primarily at the intersection of quantum field theory and string theory. He would like to understand what makes string theory a natural framework for describing a variety of phenomena. In particular, his recent research has focussed on deciphering the AdS/CFT correspondence. He also worked on topological string theory, non-commmutative field theories often with the recurring, unifying theme of understanding the large N limit of gauge theories.

PROGRAMME COMMITTEE MEMBERS

NEELIMA GUPTE | Indian Institute of Technology, Madras

Neelima M. Gupte completed her B.Sc. from the University of Bombay, M.Sc. from IIT Bombay and Ph.D. from SUNY at Stony Brook. She has been a member of the Pramana Editorial Board and has been the recipient of the StreeShakti Science Samman. She worked at the University of Pune between 1985-1996, and subsequently at IIT Madras, where she is currently a professor in the physics department.

Her broad research interests lie in the fields of nonlinear dynamics and statistical mechanics, particularly in the dynamics of extended systems and the study of complex networks. Some recent research highlights are the identification of the dynamical origin of spatiotemporal intermittency in a coupled map system, the identification of the critical configuration for load bearing hierarchical networks, the proposal of the statistical characterizers for congestion and decongestion and their application to the computer network of the IITM campus, and the airport network of the U.S., and studies of the chimera states of coupled map lattice systems.

SANJAY JAIN | Delhi University, Delhi

Sanjay Jain is a Professor at the Dept. of Physics and Astrophysics at Delhi University, Delhi from where he earned his Bachelor's and Masters degree in Physics as well. He did his Ph.D. in Theoretical Physics from TIFR. Subsequently, he went to Brown University and Harvard University for postdoctoral work. He is an honorary faculty member at JNCASR, Bangalore and Associate member of the Abdus Salam International Centre for Theoretical Physics. He is also a Fellow of the Indian Academy of Sciences, Bangalore and has served as an external faculty at Santa Fe Institute.

Sanjay's area of interest include, (i) Structure and dynamics of complex networks, including chemical, biological, and socio-economic networks, (ii) Mathematical modeling of complex adaptive systems, evolutionary mechanisms, (iii) Models of non-equilibrium statistical mechanics, (iv) Nonlinear dynamics, random matrix models and quantum chaos, (v) Quantum field theory, superstring theory and quantum gravity.

E. D. JEMMIS | Indian Institute of Science Education and Research, Thiruvananthapuram

Eluvathingal D Jemmis did his Bachelors and Masters in Chemistry from the University of Calicut and IIT-Kanpur respectively. He completed his Ph.D. in Applied Theoretical Chemistry from Princeton University with Professor Paul von R Schleyer. He was a Research Associate at Cornell University before joining University of Hyderabad. He is a Professor at the Dept. of Inorganic and Physical Chemistry at the IISc, Bangalore. He is a recipient of the 2003 TWAS Prize in Chemistry. Currently, he is on deputation to start the Indian Institute Of Science Education and Research, Thiruvananthapuram. His research is on Novel Ideas in Structure and Bonding, Transition Metal Organometallics, Electron Counting Rules, Boron-Rich Solids, Theoretical Organic Chemistry and fragment approach to stuffed boron fullerenes.

RAJEEVA KARANDIKAR | Chennai Mathematical Institute, Chennai

Rajeeva L Karandikar is Director of Chennai Mathematical Institute. He holds a Masters degree and a doctorate from the Indian Statistical Institute, Kolkata. He is a Fellow of Indian Academy of Sciences and Indian National Science Academy. He is a recipient of the Bhatanagar prize in mathematical sciences and National Award in Statistics in honour of Prof. C.N.R.Rao from Government of India.

Few of his research interest includes stochastic processes, stochastic differential equations and connections with partial differential equations, Markov processes and finitely additive probability theory.

He is also interested in applications of mathematics, statistics and probability theory to finance, cryptology, bioinformatics, psephology.

ANURAG KUMAR | Indian Institute of Science, Bangalore

Anurag Kumar obtained his B.Tech. degree from the Indian Institute of Technology at Kanpur, and the Ph.D. degree from Cornell University, both in Electrical Engineering. He was then with Bell Laboratories, Holmdel, N.J., for over 6 years. Since 1988, he has been with the Indian Institute of Science (IISc), Bangalore, in the Department of Electrical Communication Engineering, where he is now a Professor. He is currently also the Chair of the Electrical Sciences Division at IISc. From 1988 to 2003 he was the Coordinator at IISc of the Education and Research Network Project (ERNET), India's first wide-area packet switching network.

His area of research is communication networking, specifically, modeling, analysis, control and optimization problems arising in communication networks and distributed systems. Recently his research is focused primarily on wireless networking. He is a Fellow of the IEEE, of the Indian National Science Academy (INSA), of the Indian Academy of Science (IASc), and of the Indian National Academy of Engineering (INAE). He is a coauthor of the postgraduate text-books "Communication Networking: An Analytical Approach,'' and "Wireless Networking" both by Kumar, Manjunath and Kuri, published by Elsevier.

MRINALINI PURANIK | NCBS-TIFR, Bangalore

Mrinalini Puranik is a faculty member at the National Centre for Biological Sciences. She completed her Bachelors and Masters in Physics from University of Pune and Ph.D. from IISc, Bangalore before visiting Princeton University as a post-doctoral fellow. Mrinalini had set up the first UV resonance Raman facility in India at NCBS, Bangalore in 2004 to elucidate the structure and dynamics of biomolecules in the context of their function which is her main research interest.

Her lab aims at understanding nucleic acid binding enzymes with wide ranging substrate specificity using either the nucleobase or aromatic amino acids as intrinsic vibrational probes. Typically these enzymes are involved in a variety of cellular processes such as mechanisms of photo-induced DNA damage, enzymatic DNA repair by glycosylases.

PROGRAMME COMMITTEE MEMBERS

SRIRAM RAMASWAMY | Indian Institute of Science, Bangalore
TCIS-TIFR, Hyderabad (Currently)

Sriram Ramaswamy, Professor of Physics at the Centre for Condensed Matter Theory, IISc completed his B.Sc. in Physics at University of Maryland and Ph.D. at University of Chicago. He did his post-doctoral work at University of Pennsylvania. He is a recipient of the Infosys Prize (2011) for Physical Sciences.

He is interested in soft-matter physics, nonequilibrium statistical mechanics and biological physics. Currently, he is working on the mechanics and statistics of living matter, sedimentation and electrophoresis in suspensions, the glass transition in confined liquids, and granular monolayers as analogues to self-propelled systems.

SUJATHA RAMDORAI | TIFR, Mumbai/ University of British Columbia, Canada (Currently)

Sujatha Ramdorai is a Professor of Mathematics at the School of Mathematics, Tata Institute of Fundamental Research. She completed her M.Sc. at Annamalai University and Ph.D. at TIFR. She was a recipient of the Shanti Swarup Bhatnagar Award and the first and only Indian to receive the ICTP Ramanujan Award. She was a member of the Scientific Committee of several international research agencies such as the Indo-French Centre for Promotion of Advanced Research, Banff International Research Station, International Centre for Pure and Applied Mathematics. She was a Member of the National Knowledge Commission and is Member of the Scientific Advisory Council to the Prime Minister.

Sujatha's initial research comprised of the algebraic theory of quadratic forms. Her research interests include arithmetic geometry, elliptic curves, the study of motives and noncommutative Iwasawa theory.

R.SHANKAR | Institute of Mathematical Sciences, Chennai

R. Shankar is a Professor at the Institute of Mathematical Sciences (IMS), Chennai. He earned his MS in Physics from IIT- Delhi and M. Phil from University of Delhi. He obtained Ph.D. in Physics from TIFR, Mumbai followed by post-doctoral research at IMS. Subsequently, he worked as a Research Associate at IIT-Kanpur for two years before joining the faculty at IMS in February, 1991. R Shankar is recipient of Professor Y. T. Thathachari Prestigious Research Award for Science-2008.

His research is primarily in Condensed Matter Physics and Quantum Field Theory. He also holds interest in Tsunami modelling and Glacier modelling.

ASHUTOSH SHARMA | Indian Institute of Technology, Kanpur

Ashutosh Sharma is currently an Institute Chair Professor in the Department of Chemical Engineering & the Coordinator of the Center for Nanosciences at the Indian Institute of Technology, Kanpur. Ashutosh obtained his B.Tech. from IIT Kanpur (1982), M.S. from The Pennsylvania State University (1984) and Ph.D. in Chemical Engineering from State University of New York at Buffalo (1987) working with Prof. Eli Ruckenstein-a recipient of the US Medal of Science. After a brief stint (1988-90) at the SUNY School of Medicine and Biomedical Sciences as a research faculty, he joined IIT Kanpur in 1990. He was Head of Chemical Engineering (2003-05) at IIT-Kanpur.

Ashutosh has served on the Editorial Advisory Boards of Journal of Colloid & Interface science, Chemical Engineering Science, Canadian Journal of Chemical Engineering and Indian Chemical Engineer. He is an elected fellow of all the Indian academies of science and engineering and a Fellow of TWAS--the Academy of Sciences for the Developing World. He is also a recipient of the Infosys Prize (2010), MRSI Distinguished Lecturership Award (2011-12), TWAS Science Prize (2008), Lifetime Achievement Award of The Indian Science Congress Association (2010), Bessel Research Award of Alexander von Humboldt Foundation (2006), Distinguished Alumnus Award of IIT Kanpur (2007), Homi Bhabha Award of UGC (2007), Bhatnagar Prize (2002) and a J. C. Bose Fellowship of the Department of Science & Technology (2006-11).

The unifying theme in his work is the exploration of relations between the small scale mechanics, self-organized fabrication and functionalities of multi-scale structures/interfaces. Within this general theme, the current research spans interdisciplinary areas of interface science, soft thin films, self-organization, meso-patterning, nano-mechanics, micro/nano fluidics, functional interfaces and carbon based functional materials and carbon multiscale MEMS/NEMS. These fundamental studies are also being applied in a variety of settings that span health, energy and environment. Some specific current works include soft micro- and nano- fabrication/ patterning of polymers, ceramics, hydrogels and carbon; micro-batteries; smart and functional interfaces, coatings and soft adhesives; drug delivery; detergency and wetting; surface instabilities; adsorption and nucleation; and environmental remediation.

TARUN SOURADEEP | Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune

Tarun Souradeep, a Professor at IUCAA, received his B.Tech. (Mechanical Engg.) from IIT-Kanpur, MS (Physics) from University of Pune and Ph.D. (Physics-Cosmology) from IUCAA. He was engaged in post-doctoral research at Canadian Institute For Theoretical Astrophysics and then at Kansas State University. He has received several awards such as the SCOPUS Young Scientist Award, Buti Foundation Award, B.M. Birla Science Prize. He is also the member of the International Astronomical Union.

He is interested in Statistical isotropy of the Cosmic Microwave Background (CMB) sky, Odd parity non-Gaussianity, Primordial power spectrum from CMB, early universe and QFT in curved spacetime.

V. SRINIVAS | TIFR, Mumbai

Srinivas joined the TIFR, Mumbai as a Visiting Fellow in January, 1983. He was appointed as a Fellow at TIFR in August, 1983, and has been working there since then, currently as a Senior Professor. He received his MS and Ph.D. in Physics from University of Chicago. He is on the editorial board of some journals, notably Mathematische Annalen; is a Member-at-large of the Executive Committee of the International Mathematical Union. He has received several awards, including the INSA Medal for Young Scientists (1987), the Birla Award for Mathematical Science (1995), the Swarnajayanthi Fellowship of the DST (1998), the Bhatnagar Award (2003), the J.C. Bose Fellowship of the DST (2008), and the TWAS Mathematics Prize (2008). He is a Fellow of the Indian Academy of Science (Bangalore), and of the INSA.

Prof. Srinivas has worked mainly in algebraic geometry. One of his abiding interests has been the study of algebraic cycles on singular algebraic varieties. Other themes in his work are on the interface with commutative algebra, for example, on projective modules, divisor class groups, unique factorization domains, and Hilbert functions and multiplicity. He has also worked on aspects of positive characteristic algebraic geometry. An important work of his, not on any of the above themes, is the solution of Zariski's problem (Riemann-Roch problem for surfaces), obtained together with Cutkosky.

MUKUND THATTAI | NCBS-TIFR, Bangalore

Mukund Thattai received his BA in Physics from Cornell University, and a Ph.D. in Physics from MIT. As a graduate student he intended to work on condensed matter theory, but he switched to understanding biological systems more deeply, particularly, stochastic processes in living cells. Subsequently, he joined NCBS, Bangalore as a Young Investigator to start an independent lab that combines experimental and computational techniques to study transcriptional regulatory networks and eukaryotic intracellular traffic networks.

In living systems, the cell has network of protein filaments which serve as communication network to control gene expression, metabolism, in response to external conditions. Group of cells can influence one another by means of chemical and electrical signals in a neuronal network. Thattai's lab uses quantitative experiments, coupled with mathematical and computational models, to study the dynamical properties of living networks. Moreover, they use genomic and protein sequence data to probe the evolutionary history of these systems. The 'network idea' is a broad and powerful framework within which complexity of biological systems can be usefully organized and studied.

SANDIP TRIVEDI | TIFR, Mumbai

Sandip Trivedi is a Professor at the Dept. of Theoretical Physics at TIFR, Mumbai. He has completed his M.Sc., Physics at IIT, Kanpur and Ph.D. in Theoretical Physics at the California Institute of Technology, after which he did post-doctoral work at the Institute for Advanced Study, Princeton and was employed at Fermi National Accelerator Laboratory. He is a recipient of the Shanti Swarup Bhatnagar Award (2005) and Infosys Prize (2010).

His research interest is in String Theory, Particle Physics and Cosmology, and more specifically in the areas of Black Holes, Supersymmetry Breaking, Dark Energy and Applied AdS/CFT. His contributions to solving the enigma in Superstring Theory, namely finding the origin of dark energy of the Universe and understanding the absence of massless scalar particles, has been well appreciated.

UMESH WAGHMARE | Jawaharlal Nehru Center for Advanced Scientific Research (JNCASR), Bangalore

Umesh Waghmare is a Professor at the JNCASR. He graduated with B.Tech. (Engg. Physics) IIT-Bombay, MS & Ph.D. in Applied Physics from Yale University, followed by Post-doctoral fellow at Harvard University. He was awarded the Shanti Swarup Bhatanagar prize in Physical Sciences (2010), the IBM Faculty Award among the many other awards and elected as a fellow for the Indian Academy of Sciences and National Academy of Sciences.

His research group aims at determining properties of materials on the macroscopic and intermediate length and time scales through a non-empirical description of their chemistry and atomistic structure. It usually starts with computational solution of electronic motion treated within a quantum mechanical density functional theory and identification of the lowest energy degrees of freedom and their interactions. An effective (model) Hamiltonian is then derived by integrating out the rest of the degrees of freedom. This first-principles Hamiltonian is then used in large-scale simulations that yield properties of materials at different scales. Owing to continuing advances in computers and algorithms, it is now possible to characterize and design new materials, particularly at the nano-scale, based mostly on such simulations.

PEOPLE

VIJAY CHANDRU | Strand Life Sciences, Bangalore

Vijay Chandru serves as Chairman, Co-Founder & CEO of Strand Life Sciences and as the Honorary President of Association of Biotech Led Enterprises (ABLE),the apex body of Indian biotechnology industry for a 3-year term 2009-2012. He did his bachelors at BITS-Pilani and Ph.D. at MIT. He holds adjunct faculty appointments at the International Centre for Theoretical Studies and the National Institute for Advanced Studies in Bangalore. His academic career in mathematical sciences has spanned over thirty years as a research scientist and professor at Purdue University, IBM's TJ Watson Center, Indian Institute of Science, UPenn, Stanford and at MIT. He is a fellow of the national academies of science and engineering in India. Vijay received the Dewang Mehta Award, (India's highest award for innovation in information technology) and UGC Hari Om Trust award for "Science and Society" (2003). He was named a Technology Pioneer of the World Economic Forum in 2007 for his work with Strand Life Sciences and was recognized as the Biospectrum Biotech Entrepreneur of 2007. Strand specializes in applying decision sciences and systems modeling to understanding the biology of disease and towards the design of novel diagnostics and therapeutics. He also founded PicoPeta Simputers, a private limited company.

His broad research interests is in algorithms and computational mathematics. His research contributions have been in combinatorial optimization and in the computational aspects of geometry, logic and biology.

CHANDAN DASGUPTA | Indian Institute of Science, Bangalore

Chandan Dasgupta is a Professor at the Department of Physics, Indian Institute of Science, Bangalore. He obtained his Ph.D. in Physics from the University of Pennsylvania in 1978 and M.Sc. in Physics from Delhi University in 1973.

He is the recipient of a number of fellowships such as INSA and the Alfred Sloan Foundation. His area of specialization is theoretical condensed matter physics with emphasis on statistical mechanics. Some of the problems he seeks to resolve are as follows - (i) Supercooled liquids and the glass transition: Density functional theory of dynamic heterogeneity in supercooled liquids; existence of a growing length scale near the glass transition; finite-size scaling of dynamic susceptibilities and relaxation times in glass-forming liquids, (ii) Superconductivity and superfluidity: Ginzburg-Landau theory for superconductivity and unusual normal-state behavior in cuprate superconductors; equilibrium properties of "vortex matter" in layered type-II superconductors with random pinning; "supersolid" behavior in solid 4He from superfluidity in grain boundaries, (iii) Dynamics of nonequilibrium systems: First-passage statistics, such as persistence and survival probabilities, in surface growth and fluctuations; rheological chaos in sheared nematogenic fluids, (iv) Physics at the nanoscale: Dynamics of water and other small molecules in narrow

carbon nanotubes; kinetics of growth of nanocrystals of semiconducting materials (such as ZnO) in the solution route of synthesis, mechanical properties of nanostructures.

JUSTIN DAVID | Indian Institute of Science, Bangalore

Justin David completed his Ph.D. at the Tata Institute of Fundamental Research, Mumbai, in 1999 and after carrying out Postdoctoral work at the University of California, Santa Barbara, USA in 1999-2002 and at the International Centre for Theoretical Physics, Trieste, Italy in 2002-2005, joined Harish-Chandra Research Institute, Allahabad in 2005-2007 as Reader-F. Currently, he is an Assistant Professor, Centre for High Energy Physics, Indian Institute of Science, Bangalore, India.

Justin's research includes black hole entropy in string theory and gauge/string duality. The thrust of his current research is to understand black holes in less supersymmetric situations. He has proposed a partition function for black holes which preserve half the supersymmetries in a class of N=2 string theories. In the area of gauge string duality, he has pursued three areas, (i) applications of gauge gravity duality to understand strong coupling behaviour of 1+1 field theories. (ii) Recasting partition functions of gravity in 3 dimensional Anti-de Sitter space as characters of the conformal algebra in 1+1 dimensions. (iii) Using integrability and the symmetries of string theory in 3 dimensional Anti-de Sitter space to determine the S-matrix of the dual conformal field theory.

ABHISHEK DHAR | Raman Research Institute, Bangalore /ICTS-TIFR (Currently)

Abhishek Dhar is an Associate Professor at the Theoretical Physics Group at the Raman Research Institute, Bangalore. He finished his Ph.D. from TIFR. He was awarded the ICTP Prize (2008) for his outstanding contributions to non-equilibrium statistical mechanics of transport and fluctuation phenomena, classical as well as quantum mechanical. His exact and insightful results have clarified subtle issues, and corrected several misconceptions, specially about heat conduction. He is a Fellow of IAS.

His current interest is mainly in understanding thermal and electrical transport in low dimensional systems. Two different approaches that he pursues are: (i) the quantum Langevin equation method and (ii) the scattering theory approach.

Some interesting questions in these areas are the role of interactions and disorder on transport properties. Abhishek is also interested in the general topic of fluctuation theorems and their implications.

RUKMINI DEY | Harish Chandra Research Institute, Allahabad

Rukmini Dey joined Harish Chandra Research Institute as an Assistant Professor in the Department of Mathematics in 2003, after she had obtained her M.Sc. from IIT Kanpur and Ph.D. from SUNY at Stony Brook, USA.

Her research interests are: Quantization problems, geometric quantization of various moduli spaces and finite integrable systems ; PT-symmetric, non-Hermitian quantum mechanics; minimal surfaces and catastrophe theory; dynamics of accretion discs near black holes, trans-sonic surfaces and shock formation; AdS-CFT and hydrodynamics; topological fixed point theory and fiber bundles; minimal surfaces, constant mean-curvature surfaces; D-branes and integrable systems; Quantum Field theory and Conformal Field theory; geometric problems arising from String theory; integrable systems; study of minimal and almost minimal surfaces which appear in crystallography; dimensional reductions of gauge theory; solutions to equation of dimensional reduction of the Seiberg-Witten equations, integrable systems; Hilbert schemes and multisoliton systems; Lorentz surfaces; Ricci flow techniques in 3 manifold theory; Finite group actions on topological manifolds, especially in 2-dimensions.

ROHINI GODBOLE | Indian Institute of Science, Bangalore

Rohini Godbole is a Professor at the Centre for High energy Physics at Indian Institute of Science, Bangalore. A Silver Medalist from IIT-Bombay, she has completed her Ph.D. from SUNY, Stony Brook. She has made outstanding contributions to fundamental scientific research, specifically the theory of elementary particle physics. She is a Fellow of TWAS, INSA & IAS.

Her research interest is in (i) New Particle Production at current and future colliders, (ii) Physics at LHC and NLC, (iii) QCD phenomenology: Structure Functions of a proton, photon and nucleus (iv) Supersymmetry and Electroweak Physics.

RAJESH GOPAKUMAR | Harish Chandra Research Institute, Allahabad

Please refer to the information in Programme committee, page 27

BALA IYER | Raman Research Institute, Bangalore

Bala Iyer is a Professor of Theoretical Physics at Raman Research Institute. He did his B.Sc., M.Sc. and Ph.D. in Physics from University of Mumbai. He is a member of International Astronomical Union (IAU), Indian Association for General Relativity and Gravitation (IAGRG) and International Society on General Relativity and Gravitation (GRG). He has been a visiting scientist at various institutes in Germany, France, Italy, USA and Japan.

His principal research interest over the last two decades relate to the computation of high accuracy gravitational waveforms for inspiralling compact binaries (ICB) of

neutron stars and black holes using multipolar post Minkowskian methods. These high accuracy waveforms underlie the construction of gravitational wave templates used in the gravitational wave (GW) data analysis pipelines of detectors like LIGO and Virgo. They also lead to a more accurate parameter estimation accuracy which would be crucial in extracting astrophysical information from terrestrial GW detectors like LIGO and cosmological information from space based detectors like LISA. They are also imperative to validate the numerical relativity waveforms for plunge, merger and ring-down and to assess their accuracy and interpretation. Other allied research interests include application of resummation methods to extend the regime of validity of the PN approximants and to bridge the analytical relativity numerical relativity interface, phasing of binaries in quasi-elliptical orbits, development of tools to critically characterize template banks and quantify them, studies on effects of phasing and amplitude corrections for parameter estimation of ICB, astrophysical and cosmological implications of higher harmonics of GW for the science case of LISA and finally, the extent to which LISA observations of supermassive black hole binaries can test general relativity.

Over the last two years, as Chair of its Council, Bala has been involved in leading the activities of the Indian Initiative in Gravitational-wave Observations (IndIGO) Consortium.

The IndIGO Consortium is the proposer of LIGO-India and Bala is one of its principal leads. Over the last fifteen years, he has been involved in the Research Education Advancement Programme (REAP) for undergraduate teaching in Physics at the Jawaharlal Nehru Planetarium, Bangalore.

E. D. JEMMIS | Indian Institute of Science Education and Research, Thiruvananthapuram

Please refer to the information in Programme committee, page 28

RAVI KANNAN | Microsoft Research Labs., India

Ravi Kannan is a Principal Researcher in Microsoft Research Labs, India. He completed his B.Tech. in Electrical Engg. from IIT-Bombay and Ph.D. in Operations Research from Cornell University. He taught at MIT, Carnegie Mellon University and was the William K. Lanman Jr. Professor of Computer Science and Professor of Applied Mathematics at Yale University. He was awarded the 2011 Knuth Prize from the ACM Special Interest Group on Algorithms and Computation Theory (SIGACT) and the Fulkerson Prize in Discrete Mathematics, 1991 for his work on convex bodies.

His interest is in Theoretical Computer Science, Optimization, Massive Data Sets, Sampling, Clustering, Markov Chains, Linear Algebra Algorithms and Applications.

ADJUNCT FACULTY

N KUMAR | Raman Research Institute, Bangalore

N. Kumar is an Emeritus Professor at the Raman Research Institute, Bangalore. He did his B.Tech. and M.Tech in Electronics and Electrical Communication Engg. at IIT-Kharagpur, while Ph.D. from IIT-Bombay. He has been endowed with a number of awards and honors such as the Bhatnagar Prize, Padma Shri (2006) and TWAS Award (1992).

His current research interests are Quantum first-passage problem using restricted Feynmann path integral; Bohr-van Leeuwen theorem: Possibility of classical orbital magnetic moment for a non-Markowian dissipative stochastic dynamical system; Effect of microwave noise injection in a three-level EIT (Electro- magnetically Induced Transparency) system connected in the lambda- configuration; High-temperature superconductivity in layered systems: Pairing induced by the Zeno dynamics.

His continuing research interests in Condensed Matter Physics include: Quantum and Classical Transport in Disordered Systems; Anderson-Mott Localization; Magnetism; High-Tc Superconductivity; Statistical Physics. His past areas of interest include General Relativity; Astrophysics; Complex Systems: Associative Memory, Neural Net-work, turbulence, chaos.

HONG LIU | Massachusetts Institute of Technology

Hong Liu is an Associate Professor of Physics at MIT. He received his B.S. from the University of Science and Technology of China and his Ph.D. from Case Western Reserve University. He was a postdoctoral fellow at Imperial College, London and completed a five-year research associate position at Rutgers University,USA.

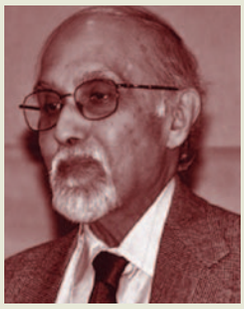
Hong Liu has long been interested in issues in quantum gravity, including quantum nature of black holes and cosmological singularities, using the framework of string theory. He also has active interests in the dynamics of many-body systems including the Quark-Gluon Plasma and strongly correlated electron systems.

SATYA MAJUMDAR | Centre National de la recherche Scientifique (CNRS), France

Satya Majumdar is the Directeur de Recherche in CNRS, working at the laboratoire de physique theorique et modeles statisques (LPTMS), Universite' Paris-Sud (Orsay, France) and Weston Adjunct Professor at the department of the physics of complex systems at Weizmann Institute (Rehovot, Israel). He completed his Bachelors and Masters in Physics from University of Calcutta. He obtained his Ph.D. from TIFR, Mumbai in 1992. He received the Paul Langevin medal for theoretical physics from the French physical Society in 2005, Young Scientist Medal by INSA in 1998, Excellence Award (2009) for outstanding contribution to statistical physics by Tata Institute Alumni Association and the 'Prime d'excellence Scientifique' (PES) by CNRS in 2009.

He has worked on a wide variety of problems in equilibrium and non-equilibrium statistical physics, with applications ranging from granular systems all the way to the analysis of algorithms in computer science. He has made important contributions in the field of self-organized criticality, polymers and self-avoiding walks, growth models, persistence and first-passage properties in nonequilibrium systems, Brownian motion/ diffusion and their applications, interacting particle systems and their nonequilibrium steady state properties and in understanding how stress propagates in granular systems. More recently, he has been working on the applications of statistical physics in computer science (sorting and search algorithms), extreme value statistics in various systems, in particular, in the theory of random matrices and its various applications.

SANJOY MITTER | Massachusetts Institute of Technology



Sanjoy Mitter is a Professor of Electrical Engg. at MIT since 1973. He received his Ph.D. degree in Electrical Engg. from the Imperial College London and Bachelors in Mathematics from Calcutta University. He had previously worked as a research engineer at Brown Boveri & Co. Ltd., Switzerland (now ASEA Brown Boveri) and Battelle Institute in Geneva, Switzerland. He served as Associate Professor at Case Western Reserve University to 1969 and joined MIT in 1969, first as a Visiting Professor and then in 1970 as an Associate Professor in the Dept. of Electrical Engineering and Computer Science. He is a fellow of the IEEE and was the recipient of the 2000 IEEE Control Systems Award and the Richard E. Bellman Control Heritage Award 2007. In 1988 he was elected to the National Academy of Engineering. He was elected as a Foreign Member of Istituto Veneto di Scienze, Lettere ed Arti in 2003.

Sanjay's research has covered the areas of Systems, Communication and Control. His current research interests are theory of stochastic dynamical systems, nonlinear filtering, stochastic and adaptive control; mathematical physics and its relationship to system theory; image analysis and computer vision; and structure, function and organization of complex systems.

RAVI NANJUNDIAH | Centre for Atmospheric and Oceanic Sciences, IISc, Bangalore

Ravi Nanjundiah is a Professor at the Centre for Atmospheric & Oceanic Sciences, Indian Institute of Science. He has an M.E. in Mechnical Engineering and Ph.D. in Atmospheric Sciences from IISc. He received Sir C V Raman Young Scientist Award for the year 2000 in the field of Earth Sciences.

His main interest is in understanding the variability of the Indian Summer Monsoon (ISMR). Simulation of ISMR and its variability is a major problem for most numerical models. He is also interested in seasonal prediction of ISMR and associated problems related to data assimilation.

He has worked on downscaling climate data to smaller spatial and temporal scales to assess the impact of climate change on a river-basin. He has also been looking into issues related to the use of high performance computing and grid computing to climate models.

RODDAM NARASIMHA | Jawaharlal Nehru Center for Advanced Scientific Research, Bangalore

Roddam Narasimha is an Honorary Professor of the Engineering Mechanics Unit at the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore. After a BE in Mechanical Engineering, he studied aeronautics at the Indian Institute of Science and obtained a Ph.D. in Aeronautics and Physics at the California Institute of Technology in 1961. He joined IISc in 1962 as a faculty member at the Department of Aeronautical Engineering, started the Centre for Atmospheric Sciences in 1982, and continued in some capacity or other till 1993. From 1984 to 1993 he was Director of the National Aerospace Laboratories, and from 1997 to 2004 Director of the National Institute of Advanced Studies. Currently, he also holds the prestigious 'Pratt and Whitney' Chair in Science and Engineering at the University of Hyderabad.

He is a Fellow of the Royal Society, Foreign Associate of the US National Academy of Engineering and US National Academy of Sciences, Honorary Fellow of the American Academy of Arts and Sciences; and a Fellow of all the major academies in India. He is a recipient of the Bhatnagar Prize, the AIAA Fluid Dynamics Award, the Trieste Science Prize and the Padma Bhushan, among many others.

Roddam's research interest is in fluid mechanics relevant to aerospace sciences and atmospheric dynamics. For several years he has been interested in the fluid dynamics of cumulus clouds, which he and his colleagues and students have simulated both in the laboratory and on the computer. The most recent contribution (with Diwan, Subrahmanyam, Sreenivas and Bhat) is a paper in PNAS which proposes that both the form and evolution of cumulus clouds are driven by diabatic heating resulting from phase transitions in H_2O in the cloud. In aerodynamics (work carried out with Deshpande, Praveen and Rakshith), he has shown how novel wing planforms can reduce induced drag by about 10% in turboprop aircraft with propellers mounted ahead of the wing in the tractor configuration. This result is derived from the use of optimization theory, and is the subject of patent applications. In other work (with Viswanath, Mukund and Crouch) he has shown how the flow in the boundary layer, within 10% of the chord around the leading edge of a swept wing of the kind that is common on modern transport aircraft, can transition back and forth between laminar and turbulent states in upto three cycles. He has a keen interest in the history of classical Indic sciences and technology.

RAHUL PANDIT | Indian Institute of Science, Bangalore

Rahul Pandit is a Professor in the Department of Physics, Indian Institute of Science, Bangalore and Chairman of the Division of Physical and Mathematical Sciences. He received his MS in Physics from IIT-Delhi and Ph.D. in Physics from University of Illinois at Urbana Champaign. Professor Pandit was a postdoctoral fellow in the Laboratory for Atomic and Solid State Physics, Cornell University. Professor Pandit has received many honours and awards including the Young Scientist Medal of the Indian National Science Academy (1989), the Shanti Swarup Bhatnagar Award of the Council for Scientific and Industrial Research (2001), the Meghnad Saha Award of the University Grants Commission (2004), the Fellowship of the Indian National Science Academy (2006) and more.

He has done research on a wide variety of problems in the statistical mechanics of condensed matter systems. These include: surface phase transitions like wetting and multilayer adsorption; complex fluids like microemulsion, micellar, lamellar and sponge phases in oil-water-surfactant mixtures and bilayer systems,

and semiflexible, living and equilibrium polymers; quantum antiferromagnets and oxides that show strong-correlation effects like the colossal magnetoresistive manganites; systems of interacting bosons; the hysteretic behavior of driven spin systems and magnets; turbulence in fluids and spiral turbulence associated with cardiac arrhythmias like ventricular fibrillation.

Rahul is on the Advisory Editorial Board of Physica A: Statistical Mechanics and its applications, an Elsevier Science Journal, and a Divisional Associate Editor of Physical Review Letters.

SRIRAM RAMASWAMY | Indian Institute of Science, Bangalore
TCIS-TIFR, Hyderabad (Currently)

Please refer to the information in Programme committee, page 30

G RANGARAJAN | Indian Institute of Science, Bangalore

Govindan Rangarajan obtained his Ph.D. from University of Maryland, College Park, USA. He then worked at the Lawrence Berkeley Lab, University of California, Berkeley before returning to India in 1992. He is currently a Professor of Mathematics at the Indian Institute of Science, Bangalore. He is a J. C. Bose National Fellow. He is also a Fellow of the Indian Academy of Sciences and the National Academy of Sciences, India. He was awarded the Chevalier (Knight) of the Order of Palms by the Government of France and was a Homi Bhabha Fellow.

His research interest is in Nonlinear dynamics and chaos, time series analysis of neurobiological signals and brain machine interface.

MADAN RAO | Raman Research Institute, Bangalore

Madan Rao is a Professor in Theoretical Condensed Matter/ Biological Physics at Raman Research Institute, Bangalore. He is also an Adjunct Faculty Position at the National Centre for Biological Sciences and also a Visiting Scientist in the Center for Condensed Matter Theory at the neighbouring Indian Institute of Science. An alumni of IIT-Bombay, IISc Bangalore, was a recipient of the Bhatnagar Award in 2004.

His research interest can be classified as - (i) Hard Matter (Material Science): Martensites; Brittleness and Ductility (ii) Soft Matter (Complex Fluids); Single Component Lipid Membranes; Equilibrium Shapes, Shape Transitions; Two-Component Lipid Membranes: Equilibrium Shapes and Dynamics (iii) Physics in Biology: Endocytic Sorting in Eukaryotic Cells; Structure of Rafts; Active Membranes: Pumps, Fission/Fusion, Flip/Flop; Elasticity and Dynamics of DNA (iv) Dynamics Far From Equilibrium: Phase Ordering of Isotropic Magnets with Torque; Driven Magnets - Steady States with Broken Symmetry and Goldstone Modes; Approach to Equilibrium in Many Body systems --- Chaos (v) Other Interests - Skyrmions in Quantum Hall Systems: Crystal.

ADJUNCT FACULTY

SRIKANTH SASTRY | Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore/ TCIS-TIFR, Hyderabad (Currently)

Srikanth Sastry is a Professor at the Theoretical Sciences Unit, Jawaharlal Nehru Centre for Advanced Scientific Research. He obtained his Ph.D. in Physics from the Boston University in 1993 and MS in Physics from IIT-Bombay. He was a Research Associate at Princeton University. He is a recipient of the Shanti Swarup Bhatnagar Award, CSIR, India, 2008 and Prof. C.N.R Rao Oration Award, JNCASR, 2001.

Srikanth Sastry's research interests have been in the area of statistical mechanics, with a focus on understanding a range of unusual and interesting properties of liquids and other soft condensed matter. Some of the areas of his research activities are: Slow dynamics and routes to structural arrest (glass transition, gelation, jamming etc) in super cooled liquids and other soft matter systems (colloids, gels, granular material), Thermodynamic aspects of glassy systems, Glass forming ability, Kinetics of phase transformations, Mechanical properties of glasses and other amorphous solids, Anomalous thermodynamic and dynamical properties, liquid-liquid phase transitions in water, silicon and other network forming liquids, Statistical mechanics of biomolecular systems, Computational study of phase behavior, equilibrium properties, dynamics and phase transformations in disordered condensed matter.

KRISHNENDU SENGUPTA | Indian Association for the Cultivation of Sciences, Kolkata

Krishnendu Sengupta is an Associate Professor at the Indian Association for the Cultivation of Sciences, Kolkata. Prior to this, he was at the Saha Institute of Nuclear Physics, Kolkata. He obtained his M.Sc. in Physics from IIT-Kharagpur and another MS and then a Ph.D. from the University of Maryland at College Park.

His research interest spans two separate areas in theoretical condensed matter physics. The first area involves study of properties of Dirac materials such as graphene and topological insulators. The low-energy quasi-particles of these materials obey Dirac-like equation which renders them with several unconventional properties. His main interest in this area involves understanding the implication of such properties on junctions and STM spectra of these materials. The second area involves study of non-equilibrium phenomenon in closed strongly interacting quantum systems near a quantum critical point, to find, in particular, the possibility of using several ultracold atom systems as test beds to explore such phenomena.

VIJAY SHENOY | Indian Institute of Science, Bangalore

Vijay Shenoy is an Associate Professor at the Centre for Condensed Matter Theory in Department of Physics at Indian Institute of Science, Bangalore. He has completed his B. Tech. at IIT Madras in 1992, M. S. at Georgia Tech., in 1994, Ph.D. at Brown in 1998 and became Adjunct Assistant Professor at Brown in 1999 and then Assistant Professor at Indian Institute of Technology, Kanpur from 1999-2002 and Assistant Professor at Indian Institute of Science, Bangalore from 2002 to present.

His research interest is in Physics of materials with strong electron correlations, Cold quantum gases and optical lattices, Nanoscience Pattern formation and complex phenomena in soft thin films.

AJAY SOOD | Indian Institute of Science, Bangalore

Ajay Sood is a Professor in Department of Physics at Indian Institute of Science, Bangalore. He completed his B.Sc., M.Sc. in Physics at Punjab University and Ph.D. at IISc, Bangalore. Later he went to Max Planck Institute, Germany for his post-doctoral work.

He was a Scientist at the Indira Gandhi Centre for Atomic Research. He has many fellowships and awards; such as the Shanti Swarup Bhatnagar Award, G.D. Birla Science Award, C.V. Raman Award, 2000 TWAS Prize in Physics.

His research interest is in the area of Soft Condensed Matter like Colloids, surfactant systems like lyotropic liquid crystals, micelles, membranes, vesicles, ferrofluids; Experimental studies: Laser light scattering, Digital optical microscopy, SAXS and SANS, Coherent X-ray scattering, X-ray fluorescence correlation spectroscopy, Rheology; Theoretical studies: Density functional theory, computer simulations- Monte-Carlo, Brownian dynamics and Molecular dynamics.

In Solid State Physics, his interest include: (i) Raman Scattering: Semiconductor superlattices, Fullerenes, Nanotubes, Graphene, strongly electron correlated oxides, Geometrically spin frustrated pyrochlores, nano - crystalline materials, bulk semiconductors, Raman scattering under ultra high pressure using diamond anvil cell; (ii) Time resolved spectroscopy: Photon Control of ionic motion using femtosecond lasers-squeezed photons, Nonlinear optical properties; (iii) Brillouin Scattering: Semiconductors, Manganites, CDW systems, Pyrochlores and (iv) Transport: Fluid flow induced voltage generation in nanotubes.

Ajay's other Theoretical Studies include:
1. Stochastic theory of spectral line shapes;
2. Hydrodynamic theory of non-equilibrium steady states.

J SRINIVASAN | Indian Institute of Science, Bangalore

J. Srinivasan is a Chairman in Divecha Centre for Climate Change at Indian Institute of Science, Bangalore. He completed his Ph.D. at Stanford University in the year 1975, M.S. in State University of New York in 1971 and B.Tech. in IIT Madras in the year 1969. He was awarded Hari Om Ashram Prerit S.S.Bhatnagar research award - Solar Energy 1994.

His research interest is in Double Diffusive Convection, Monsoon Models, Monsoon Variability Simple Climate Models and Satellite Meteorology.

TARUN SOURADEEP | Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune

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PEOPLE

ADI ADIMURTHY | CAM-TIFR, Bangalore

Adi Adimurthy is a senior Professor at the Centre for Applicable Mathematics, TIFR, Bangalore. He has completed his Ph.D. in Mathematics from University of Bombay. He is a fellow of all three science Academics in India and is a recipient of the J.C. Bose fellowship.

His current research interests is in Non linear PDE, Hamilton Jacobi Equations, Conservation Laws and Hardy Sobolev Inequalities.

AMIT APTE | CAM-TIFR

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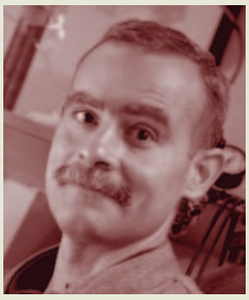
UPINDER BHALLA | NCBS-TIFR, Bangalore



Upinder Bhalla, graduated in Physics from Cambridge and did Ph.D. in Biology from Caltech on olfractory information processing. He went to Mount Sinai School of Medicine, USA for his post-doctoral work. Since then, he works at NCBS as a Professor at the Department of Neurobiology, where he continues to pursue both experiments and models in neural computation at levels ranging from single molecules up to the entire brain.

His research in the field of computational neuroscience involves studying Olfactory Physiology, Olfactory Behaviour, Hippocampal connection-function models, Signalling and Memory, Simulators and databases. Upinder and his team work on the theory that memories are stored in the pattern of connections between brain cells for which the brain must convert information into activity patterns, modify connections, and stably retain these modifications. The research involves use of optical imaging to monitor activity in the hippo-campus, which receives different kinds of sensory input. The activity patterns are analyzed and influence of one cell activity on another is tested. Connection patterns are designed and retention of memory at synapse is probed using both experiments and computer models. His lab develops software such as MOOSE to monitor activities at synapse. Overall, their work falls into the domains of systems biology and computational neuroscience, with a lively mix of experiments and computer modeling. His lab includes people from physics, chemistry, mathematics, biology, computer science and other branches of engineering.

JOINT FACULTY

KEDAR DAMLE | TIFR, Mumbai

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AMOL DIGHE | TIFR, Mumbai

Amol Dighe is an Associate Professor at Tata Institute of Fundamental Research, in the Department of Theoretical Physics, Mumbai. He completed his B.Tech. in Engineering Physics (1992) from the Indian Institute of Technology, Bombay, while M.S. and Ph.D. (1997) from the University of Chicago, where he explored signals of charge-parity violation in particle physics interactions. Later, he was a postdoctoral researcher in ICTP (Trieste, Italy), CERN (Geneva, Switzerland) and Max Planck Institute for Physics (Munich, Germany), before joining TIFR as a faculty member in 2003. He was one of the first Indian Bronze Medalists in the International Mathematics Olympiad, Germany (1989). He received the Worldlab-CERN John Bell Scholarship and was the Leader of the Max Planck -- India Partner Group in Neutrino Physics and Astrophysics for five years. He has won the Swarnajayanti Fellowship from the Department of Science and Technology, Govt. of India.

His research interest is in High Energy Physics, Phenomenology, Neutrinos: Theory, Phenomenology, Astroparticle physics, Colliders: B decays, CP violation. He performs indirect searches of physics beyond the Standard Model of particle physics (SM) through the decays of B mesons. He works on constructing models of neutrino masses and mixing, and their connection to the quark masses through unification.

AVINASH DHAR | TIFR, Mumbai

Avinash Dhar is a Senior Professor at the Department of Theoretical Physics, TIFR. He completed his B.Sc. and M.Sc. in Physics from University of Jammu and IIT-Kharagpur respectively. He obtained his Ph.D. from University of Bombay and TIFR. He was a Post-doctoral Fellow at SLAC and has been an Associate Member at Abdus Salam International Centre for Theoretical Physics, Italy. He has also served as a Scientific Associate at CERN, Geneva.

His research interest is in High Energy Physics, Field Theory and String Theory, Gauge Theory / Gravity correspondence. He was among the first to discover a manifestly supersymmetric formulation of the Chapline-Manton theory. He showed that the Hawking decay rate in constituent models of black holes in string theory agrees with general relativity, a result that has implications for the resolution of the information puzzle. His work helped solve the half-century old problem of Tomonaga. His current research involves holographic models of strong interactions and non-Lorentz invariant models with anisotropic scale invariance.

MANOJ GOPALKRISHNAN | TIFR, Mumbai

Manoj Gopalkrishnan received a B. Tech. in Computer Science and Engineering from IIT Kharagpur in 2003, and a Ph.D. in Computer Science from the University of Southern California in 2008. He is a recipient of the Ramanujan fellowship from the Department of Science and Technology, and has held a brief visiting position in the Department of Mathematics at Duke University. He is a faculty member at the School of Technology and Computer Science, TIFR, Mumbai and joint faculty member at the Centre for Interdisciplinary Science, TIFR Hyderabad.

His research interest is in DNA self-assembly, systems biology, algorithms, chemical reaction networks, molecular computation and the thermodynamics of computation.

Molecular biologists have amassed much information about the biochemical reaction networks that occur in living cells. Manoj hopes to use the mathematical insight gained from work on chemical reaction networks to study this complexity and self-organization.

Some of his other interests are cognition, scientific method, computational learning theory, evolution, computational complexity theory, quantum computing, algebraic geometry, and category theory.

YAMUNA KRISHNAN | NCBS-TIFR, Bangalore

Yamuna Krishnan is a Professor at the Department of Biochemistry, Biophysics and Bioinformatics, NCBS. She completed her MS in Chemical Sciences and Ph.D. in Organic Chemistry from IISc-Bangalore. She was associated with the University of Cambridge, UK as a Research Fellow in the Department of Chemistry. She was awarded a Wellcome Trust – DBT India Alliance Senior Research Fellowship, Indian National Science Academy's Young Scientist Medal in 2010 and Innovative Young Biotechnologist Award from the Department of Biotechnology, Govt. of India in 2006.

Her lab is focussed on studying the structure and dynamics of nucleic acids to create DNA-based nanodevices for applications in bionanotechnology. Her research interest is in finding the cause of tetramerization in the I-motif, and focuses on the I-motif as a building block for rigid 1D scaffolds on the nanoscale.

SUBHABRATA MAJUMDAR | TIFR, Mumbai

Subhabrata Majumdar is a Professor in the Department of Astronomy and Astrophysics at TIFR, Mumbai. He obtained his Ph.D. from Indian Insititute of Science, Bangalore. His research interest is in Theoretical and Observational Cosmology, Astrophysical probes of Dark Matter, Dark Energy and Early Universe, Physics of Galaxy Clusters, Large Scale Structure Surveys, Secondary Anisotropies of the Cosmic Microwave Background, Dynamics of the Milky Way halo and its impact on Dark Matter detection experiments.

SATYAJIT MAYOR | NCBS-TIFR, Bangalore

Satyajit Mayor is a Dean at NCBS-TIFR, Bangalore. He received his MS in Chemistry from IIT-Bombay and Ph.D. in Life Sciences from Rockefeller University, New York where he worked on molecular parasitology in Trypanosoma brucei specifically, the biosynthesis of GP1 anchors. He then joined the Dept of Pathology at Columbia University where he developed tools to study the trafficking of GPI-anchored proteins in mammalian cells using quantitative fluorescence microscopy. He then joined NCBS as a Professor in the area of Cellular Organization and Signalling. Mayor has received a number of fellowship including the JC Bose Fellowship, SS Bhatnagar Award (2003), 2010 TWAS Prize in Biology and Swarnajayanti Fellowship by DST. He is a Fellow of INSA, IAS.

He is interested in the Mechanisms of endocytosis in metazoan cells i.e., Structure and function of membrane rafts, Mechanism of endocytosis of GPI-anchored proteins via a novel dynamin independent endocytic pathway, Functional genomics of endocytosis in Drosophila, a metazoan system capable of genetic manipulation, Understanding pathways of antigen presentation for loading onto MHC class II, and endocytic mechanisms related to virus induced immune evasion.

SHIRAZ MINWALLA | TIFR, Mumbai

Shiraz Minwalla is a Professor in Department of Theoretical Physics at TIFR, Mumbai. He graduated from IIT-Kanpur and completed Ph.D. from Princeton University. He served as a Harvard Junior Fellow and then as an Assistant Professor at the Harvard University. He has received the Swarnajayanti Fellowship, ICTP Prize (2010) for contributions in String Theory and Gauge/ Gravity duality and the Shanti Swarup Bhatnagar Prize for Science and Technology (2011).

Shiraz Minwalla is recognized for his many outstanding contributions in different fields such as, analysis of primary operators on AdS4 and AdS7; Noncommutative perturbative dynamics, OM-theory, Stringy interactions in pp-waves and his most recent work includes obtaining equations of Nonlinear fluid dynamics in 3+1 dimensions from Einstein's equation for black-branes in 5-dimensional anti-de-Sitter space.

JOINT FACULTY

SEEMA NANDA | CAM-TIFR, Bangalore

Seema Nanda is a Reader in Centre for Applicable Mathematics (CAM), Tata Institute of Fundamental Research (TIFR). She completed B.A. (Liberal Arts) from Delhi University, and MBA (Finance) from Baylor University, USA. She then pursued M.S. and Ph.D. in Mathematics from Courant Institute of Mathematical Sciences, New York University, on the subject of "Spatial Random Graphs and Dynamics of Disordered Systems". After which she was a Post-Doctoral Research Associate at the University of Tennessee, USA.

Her broad research interests lie in applying mathematics to life sciences, engineering and social sciences to solve real world problems. Within this, her focus has been to understand biological processes, especially as related to diseases such as cancer and diabetes. The aim of her research is to build mathematical models based on in-vivo and in-vitro experiments with the aim of gaining some understanding and insight into phenomenon not well understood, such as drug resistance in cancer, or glucose metabolism in the case of diabetes mellitus. Working in conjunction with biologists is an emphasis here so that models developed are realistic.

In addition to the above research interests she works on mathematical problems in the application area of finance. Most recently this has involved trying to model stochastic volatility.

MRINALINI PURANIK | NCBS-TIFR, Bangalore

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JAIKUMAR RADHAKRISHNAN | TIFR, Mumbai

Jaikumar Radhakrishnan is a Professor and Dean at the School of Technology & Computer Science of TIFR, Mumbai. He completed his B.Tech. at IIT Kharagpur, in 1985 and Ph.D. at Rutgers University, USA in 1991. He worked for CMC Ltd., Kolkata as Associate Systems Engineer and spent a year at Japan Advanced Institute of Science and Technology, Japan as Visiting Associate Professor.
He is a recipient of the Shanti Swarup Bhatnagar Award 2008 and Fellow of IAS.

His research interest is in Randomness and Computing, Quantum Information and Computation, Information Theory, Combinatorics, Algorithms and Circuit Complexity.

M. S. RAGHUNATHAN | IIT, Bombay

M.S. Raghunathan is currently Head of the National Centre for Mathematics, Indian Institute of Technology, Mumbai. He obtained his Ph.D. in Mathematics from TIFR,Mumbai. A recipient of notable awards such as Padma Bhushan (2012), Padma Shri (2001), Shanti Swarup Bhatnagar Prize and a fellow of the Royal Society of London. He retired as a Professor of Eminence from TIFR in 2006.
His main area of research is in Algebraic Groups and Discrete Groups, Secondary interests: Differential Geometry and Topology. He has made important contribution to the Lie Theory.

N RAJA | TIFR, Mumbai

N. Raja is a Reader with the School of Technology & Computer Science at TIFR, Mumbai. He completed his Master's degree from the Indian Institute of Science, Bangalore and Ph.D. at TIFR, Mumbai.
His research interest is in Logic and Foundations of Mathematics, Models of Concurrent and Interacting processes, Programming Paradigms and Languages, Formal Methods and Semantics of computation and Automated and Interactive Theorem Proving.

C.S. RAJAN | TIFR, Mumbai

C. S. Rajan is a Professor in the Department of School and Mathematics at TIFR, Mumbai. He completed his M.Sc. at IIT Kanpur in 1984 and subsequently earned his Ph.D. at TIFR in 1992. He spent the years 1994-96 as a postdoc at McGill University, Montreal.

His basic areas of interest are arithmetic geometry, automorphic forms and representation theory. Some of the questions that he is currently interested in investigating are: one is based on a conjectural theme that the geometry associated to canonical metrics (for example, the spectrum of Laplace type operators associated to the metric) on the complex points of a variety defined over a number field (for various embeddings of the number field into complex numbers) should determine the arithmetic of the variety and vice versa.
In representation theory, he is interested in the arithmetic properties of characters of irreducible representations of a simple algebraic group, especially in knowing whether it is irreducible as an element in the ring of conjugacy invariant regular functions on the group.

P.N. SRIKANTH | CAM-TIFR, Bangalore

P.N. Srikanth is a faculty in CAM-TIFR, Bangalore. He completed his Ph.D. at BITS, Pilani (1977) on thesis titled - 'Existence Theorems for Operator Equations of Generalized Hammerstien Type and Some Applications'.

His research interest is in Nonlinear Functional Analysis and Applications in the study of Differential Equations. More specifically interests are in questions of Existence, Multiplicity, Uniqueness, Concentration, Break of Symmetry of Solutions of Semi-linear Elliptic Problems.

V. SRINIVAS | TIFR, Mumbai

Please refer to the information in Programme committee, page 32

MUKUND THATTAI | NCBS-TIFR, Bangalore

Please refer to the information in Programme committee, page 32

SANDIP TRIVEDI | TIFR, Mumbai

Please refer to the information in Programme committee, page 33

T. N. VENKATARAMANA | TIFR, Mumbai

T.N. Venkataramana is a Senior Professor at the School of Mathematics, TIFR, Mumbai. He obtained his Ph.D. from University of Mumbai in 1990 under M.S. Raghunathan. He is the winner of ICTP Prize 2000. His research interest is in Lie groups and Arithmetic groups. He has made significant contribution in extending the result of Margulis on the arithmeticity of lattices in higher rank real and p-adic groups to positive characteristics. He has undertaken an extensive study of the restriction of cohomology classes on a locally symmetric manifold to a totally geodesic closed submanifold. His work displays commendable scholarship and originality.

SPENTA R. WADIA | TIFR, Mumbai & Director, ICTS-TIFR

Spenta Wadia is the founding Director of ICTS-TIFR. After graduating from St. Xavier's College, Mumbai and IIT Kanpur, he did his doctoral work at the City University of New York. He was at the University of Chicago before joining TIFR in 1982, where he is presently a Distinguished Professor in the Department of Theoretical Physics. He is a fellow of TWAS and all the major science academies of India. He is a recipient of the TWAS Physics Prize and the Steven Weinberg Prize of ICTP (Trieste).

His research areas include elementary particle physics, string theory and related areas of quantum gravity and cosmology.

FACULTY AND LONG TERM APPOINTMENTS AT ICTS

It is our firm conviction at ICTS to carry forth the tradition set by Dr. Homi Bhabha, the founding Director of TIFR, that an institution should be created around outstanding individuals. A process that ensures this at ICTS has been put in place by its Management Board. Below are listed the various bodies that are involved at various stages of the faculty induction process.

SCREENING COMMITTEE

This committee makes a preliminary judgement on the suitability of an application for ICTS faculty and other long term academic positions, and makes a recommendation to the "ICTS Appointments Committee" for further processing. The committee is also free to invite outstanding candidates to apply.

Indranil Biswas (TIFR)
Kedar Damle (TIFR)
Justin David (IISc, Bangalore)
Amol Dighe (TIFR)
Subhabrata Majumdar (TIFR)
Spenta Wadia (TIFR) (Chair)

APPOINTMENTS COMMITTEE

This committee is to assess, process and recommend an application for a faculty or a long term academic position (maximum 5 years) to the ICTS Appointments Board and the ICTS Management Board. The processing includes requesting referee letters and the assessment of a seminar and colloquium by the applicant. The committee is also free to invite outstanding candidates to apply.

Vivek Borkar (IIT, Bombay)
Avinash Dhar (TIFR)
Deepak Dhar (TIFR)
Rajesh Gopakumar (HRI, Allahabad)
Bhuvnesh Jain (U Penn, USA)
H. R. Krishnamurthy (IISc, Bangalore)
Satya Majumdar (LPTMS, Paris)
Shiraz Minwalla (TIFR)
Anirvan Sengupta (Rutgers, USA)
T. Senthil (MIT, USA)
Tarun Souradeep (IUCAA, Pune)
P. N. Srikanth (CAM-TIFR)
R. Sujatha (UBC, Canada)
M. Thattai (NCBS-TIFR)
Sandip Trivedi (TIFR)
T. N. Venkataramana (TIFR)
Spenta Wadia (ICTS-TIFR) (Chair)

ICTS APPOINTMENTS ADVISORY BOARD

The Appointments Advisory Board reviews the recommendation of the ICTS Appointments Committee for faculty and other long-term academic positions at ICTS-TIFR. The ICTS Appointments Board makes a final recommendation for faculty and other long-term academic appointments to the ICTS Management Board and the Governing Council of TIFR. The Board is also free to invite outstanding candidates to apply.

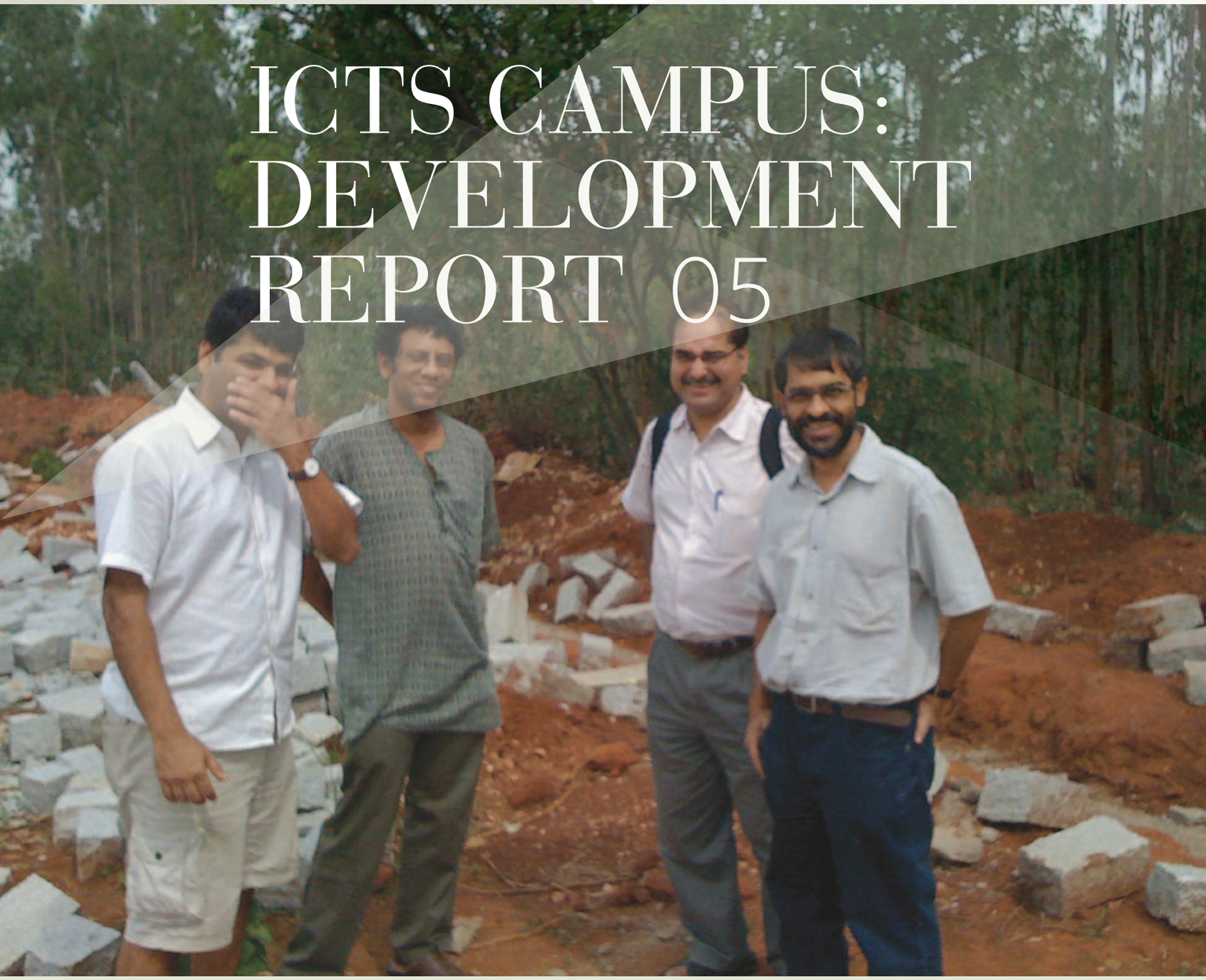
Mustansir Barma (TIFR) (Chair)
Edouard Brezin (ENS, Paris)
David Gross (KITP, Santa Barbara)
Subir Sachdev (Harvard University)
Ashoke Sen (HRI, Allahabad)
C.S. Seshadri (CMI, Chennai)
S.R.S. Varadhan (NYU, New York)
Spenta Wadia (ICTS-TIFR)
Matias Zaldarriaga (IAS, Princeton)

VISITING SCIENTISTS

Girish Agarwal (Oklahoma State University, USA)
Collins Assissi (Salk Institute, USA)
Pallab Basu (University of Kentucky, USA)
Sayantani Bhattacharya (HRI, Allahabad)
C.W.J. Beenakker (Institut-Lorentz, Netherlands)
Vivek Borkar (IIT, Bombay)
Kedar Damle (TIFR, Mumbai)
Abhishek Dhar (RRI, Bangalore)
Uriel Frisch (Universite de Nice-Sophia Antipolis, France)
Rajesh Gopakumar (HRI, Allahabad)
Sanjay Jain (Delhi University, Delhi)
K. Johansson (Royal Inst. of Technology, Sweden)
Romesh Kaul (IMSc, Chennai)
Klaus von Klitzing (Max Planck Institute for Solid State Research, Stuttgart, Germany)
Anupam Kundu (RRI, Bangalore & IISER, Kolkata)
Shailesh Lal (HRI, Allahabad)
Kody Law (Warwick University, UK)
Satya Majumdar (University of Paris-Sud, Paris)
Gautam Mandal (TIFR, Mumbai)
M. Marino (University of Geneva, Switzerland)
Mayank Mehta (University of California at LA, USA)
Shiraz Minwalla (TIFR, Mumbai)
Sanjoy Mitter (MIT, USA)
Suhita Nadkarni (Salk Institute, USA)
Onuttam Narayan (University of California, Santa Cruz, USA)
Arun Paramekanti (University of Toronto, Canada)
Sanjib Sabhapandit (RRI, Bangalore)
Subir Sachdev (Harvard University, USA)
Arunabha Saha (HRI, Allahabad)

Peter Sarnak (Princeton University & Institute for Advanced Study, USA)
Ritu Sarpal (University of Toronto, Canada)
Jay Deep Sau (Harvard University, USA)
Aninda Sinha (IISc, Bangalore)
Sandip Trivedi (TIFR, Mumbai)
Ashwin Vishwanath (University Of California, Berkeley, USA)
J.B. Zuber (University Pierre et Marie Curie, France)
Tapan Mishra (Georgetown University) Post Doctoral Fellow

ICTS CAMPUS: DEVELOPMENT REPORT 05



CAMPUS SITE

An area of 17.35 acres of land has been allotted on a long lease by the state government of Karnataka for setting up of the ICTS campus, in survey no. 151 of Shivakote village, Hessarghatta Hobli, north Bangalore. On our request to the State government, about 14 km of the access road has already been widened.

The compound wall for the campus site has been constructed on three sides (east, west and south). To accommodate the possibility of further broadening of the access main road, the north side will temporarily be covered by a barbed wire fence instead of a concrete wall.

PROJECT MANAGEMENT

The Director TIFR & Centre Director are advised on financial and technical matters pertaining to the design and construction of facilities for ICTS Campus by the ICTS-TIFR Building Committee.

The Directorate of Construction, Services and Estate Management (DCSEM), the construction wing of the Department of Atomic Energy, Government of India has taken up the supervision of the ICTS campus construction. The engineers team manages the pre-project activities from their office in the CAM-TIFR campus at Yelahanka.

MEMBERS OF THE BUILDING COMMITTEE

Mustansir Barma, Director, TIFR (Chair)
Avinash Dhar, TIFR, Mumbai
Mukesh Dodain, ICTS-TIFR (Secretary)
N.S.Gabhane, Director, DCSEM-DAE
H R Krishnamurthy, IISc, Bangalore
Ms. Uma Mahadevan, OSD, TIFR, Mumbai
S. Ramakrishnan, TIFR, Mumbai
Spenta Wadia, Director, ICTS-TIFR
Joint Secretary (R&D), DAE
Joint Secretary (Finance), DAE
Registrar, TIFR, Mumbai

ARCHITECTS

M/s Venkataramanan Associates (Bangalore) was awarded the contract to provide consultancy services for architectural design, interiors and landscaping & developmental works for the academic, programme and residential campus of the International Centre for Theoretical Sciences of TIFR at Bangalore. This agency was recommended by a committee of experts (including Bijoy Jain, Chitra Vishwanath, Sen Kapadia, the Principal, JJ School of Architecture, and the Head Architect, BARC) after evaluating the designs and concepts of a total of 6 competing agencies on 02 December 2010 at TIFR.

The masterplan for the campus has been prepared by the architectural agency after many interactive sessions with ICTS users. Detailed drawings for the individual units are also ready.

Construction agency for the campus:
Efforts are on for the selection of a company for the construction of the ICTS campus buildings. Seven agencies had been shortlisted and were called for tendering in January 2012. The selection will be based on the parameters of quality and cost. The process of awarding the work contract to the selected construction company is expected to be completed by August 2012. We expect the construction work to be completed by mid 2014.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ICTS CAMPUS: MASTER PLAN

01 Main Entrance
02 Security Gate + Waiting
03 Academic Block Entrance
04 Arrival Plaza
05 Reception
06 Lecture Room
07 Library + Data Centre
08 Director's Office
09 Deskspace Faculty / Post Docs / Participants + Lounge
10 Exhibition Walk
11 Outreach
12 Seminar + Auditorium Complex
13 Residential Entry + Security Gate
14 Director's Residence
15 Faculty Housing
16 Housing For Post Docs + Participants
17 Creche
18 Medical Centre
19 Dining + Recreation
20 Amphitheatre
21 Playing Fields
22 Future Expansion
23 Service Entrance
24 Service Roads
25 Parking
26 Facility for Day Workers
27 UG Sump
28 Transformer + DG
29 STP

ICTS CAMPUS: AERIAL VIEW IN 3D

ICTS FACILITY IN IISc, BANGALORE

The ICTS is presently located in the old TIFR Building at the Indian Institute of Science campus, Bangalore and it is being used regularly for academic activities and its programmes.

This facility consists of office space for 20 faculty/academic members, a seminar room with a capacity of 50 people, a secretariat office, a server room and a small pantry.

06

ICTS
INAUGURAL EVENT & FOUNDATION STONE CEREMONY

The ICTS Inaugural event was organized during 27-31 December, 2009 in the campus of IISc, Bangalore. The purpose of this event was to mark the foundation of a Campus at Bangalore for the newly established centre of the TIFR in Bangalore. The event consisted of the following programmes:

Academic programme – talks & panel discussions
Foundation stone ceremony
Out-reach programme – 3 public lectures
Satellite meetings

The academic part of the inaugural event has been described in detail under the section "PROGRAMMES".

On 28th December 2011, the foundation stone of the new Centre, the ICTS of TIFR, was unveiled by Prof. C.N.R. Rao, FRS in the presence of Prof. David Gross, Nobel Laureate, and other distinguished guests, in the J.N. Tata Auditorium, IISc, Bangalore. Due to unforseen circumstances Prof. Michael Atiyah was unable to attend the Foundation Stone Ceremony. His message was read out by Prof. Spenta Wadia.

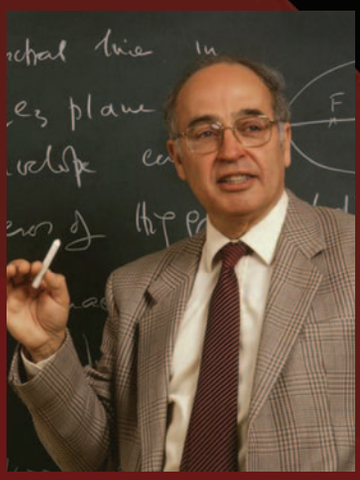
This ceremony was preceded by an invocation by carnatic vocalist Manasi Prasad and was followed by a public lecture, "The Role of Theory in Science" by Prof. David Gross.

A classical music (Hindustani vocal) performance by Shri Jayateerth Mevundi was held on December 29, 2009 at 1830 hrs in the J N Tata Auditorium, Indian Institute of Science, Bangalore.

INAUGURAL EVENT & FOUNDATION STONE CEREMONY


INTERNATIONAL
CENTRE for
THEORETICAL
SCIENCES
science without boundaries


INTERNATIONAL
CENTRE for
THEORETICAL
SCIENCES
science without boundaries



FOUNDATION STONE REMARKS BY MICHAEL ATIYAH

"I very much regret not being with you for the laying of this Foundation Stone for the International Centre for Theoretical Sciences, but I am with you in spirit and send my best wishes for the future success of this important Centre.

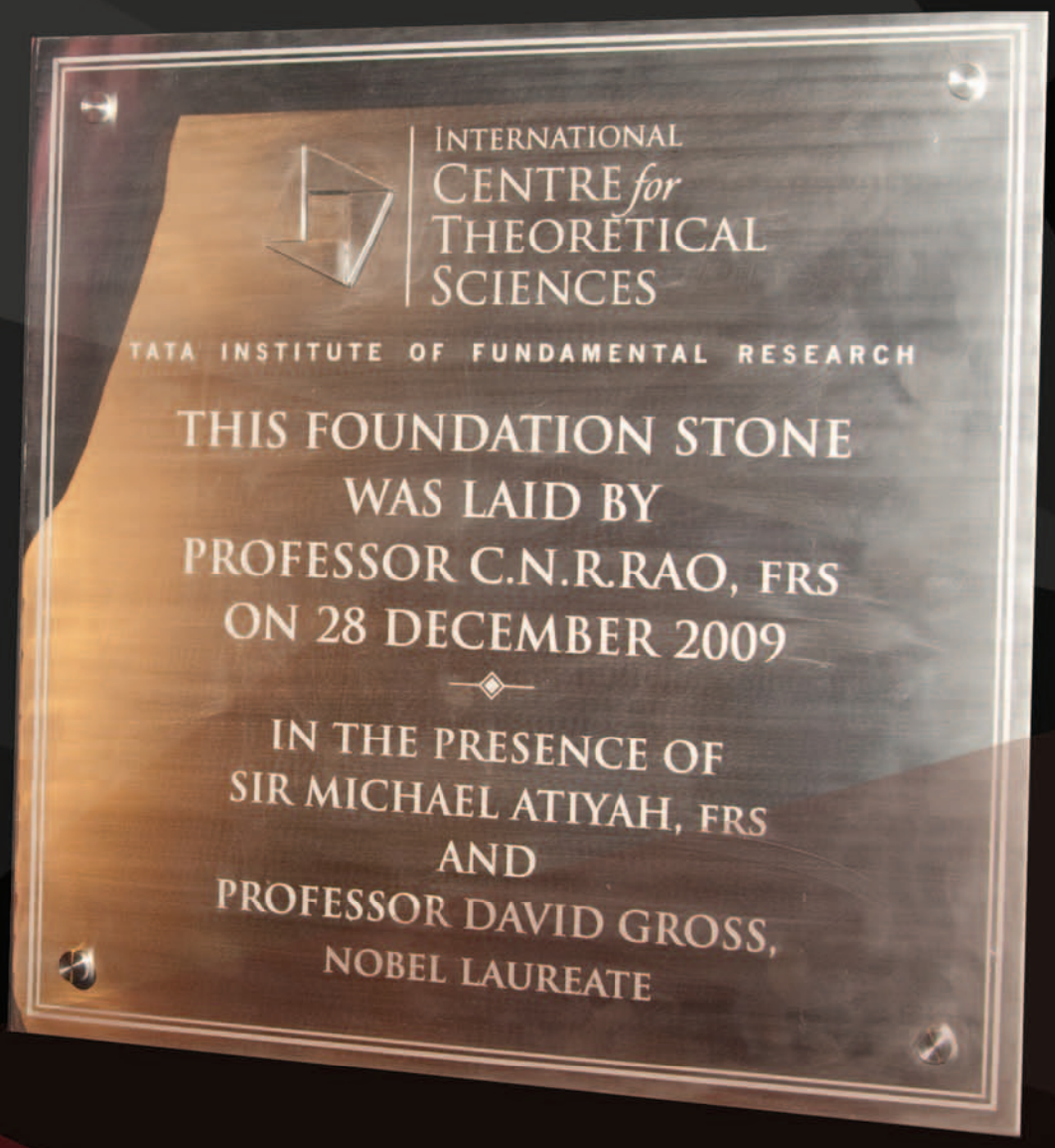
Science that has the noble aim of trying to understand the natural world in human terms: to make sense of what we see. This brief phrase encapsulates both theory and experiment. What we see, in the broad sense, covers experiment and making sense is the task of theory. As the great French mathematician Henri Poincare said, science is no more a collection of facts than a house is a collection of bricks: it requires theory to hold it together.

Theory needs a framework in which to develop and, as a mathematician, I believe that mathematics provide that unifying framework. As Galileo said, the book of nature is written in the language of mathematics. Galileo was thinking primarily of mechanics and astronomy but, increasingly since his time, mathematics has provided the essential underpinning of ever-widening branches of science. As soon as science moves from the qualitative to the quantitative, mathematics becomes indispensable.

Not only does mathematics provide the technical tools that all sciences require but, by its very nature, it acts as a unifying principle, integrating the diverse aspects of nature into an organic whole.

I am sure that mathematics, in all its various aspects, will play an important part in the future activities of this Centre. In the complex modern world with the enormous challenges that we face, from climate change to energy, from poverty to water shortages, science provides the bedrock on which we can build our future. I am sure that this Centre will play its part in guiding both India and the wider world in the years ahead."

Sir Michael Francis Atiyah
University of Edinburgh

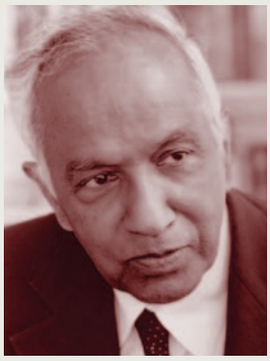

INTERNATIONAL
CENTRE for
THEORETICAL
SCIENCES
TATA INSTITUTE OF FUNDAMENTAL RESEARCH
THIS FOUNDATION STONE
WAS LAID BY
PROFESSOR C.N.R.RAO, FRS
ON 28 DECEMBER 2009
IN THE PRESENCE OF
SIR MICHAEL ATIYAH, FRS
AND
PROFESSOR DAVID GROSS,
NOBEL LAUREATE

ACTIVITY REPORT Oct 2009 - Oct 2012

07

“The methods of theoretical physics should be applicable to all those branches of thought in which the essential features are expressible with numbers.”

- Paul Dirac



SUBRAHMANYAN CHANDRASEKHAR LECTURE SERIES

Black Holes- The Harmonic Oscillators of the 21st Century

Speaker: Andrew Strominger, Harvard University

Date: 4 January, 2010

Venue: TIFR, Mumbai

Abstract

In the twentieth century, many problems across all of physics were solved by perturbative methods which reduced them to harmonic oscillators. Black holes are poised to play a similar role for the problems of twenty-first century physics. They are at once the simplest and most complex objects in the physical world. They are maximally complex in that the number of possible microstates, or entropy, of a black hole is believed to saturate a universal bound. They are maximally simple in that, according to Einstein's theory, they are featureless holes in space characterized only by their mass, charge and angular momentum. This dual relation between simplicity and complexity, as expressed in black holes, has recently been successfully applied to problems in a disparate variety of physical systems. In the first lecture I will give an introduction to the subject intended for a general audience. Subsequent lectures will describe recent developments.

The Standard Model of Cosmology

Speaker: Lyman Page, Princeton University

Date: 6 April, 2010

Venue: TIFR, Mumbai

Abstract

We now have a well established standard model of cosmology that agrees with virtually all cosmological observations regardless of the method or the object under study. The model indicates that the universe today comprises 5% atoms, 23% dark matter and 72% dark energy. The model assumes a geometrically flat universe, but is robust to relaxing this assumption. The model is based on physics of the Universe at 10-35 sec, and makes testable predictions directly linked to physics of that epoch. For example, it predicts that primordial gravitational waves should be traversing the cosmos. In this talk, we review the foundations of the standard model with an emphasis on what we can tell from the cosmic microwave background (CMB) radiation. We discuss the observational forefront and what we hope to learn over the next few years.

What Modern Mathematical Physics should be - A point of view

Speaker: Ludwig Dmitrievich Faddeev, Steklov Mathematical Institute

Date: 23 November, 2010

Venue: TIFR, Mumbai

Abstract

I present my own point of view on the main goal of mathematical physics. It is not the proof of theorems of results known to theoretical physicists. Rather it is the use of the mathematical intuition to deal with problems which arise in physics. This satement is illustrated by several examples from recent developments.

The Quantum Phases of Matter

Speaker: Subir Sachdev, Harvard University

Date: 6 December, 2010

Venue: IISc, Bangalore

Abstract

Quantum mechanics was developed in the early twentieth century to describe the motion of a single electron in a hydrogen atom. Later, Einstein and others pointed out that the quantum theory of a pair of electrons had non-intuitive features which they found unpalatable: two well-separated electrons can have their quantum states "entangled", indicating that they talk to each other quantum mechanically, even though they are far apart. Today, quantum entanglement is not viewed as a subtle microscopic effect of interest only to a few physicists, but as a crucial ingredient necessary for a complete understanding of the many phases of matter. A crystal can have roughly trillion trillion electrons entangled with each other, and the different patterns of entanglement lead to phases which are magnets, metals, or superconductors. I will give a simple discussion of these and other remarkable features of the quantum mechanics of a trillion trillion electrons, and of their importance to a variety of technologically important materials. The theory also has surprising and unexpected connections to string theory: remarkably, this connects the motion of electrons within a plane of a crystal in the laboratory, to the theory of astrophysical black holes similar to those studied by Chandrasekhar.

Applied String Theory

Speaker: Dam Thanh Son, University of Washington

Date: 21 March, 2011

Venue: TIFR, Mumbai

Abstract

Gauge/gravity duality, discovered in string theory in 1997, has became a powerful theoretical tool in the study of quantum field theories at strong coupling. I will review recent attempts to use gauge/gravity duality to understand the physics of strongly interacting media, focusing on the quark gluon plasma and the cold atomic gases. In particular, I will describe how the method has helped the discovery of new effects in relativistic hydrodynamics that arise from triangle anomalies.

Is Direct Numerical Simulation of Turbulence Entering into the High-Precision Era?

Speaker: Uriel Frisch, Laboratoire Lagrange, Observatoire de la Cote d'Azur Universite de Nice- Sophia Antipolis

Date: 12 December, 2011

Venue: IISc, Bangalore

Abstract

Over the last few years, direct numerical simulation (DNS) of turbulence have achieved, in extreme cases, spatial resolutions of 32K squared collocation points in 2D and 4K cubed points in 3D. In the past, it was deemed unnecessary in DNS simulations to exceed double precision (roughly 16 significant decimal places). As higher resolutions become accessible, higher precision may also be required. This is not just because higher resolution increase the number or floating point operations and thus the accumulation of rounding errors. Indeed, recent results by Joris van der Hoeven and others indicate that in order to obtain a reasonable precision on scaling exponents (say, a precision of 3-4 digits) the floating point operations - in particular the FFTs - must be performed in much higher than double precision. This has to do with the presence of subdominant corrections involving small parameters such as the viscosity.

Top Eigenvalue of a Random Matrix: A tale of tails

Speaker: Satya Majumdar, Centre National de la Recherche Scientifique (CNRS)

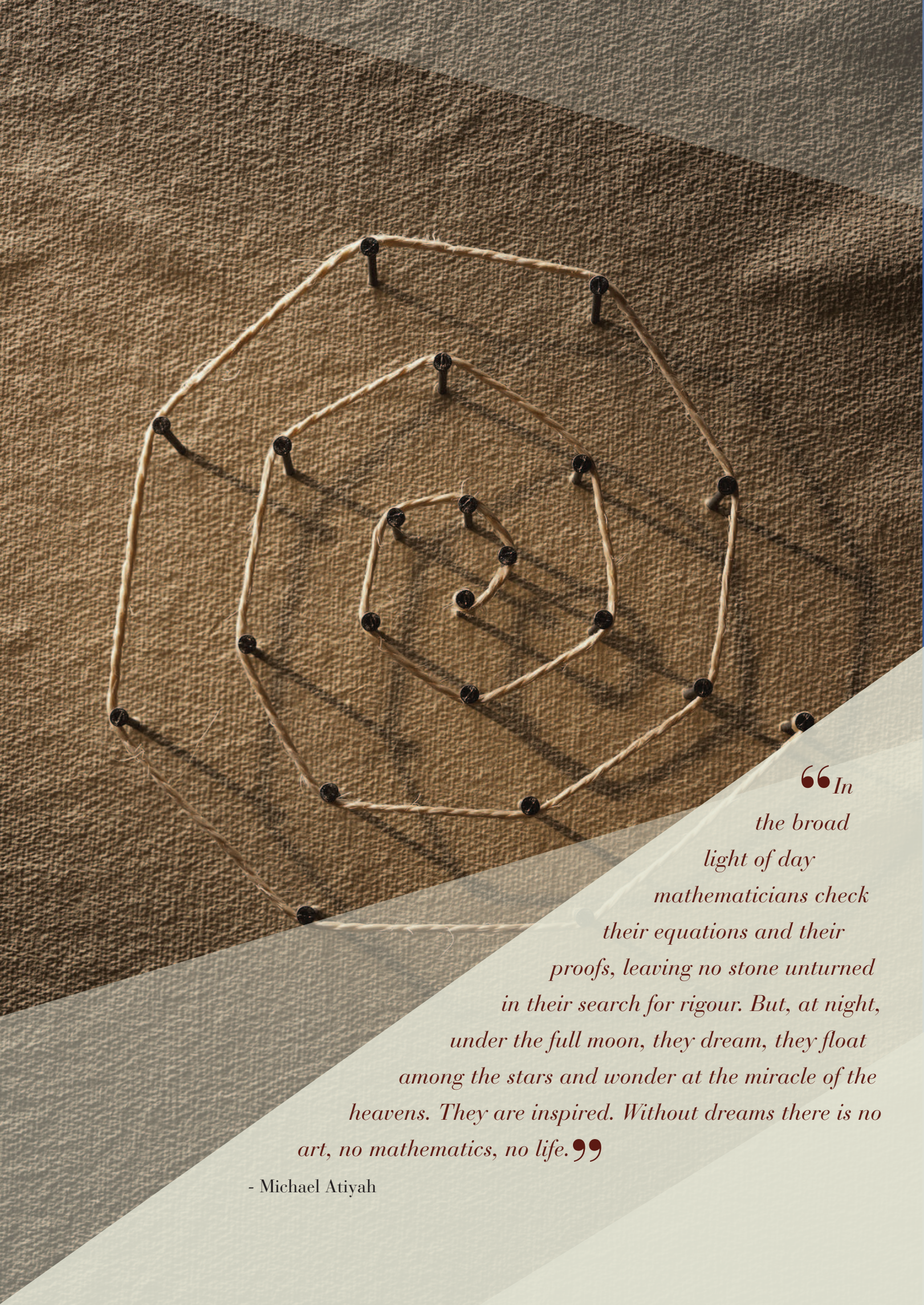
Date: 27 January, 2012

Venue: IISc, Bangalore

Abstract

Random matrices were first introduced by Wishart (1928) in the statistics literature to describe the covariance matrix of large data sets. In physics literature, Wigner introduced random matrices to describe the highly excited energy levels of large complex nuclei. Random matrix theory (RMT) proved to be a very successful approach in nuclear physics. Since then, RMT has gone beyond nuclear physics and has found a wide number of applications in various fields in physics, mathematics, biology and statistics. These include quantum chaos, disordered systems, string theory, number theory just to name a few. The real beauty of RMT is in providing bridges between seemingly different areas of science.

Recently, there has been a renewed interest in RMT concerning the extreme statistics, i.e., the statistical properties of the top (largest) eigenvalue of a random matrix. The celebrated Tracy-Widom limiting law has been found in a large number of unexpected domains and has recently been measured experimentally. In these lectures, I will discuss some of the recent developments with a particular focus on the large deviation tails of the top eigenvalue. We will see how the Coulomb gas method of statistical physics can be successfully used to understand very simply such rare events. In addition, we will see how there is a hidden third order phase transition in this system. Similar third order phase transitions were earlier observed in completely different contexts, namely in the two-dimensional Yang-Mills gauge theory. I will also discuss how this Coulomb gas method can be successfully used in other problems ranging from quantum entanglement in bipartite systems to the celebrated vicious walker problem introduced by de Gennes and Fisher.



“In the broad light of day mathematicians check their equations and their proofs, leaving no stone unturned in their search for rigour. But, at night, under the full moon, they dream, they float among the stars and wonder at the miracle of the heavens. They are inspired. Without dreams there is no art, no mathematics, no life.”

- Michael Atiyah

SRINIVASA RAMANUJAN LECTURE SERIES

The Generalized Ramanujan Conjectures and Applications

Speaker: Peter Sarnak

Date: 21-24 May, 2012

Venue: TIFR, Mumbai

Lecture 1: The Generalized Ramanujan Conjectures

Abstract

In the twentieth century, many problems across all of physics were solved by perturbative methods which reduced them to harmonic oscillators. Black holes are poised to play a similar role for the problems of twenty-first century physics. They are at once the simplest and most complex objects in the

physical world. They are maximally complex in that the number of possible microstates, or entropy, of a black hole is believed to saturate a universal bound. They are maximally simple in that, according to Einstein's theory, they are featureless holes in space characterized only by their mass, charge and angular momentum. This dual relation between simplicity and complexity, as expressed in black holes, has recently been successfully applied to problems in a disparate variety of physical systems. In the first lecture I will give an introduction to the subject intended for a general audience. Subsequent lectures will describe recent developments.

Lecture 2: Thin Groups and Expansion

Abstract

Infinite index subgroups of matrix groups like SL(n,Z) which are Zariski dense in SL(n), arise in many geometric and diophantine problems (eg as reflection groups, groups connected with elementary geometry such as integral apollonian packings, monodromy groups of families of algebraic varieties.). One of the key features needed for number theoretic applications is that these groups obey some form of the Ramanujan Conjectures. In this context this asserts that certain congruence graphs associated with these groups are expanders. We will introduce these ideas and review some of the many recent developments.

Date: 22 May 2012

Lecture 3: Mobius Randomness and Horocycle Dynamics

Abstract

The Mobius function mu(n) is minus one to the number of distinct prime factors of n if n has no square factors and zero otherwise. Understanding the randomness (often referred to as the "Mobius randomness principle") in this function is a fundamental and very difficult problem. We will explain a precise dynamical formulation of the randomness and report on recent advances establishing it. In particular the disjointness of the resulting Mobius Flow from horocycle flows and related horocycle dynamics at "prime times".

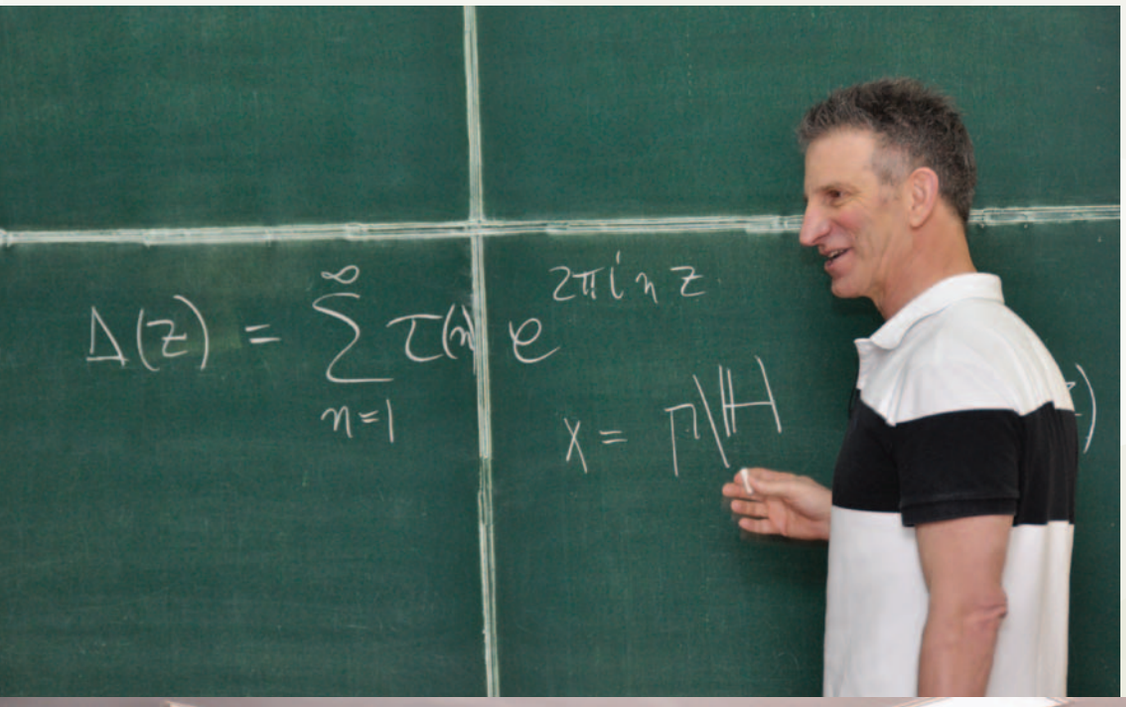
Date: 23 May 2012

Lecture 4: "Nodal lines of Maass Forms and Critical Percolation"

Abstract

We describe some results concerning the number of connected components of nodal lines of high frequency Maass forms on the modular surface. Based on heuristics connecting these to an exactly solvable critical percolation model, Bogomolny and Schmit have conjectured, and numerics confirm, that this number follows an asymptotic law. While proving this appears to be very difficult, some approximations to it can be proved by developing number theoretic and analytic methods (Joint with A. Ghosh and A. Reznikov).

Date: 24 May 2012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n=1
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PUBLIC LECTURES

2009

The P versus NP problem - Efficient Computation and the Limits of Human Knowledge

27 December

Speaker: Avi Widgerson, Institute of Advanced Studies, Princeton

Venue: J.N. Tata Auditorium, Indian Institute of Science, Bangalore

Abstract

The P vs. NP problem is a central outstanding problem of computer science and mathematics. In this talk, I attempt to describe its technical, scientific and philosophical content, its status and the implications of its two possible resolutions.

The Role of Theory in Science

28 December

Speaker: David Gross, KITP, Santa Barbara

Venue: J.N. Tata Auditorium, Indian Institute of Science, Bangalore

Abstract

On the occasion of the inauguration of the International Centre for Theoretical Sciences, TIFR, I shall share some of my observations and conclusions as to the various roles of theory in science. Physics is the field of science where theory is most established and it is the most mature and powerful of the sciences. But theory, much of it derived from physics, is growing in importance in the neighboring fields of astronomy, chemistry and biology. Theory can both deepen our understanding of separate areas of science, as well as provide the intellectual glue of interdisciplinary research.

The Origin of Life – From Geophysics to Biology

30 December

Speaker: Albert Libchaber, The Rockefeller University, NY

Venue: J.N. Tata Auditorium, Indian Institute of Science, Bangalore

Abstract

One of the deepest and most controversial questions of our time is that of the origin of life. In this public lecture a hypothesis is presented, according to which the temperature gradients existing in the earth - which led to plate tectonics and the formation of undersea thermal vents - also led to the evolution of life around these vents. Movies will be shown of experiments, in which all stages of this scenario are justified: how thermal gradients led to plate tectonics, to DNA amplification in thermal vents, to polymerisation of peptides at high pressure and to the organization of bacteria. This mixture of physics, chemistry, and biology illustrates how life can originate without the intervention of the sun, driven only by geophysical thermal gradients.

2010

Time, Einstein and the Coolest Stuff in the Universe

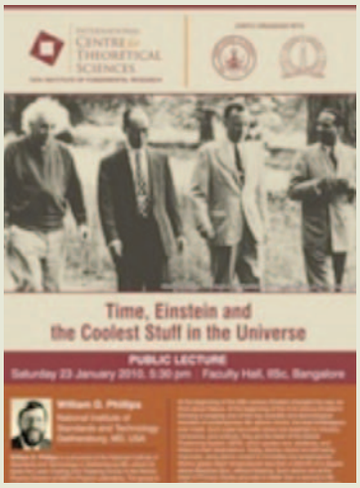
23 January

Speaker: William D. Phillips, National Institute of Standards and Technology, Gaithersburg, MD, USA

Venue: Faculty Hall, Indian Institute of Science, Bangalore

Abstract

At the beginning of the 20th century Einstein changed the way we think about Nature. At the beginning of the 21st century, Einstein's thinking is shaping one of the key scientific and technological wonders of contemporary life: atomic clocks, the best time keepersever made. Such super-accurate clocks are essential to industry, commerce, and science. They are the heart of the Global Positioning System (GPS), which guides cars, airplanes and hikers to their destinations. Today, atomic clocks are still being improved using atoms cooled to incredibly low temperatures. Atomic gases reach temperatures less than a billionth of a degree above Absolute Zero without freezing. Such atoms are at the heart of Primary Clocks accurate to better than a second in 80 million years as well as both using and testing some of Einstein's strangest predictions. This will be a lively, multimedia presentation, including experimental demonstrations and down-to-earth explanations about some of today's most exciting science.



2011

How long is 1 Metre ? From ancient length units to modern concepts in metrology

4 July

Speaker: Klaus von Klitzing, Max Planck Institute for Solid State Research, Stuttgart

Venue: J.N. Tata Auditorium, Indian Institute of Science, Bangalore

Abstract

Length measurements are as old as humanity itself. Together with time and mass measurements, they have had a profound influence on all aspects of our lives, including trade, science and industrial developments. The presentation gives a survey of the development of these units, starting with a historical overview and concluding with the most recent developments where fundamental constants form the basis for units independent of space and time. In a surprising twist, the quantum Hall effect, which essentially represents a new type of electrical resistance, plays a crucial role for these modern aspects, and it may even be important for a new definition of kilogramme, the unit of mass.

Scientific, Moral and Ethical Battles in the Making of a Nuclear World

26 September

Speaker: Istvan Hargittai, Budapest University of Technology and Economics & Hungarian Academy of Sciences

Venue: Homi Bhabha Auditorium, TIFR, Mumbai

Abstract

Historical circumstances brought together an extraordinary group of scientists during the first half of the twentieth century that included the aerodynamicist Theodore von Kármán, the physicists Leo Szilard, Eugene P. Wigner, and Edward Teller, and the mathematician John von Neumann. These Jewish-Hungarians first left Hungary for Germany, then were forced out of Europe, and in the United States they became instrumental in the defense of the Free World during World War II and the Cold War. In addition to their extraordinary achievements in basic science, they significantly contributed to the creation of stored-programmed computers, nuclear engineering, nuclear weapons and the creation of the modern American air force. The lessons of their lives and oeuvres will be discussed with emphasis on the most controversial one, Edward Teller, also known as “The Father of the Hydrogen Bomb”.

The Universe Unravelled – Cosmology, Gravitation and Elementary Particles

13 December

Speaker: Kip S. Thorne, P. James Peebles, J. Richard Bond and John Ellis

Venue: Homi Bhabha Auditorium, TIFR, Mumbai

Abstract

What are we? Where do we come from? Where are we going? In the language of physics, these become: What is the structure of matter? How did the Universe evolve? How will it evolve in the future? John Wheeler's famous mantra, IT from BIT, envisaged the Universe as an information structure of BITs. And, of course, so IT is, fundamentally quantum and statistical, the many paths/ many-worlds story with our Universe expanding from an initial hot dense state. This idea of an expanding Universe grew out of observations of the motions of the galaxies around us and a series of discoveries turned the idea of expansion into a convincingly demonstrated aspect of reality. A notable piece of the evidence of this hot big bang is the fossil thermal radiation left from the past. There is an intimate entanglement of theory with precision 'first-light' and other cosmic data. Examination of the properties of this radiation and of the galaxies and the nature of space-time around them, shows that the expansion is well described by Einstein's theory of gravity, general relativity. This theory tells us that there is a warped side to our Universe: objects and phenomena, that are made from warped space and warped time. Three examples are black holes, the big-bang in which our Universe was born and ripples in the fabric of spacetime called gravitational waves.

In this public event, the four eminent speakers will unravel the fascinating story of our Universe and broaden the enquiry into the vast sweep of ideas about the nature of our Universe.

Solving Cubic Equations

6 January

Speaker: Benedict Gross, George Vasmer Leverett Professor of Mathematics, Harvard University

Venue: TIFR, Mumbai

Abstract

I will discuss a problem which has been central in number theory for several centuries – whether a cubic equation in the plane has infinitely many rational solutions.This led to a precise conjecture by Birch and Swinnerton-Dyer in the 1960s, and to some partial progress in the 1980s. More recently, Manjul Bhargava has introduced a new method to study the average number of solutions. I will give some idea of the historical development of this subject, and will try to illustrate the excitement of working in this field.

Structure and Randomness in the Prime Numbers

23 February

Speaker: Terence Tao, UCLA

Venue: TIFR, Mumbai

Abstract

"God may not play dice with the universe, but something strange is going on with the prime numbers"
- Paul Erdos.
The prime numbers are a fascinating blend of both structure (for instance, almost all primes are odd) and randomness. It is widely believed that beyond the "obvious" structures in the primes, the primes otherwise behave as if they were distributed randomly; this "pseudorandomness" then underlies our belief in many unsolved conjectures about the primes, from the twin prime conjecture to the Riemann hypothesis. This pseudorandomness has been frustratingly elusive to actually prove rigorously, but recently there has been progress in capturing enough of this pseudorandomness to establish new results about the primes, such as the fact that they contain arbitrarily long progressions. We surveyed some of these developments in this talk.

When Mathematicians use Geometry to Cut Cloth - A Tale from the 18th to the 21st Century

13 April

Speaker: Etienne Ghys, Ecole Normale Superieure, Lyon, France

Venue: Homi Bhabha Auditorium, TIFR, Mumbai

Abstract

Some interesting questions about surfaces have been studied mathematically for centuries. For example, in 1772 Euler characterised the surfaces that can be covered with paper, allowing bending but not stretching, cutting or wrinkling. For cloth in place of paper, it would be a different question, as cloth is more flexible, and that was answered by Chebyshev in 1878.

In this talk we shall see how a ball can be clothed. The modern developments and unsolved problems on the theme will be discussed, through a blend of theory, applications, and pictures.

The Ramanujan Conjecture and some diophantine equations

18 May & 25 May

Speaker: Peter Sarnak, Princeton University & Institute of Advanced Study, Princeton

Venue: TIFR, Mumbai (18 May), IISc, Bangalore (25 May)

Abstract

One of Ramanujan's most influential conjectures concerns the magnitude of the Fourier Coefficients of a modular form. These were made on the basis of his calculations as well as a far-reaching insight as to their usefulness in the study of some diophantine problems. Today his original Conjecture is a Theorem and its generalizations constitute one of the central unsolved problems in number theory. We will review some of these basic developments and highlight some recent far reaching applications of his remarkable insights.

“If we do discover a complete theory, it should be in time understandable in broad principle by everyone. Then we shall all, philosophers, scientists, and just ordinary people be able to take part in the discussion of why we and the universe exist.”

- Stephen Hawking

NEW INITIATIVES

1) ICTS Srinivasa Ramanujan Lecture Series

The Srinivasa Ramanujan lecture series is a new initiative of ICTS. In this series eminent mathematicians and scientists are invited to deliver lectures on important developments in their area.

Prof. Peter Sarnak of the Institute for Advanced Studies, Princeton, delivered the first series of Srinivasa Ramanujan lectures during 21-24 May 2012.

2) ICTS Alan Turing Lecture Series

The Alan Turing Lecture Series is a new initiative of ICTS. In this series eminent Biologists, Computer Scientists and Engineers would be invited to deliver lectures on significant developments in their areas.

3) Maths for Planet Earth 2013 - A public outreach initiative

In connection with Mathematics of the Planet Earth 2013 (MPE-2013), a global initiative, ICTS has invited the Indian scientific community, possibly in collaboration with researchers around the world, to propose workshops, thematic programmes and conferences on topics that are aligned with the MPE initiative.

ICTS has received enthusiastic response to the call for pre-proposals. Four proposals are under active development:
i. Mathematics of tropical meteorology and data assimilation
ii. Mathematical modeling of remote sensing
iii. Design and development of advanced dynamical cores for Atmospheric and Oceanic circulation modeling
iv. A programme at the interface of fluid dynamics and atmospheric/ocean dynamics.

In addition, several meetings have been held in order to discuss possible outreach activities associated with MPE-2013. We are planning various activities, including a series of public lectures, workshops, and publications of articles to popularize the applications of mathematics to planetary issues.

4) BIxLight - Indian Open Lightpath Exchange Facility at Bangalore for Global Scientific Cooperation

The BIxLight project is a collaborative effort to build advanced networking and other technology infrastructure for the data intensive sciences. It is built around a donation of two high-speed (1Gbps each) links to the US via Singapore and Amsterdam respectively, for a period of one year, by Tata Communications. These links will help connect Indian researchers, engaged in research in the data intensive sciences, to the GLORIAD (Global Optical Ring Network for Advanced Applications Development) network. With GLORIAD, the scientific community can move unprecedented volumes of valuable data effortlessly, have access to cutting edge tools and technologies being developed for large data research and be connected at high-speeds to researchers in Asia, Europe and the United States.

The BIxLight project envisages the creation of an open exchange facility which is modeled after the US NSF-funded StarLight facility in Chicago. Starlight is operational since 1997 and is today the largest science exchange in the world. The effort is being led by ICTS - TIFR and is a first of its kind effort in the country to create shared technology infrastructure through a bottom-up approach.

The international links of the BIxLight exchange facility are expected to be inaugurated in May-June 2012. The exchange is presently being hosted by TIFR-CAM (Centre for Applicable Mathematics) which has paid for a local loop connection, also at 1 Gbps, from CAM to the exchange at Tata Communications. In time we expect to connect several other institutions in Bangalore that are engaged in research in the data intensive sciences. BIxLight is expected to supplement, and cross-connect with, other science infrastructure efforts in India such as the National Knowledge Network (NKN) and ERnet.

COMPLETED PROGRAMMES

PROGRAMME	**ICTS CONDENSED MATTER PROGRAMME 2009**
DATE	05 – 23 December 2009
ORGANIZERS	Kedar Damle, H.R. Krishnamurthy, R. Shankar, Vikram Tripathi
VENUE	Fountain Hotel, Mahabaleshwar

PURPOSE

This programme was aimed at bringing together researchers working in the different sub-areas of condensed matter physics, statistical physics, both from India and abroad. A wide range of topics related to current research in cold atoms, frustrated magnetism, granular metals, graphene, thermal transport and variational wave-functions in strongly correlated systems, unconventional phases and transitions and computational methods were covered during the workshop. This programme initiated a new series which was intended to provide a platform for the condensed matter physicists' community to interact and discuss ideas.

STRUCTURE

This activity, the third in a series that started in November 2007, the first in Goa (November 2007) and the second in Mahabaleshwar (December 2008). The programme consisting of pedagogical school, which was split into two seven day sessions – one running from December 6 to December 12, and the other from December 16 to December 22 – by several experts for introducing the research topics to an audience of students, postdocs and non-experts, as well as more technical seminars covering recent work. The intervening three days (December 13-15) were devoted to a conference on topics related to the themes of the school.

SPEAKERS AND TITLES OF TALKS LECTURERS IN THE SCHOOL

Subroto Mukerjee	Thermal Transport
Anders Sandvik	Computational Methods
David Logan	Kondo Physics Multilevel Quantum Dots

“If my view is correct, the universe may have a kind of domain structure. In one part of the universe you may have one preferred direction of the axis; in another part, the direction of the axis may be different.”

- Yoichiro Nambu

Philippe Mendels	Kagome Spin Liquids: The Case of Herbertsmithite
Anders Sandvik	Computational Methods
Leon Balents	Frustrated Magnets and Multiferroics
M. Mambrini	Frustrated Heisenberg Quantum Antiferromagnets to Quantitative Generalized Quantum Dimer Models
E. Altman & A. Polkovnikov	Cold Atoms
Sylvain Capponi	Entanglement and Fidelity of Quantum Spin Systems: A Valence Bond Approach
Ribhu Kaul	Interplay of Geometric Frustration and Criticality in Columbite
Amit Dutta	Quantum Quench Dynamics
Andreas Lauchli	Entanglement Spectra of Fractional Quantum Hall States
A.M.M. Pruisken	Macroscopic Charge Quantization in Single Electron Devices
Medhi Amal	Superconductivity in Bilayer t-J Model: A VMC Study
Zakir Hossain	Interplay between Superconductivity and Magnetism
Amnon Aharony	Writing and Reading Information on Mobile Qubits
Nandini Trivedi	Bosons and Fermions in Optical Lattices
S. Vidhyadhiraja	Interplay of Magnetic Field and Strong Correlations in Heavy Fermion Materials
Krishnendu Sengupta	Junctions of Dirac Liquids
Subir Sachdev	Quantum Phase Transitions
Mikhail Feigelman	Granular Metals and Superconductors
Leonid Levitov	Graphene
V. Shenoy & A. Paramekanti	Variational Monte Carlo
Efrat Shimshoni	Large Thermo magnetic Effects in Quasi One-Dimensional Spin System
Joel Moore	Topological Insulators and Superfluids
Peter Holdsworth	Magnetic Monopoles in Spin Ice
Kirill Shtengel	Nonabelian Anyons and Quasiparticle Interferometry: An Introduction
Roderich Moessner	Disorder in Kitaev's Honeycomb Model
Fabrice Bert	Kagome Antiferromagnet with Easy Axis Anisotropy
Shivaji Sondhi	Magnetic Monopoles in Spin Ice: The Fine Print Statistical Mechanics and Quantum Computation
Arindam Ghosh	Some Recent Experiments on Spontaneous Spin Effects Semiconductors
Satyajit Banerjee	Strange Magnetic Properties of Ferromagnetic Nanowires
Gil Refael	Vortex Drag in Superconducting Thin-Film Bilayers
Kamran Behnia	Nernst Effect across the Quantum Limit
Ramesh Pai	Mott-Insulator and Superfluid Shells in the Bose - Hubbard Model
Sudhanshu Mandal	Neutral Collective Excitations in Fractional Quantum Hall Effect
Pratap Raychaudhuri	Experimental Investigations of Disordered s-Wave Superconductors – NbN
K.J. Thomas	Interaction Effects in Weakly Confined Quatum Wires
Saurabh Basu	Imbalanced Fermi Systems in a Harmonic Trap
Sujit Sarkar, Kalobaran Maiti, Ora Entin-Wohlman, C. V. Tomy, Sankalpa Ghosh, Kliment Kugel, Boris Aronzon, Indra Dasgupta & Chiranjib Mitra	Superconducting Quantum Dots

CONFERENCE SPEAKERS

Utpal Chatterjee	Universal d-Wave Gap in the Entire Doping Range of Cuprate High Temperature Superconductors
T. Saha-Dasgupta	First Principles Study of Double Perovskites
Sudhakar Yarlaggada	Ordering in Undoped Manganites via a Generalised Peierls Instability
P. Paulose	Magnetism and Superconductivity in FeT(1-x)Se(x)
Mukul Laad	Superconductivity in the Iron Age: The Curious Iron Pnictides
B.Sriram Shastry	Extremely Correlated Quantum Liquids
Subhasis Sinha	Ultracold Dipolar Atoms in an Optical Lattice
Vijayaraghavan Rajamani	Dispersive SQUID Magnetometry for Molecular Magnets
E. V. Sampathkumaran	Novel Magnetic, Transport and Field-Induced Features in Some Local Moment Systems
Brijesh Kumar	Emergent Radiation in an Atom-Photon System
Vidya Madhavan	STM Spectroscopy on Cuprates and Pnictides
Raymond Bishop	Quantum Phase Transitions in Strongly Correlated and Highly Frustrated Spin-Lattice Systems: An ab-initio Quantum Many Body Theory Formulation
Didier Poilblanc	Generalised Quantum Dimer Model for Frustrated Magnets
Fiona Burnell	Topological lattice models: surgical connections to the continuum
Yigal Meir	Theory of the Quantum Hall Insulator
Yuval Oreg	Magnetic impurities on the edge of topological insulators
Ravindra Bhatt	Importance of Rare Fluctuations in Quantum Condensed Matter Systems
Priya Mahadevan	Spin Reorientation Transitions in NiO: Role of Coulomb Interactions
S. Bandyopadhyay	Entanglement Inequalities in Spin-1/2 Particles
Sushanta Dattagupta	Dissipative Quantum Systems and the Heat Capacity Enigma

PARTICIPANTS

42 from India
12 from abroad

PROGRAMME	**SCHOOL AND CONFERENCE ON MULTISCALE MODELING AND SIMULATIONS OF HARD AND SOFT MATERIALS**
DATE	07 – 20 December 2009
ORGANIZERS	P B Sunil Kumar, Srikanth Sastry and Umesh V Waghmare
VENUE	Centre for Computational Materials Science (CCMS), JNCASR, Bangalore

PURPOSE

Phenomena in many systems of interest in materials science, soft condensed matter physics and biology require analysis of processes that span a wide range of time and length scales, from atomic

level details of bonding and corresponding dynamics to the emergence of morphologies of interest on mesoscopic scales, occurring on times scales of seconds, hours and beyond. Computational modelling of such phenomena has always been a challenge. Separate models for different scales, for example, from models that focus on an atomic level description to those that treat the system at a gross macroscopic level, have been around for some time now. However, models that systematically coarse grain the description or models that incorporate the treatment of different scales into one description are just beginning to emerge. Development of a multi-scale modeling strategy and methods would expand the range of applications of first principles methodology to phenomena which involve much longer time and length-scales. Progress in such modeling is aimed at linking of atomic level models and calculations to larger scale computations such as the simulation of devices or a biological cell. It is thus timely and appropriate to bring together people working on the development of multi-scale simulation methods in soft and hard materials, and use the exchange of ideas and tricks of the trade to facilitate development of more robust approaches to multi-scale simulations across these disciplines.

STRUCTURE

This programme had a school for ten days, followed by a four day conference. Content of the school was divided into roughly four parts, with pedagogical level lectures and tutorial sessions on (a) General strategies and formalism for coarse graining, (b) Hybrid Quantum-Classical modeling, (c) Coarse grained modeling of soft and bio-molecular systems and (d) Multiscale modeling of solids and surface phenomena (including phenomena such as catalysis). Two lectures each of 90 minutes duration were planned per day during the morning session.

There were hands-on sessions and discussions in the afternoons. The school was followed by a four day conference at which active researchers in multi-scale modeling from around the world presented state of the art approaches and results in this area.

TARGET AUDIENCE

Audience for the school were Ph.D. students, typically beyond 2 years of Ph.D. study, with graduate level training in computation, engaged in computational research. The conference is aimed at all researchers engaged in computational modeling in material science and biology; including physicists, chemists, biologists and engineers.

SPEAKERS AND TITLES OF TALKS LECTURERS IN THE SCHOOL

P. B. Sunil Kumar	Introductory lecture
Carlo Pierleoni	General Strategies for coarse graining in soft-materials; Coupled Electron- Ion Monte Carlo Simulation of High Pressure Hydrogen
Shekhar Garde	General Strategies for coarse-graining in soft materials.
Amalendu Chandra	Hybrid quantum-classical simulations: An introduction to the QM/MM method
Marcus Elstner	Multi-scale modeling approaches to understand biological structure and function
Sankara Subramanian	Application of the finite element method to problems in solid mechanics
M.P. Gururajan	Phase Field modeling of microstructure in solids
Michael Falk	Multiscale Modeling of the Mechanical Response of Solids
Prabal Maiti	Implicit solvent models
Teresa Head-Gordon	Coarse-grained biomolecular simulations
Siewert J. Marrink	Multi-scale approaches to bio-molecular simulations: Development of the coarse- grained Martini model, and embellishing coarse grained models with atomic detail.
Luca Monticelli	The Martini coarse-grained force field proteins

Luigi Delle Site	Adaptive Coarse-graining
Peter Bolhuis	Long time scale simulations and reaction coordinates of protein conformational change.

CONFERENCE SPEAKERS

Masao Doi	Challenges in Multi Scale Modeling- Our Experience in the Polymer Modeling Project
Yuichi Masubuchi	Multi-scale simulations with primitive chain network model for entangled polymers
C. Pierlioni	Course-grained model for di-block copolymers in solutions
Shekhar Garde	Water at the nanoscale: From density fluctuations and correlations to hydrophobicity
Giuseppe Foffi	Attraction for clarity: colloidal characterization and thermodynamic stability of mixtures of eye-lens proteins
Apratim Chatterji	Dynamics of Ultra soft colloids under shear
Ronojoy Adhikari	Multiscale simulation of suspensions out of equilibrium
Arthur Voter	Accelerated Molecular Dynamics Methods
Michael Falk	Stitching Time: Accelerating simulations of mass transport and friction
Swapan K. Ghosh	Modeling Hard and Soft Materials through Density Functional Theory at Different Length Scales
Rajiv Kalia	Hybrid petascale simulations of deformation, flow and fracture involving multimillion atoms over microsecond time scales.
Priya Vasishta	Multimillion Atom Simulations of Reactive Nanosystems
Amalendu Chandra	Hydration structure and transport kinetics of protonic defects in water-filled narrow hydrophobic pores: Role of hydrogen bond fluctuations
Dhananjay Bhattacharyya	Structure, Stability and Dynamics of Different Canonical and Noncanon-ical Base Pairs: Quantum Chemical and Molecular Mechanical Calculations
Nisanth Nair	Magnetic Exchange and Magneto-structural Dynamics in Ferrodoxins
Luigi Delle Site	Scales' interplay in Molecular Liquids: Local vs. Global
Subir K Das	Kinetics of Phase Separation in Binary Mixtures: From lattice to continuum
Ganapathy Ayappa	Studies on the Bilayer Gel to Liquid Crystalline Transition: Influence of Polymer Grafting and Composition
Ravi Radhakrishnan	Mesoscale Modeling of Cell Membrane-Mediated Trafficking
Mohamed Laradji	Meso-scale modeling of multi-component membranes
H. Eugene Stanley	Coupled Computer Simulations and Experiments of Relevance to Alzheimer Disease
Sergey Buldyrev	Application of Discrete Molecular Dynamics to coarse-grained modeling of biomolecules
Peter Bolhuis	Coarse graining of self-assembling fiber forming proteins
Brigita Urbanc	Discrete molecular dynamics simulations of amyloid -proteinassembly
Satyavani Vemparala	Aggregation of antimicrobial polymers: a coarse grain study
Sanjoy Bandyopadhyay	Bio-molecular Hydration: A Perspective from Molecular Simulation
Sanjib Senapati	Relating Nucleotide-dependent Conformational Changes in Free Tubulin Dimer to Microtubule Dynamic Instability
B. Jayaram	Biomolecular recognition
N. Gautham	Exploring Conformational Space Using the MOLS Technique
S-J Marrink	Proteins Moving Lipids and Lipids Moving Proteins
Prabal Maiti	Elasticity at nanoscale: DNA under tension

PARTICIPANTS

97 from India
6 from abroad

FOUNDATION STONE CEREMONY OF ICTS

PROGRAMME	**ICTS INAUGURAL EVENT – SCIENCE WITHOUT BOUNDARIES**
DATE	27 – 31 December 2009
ORGANIZERS	Vivek Borkar, S.G. Dani, A. Dhar, H.R. Krishnamurthy, K. VijayRaghavan, Spenta R. Wadia
VENUE	Indian Institute of Science, Bangalore

PURPOSE

The purpose of this event was to mark the foundation of a Campus at Bangalore for the newly established International Centre for Theoretical Sciences of the TIFR. The academic programme of the event consisted of keynote lectures by leaders in traditional areas of basic sciences as well as in interdisciplinary areas. There were two panel discussions on interdisciplinary research. There were several public lectures by eminent scientists as a part of the ICTS outreach effort.

SPEAKERS AND TITLES OF TALKS

C.N.R Rao	Graphene
Ajay Sood	Nonequilibrium fluctuations in driven soft matter
S.R.S Varadhan	Random walk in a random environment. A survey
J. Radhakrishnan	Some randomness, some memory and some error
Yamuna Krishnan	Wires, Reporters and Information Capsules: Cellular Journalism with DNA
Michael Green	Some dualities of string theory amplitudes
Andrew Strominger	Black Holes: the Harmonic Oscillators of the 21st Century
Upinder Bhalla	Cellular logic, moving molecules and the emergence of identity
Tarun Souradeep	Peering beyond Standard Cosmology with the Cosmic Microwave Background
Chandrashekhar Khare	Modular forms and Galois Theory
Ashoke Sen	Black Holes & String theory
Sandip Trivedi	Accelerating Universes and the Emerging Landscape in String Theory
Raman Sundaram	Spacetime structure and the Large Hadron Collider
Amol Dighe	Spectrum and Arithmetics
K. Sandeep	Concentration phenomenon in semilinear elliptic problems
Sriram Shastry	Extremely Correlated Quantum Liquids; Coping with Projected Electrons
Ashwin Vishwanath	Beyond Landau : Deconfinement & Topology in Quantum Solids
Siva Athreya	Survival of the contact process on the Hierarchical group
C. S. Rajan	Spectrum and Arithmetics
Manjul Bhargava	Counting problems in number theory
T.V.Ramakrishnan	Concluding Remarks

PUBLIC LECTURES

Avi Wigderson	The P versus NP problem: Efficient computation and the limits of human knowledge
David Gross	The Role of Theory in Science
Albert Libchaber	The Origin of Life: from Geophysics to Biology?

PANEL DISCUSSIONS

I. Physics and Consilience

Panelists:
Édouard Brézin (Chair)
Naama Barkai
Albert Libchaber
Govindan Rangarajan
Avichai Wigderson

Topics of discussion:

The number of interfaces between physics and other branches of knowledge has grown considerably over the past years. In keeping with Galileo's prophecy, "Nature is a book written in the language of mathematics", the interpenetration of physics with biology is now more and more evident, and many new areas such as neural networks, algorithmic complexity, econophysics, sociophysics, have appeared recently. In the round table, the four speakers illustrated this in the areas of life sciences, mathematics, theory of computation and complexity. The speakers commented on a few questions such as
- is physics for biology and biologists more than additional tools such as imaging?
- when physicists deal with "living matter" do they bring a different perspective?
- what are the important achievements in the physics/biology interface?
- what are the main problems in which this cross-disciplinary science is important?
- how fertile is the interface between statistical physics, quantum physics and computation?
- what are the new areas in which mathematics and physics travel side by side?

II. Interdisciplinary Science by way of some examples

Panelists:
K. R. Sreenivasan (Chair)
Sriram Ramaswamy
Subir Sachdev
Eitan Tadmor
Mukund Thattai

Topics of discussion:

The panel consisted of a biologist (MT), two condensed matter theorists (SS and SR), a mathematician (ET) and a fluid dynamicist (KRS). The discussion was "theory heavy" and oriented more towards physical and mathematical sciences.

The term "interdisciplinary" means that a researcher crosses boundaries across established disciplines to create her own approach that is best suited to the problem on hand. The panel intended to illustrate the richness of interdisciplinarity via examples within its own experience, rather than speak about it generally.

K.R.Sreenivasan introduced the panel and briefly described his recent work on quantum turbulence, which combines the curious properties of superfluidity ("flow without friction") and classical turbulence in hydrodynamic systems.

Ramaswamy discussed the richness of interactions between physics and biology from the point of view of his recent work on soft matter far from equilibrium. He discussed mainly the features of active biological matter, and briefed on sedimentation and glassy materials---all of which have common elements whose understanding enriches these subjects.

Sachdev focussed on the recent cross-fertilization between condensed matter physics and string theory. The quantum theory of gravity near black holes has turned out to have remarkable connections to problems in many body physics, and analogs of quantum critical points, superconductors, and non-Fermi liquids have been found. This connection has led to new insights in both fields. He discussed the promise for the future, as well as some of the pitfalls.

Tadmor discussed the recent developments of analytical theories and their interplay with computational algorithms for models which involve separation, decomposition and averaging of scales. He demonstrated the synergy of different points of view from different fields through examples of his recent work on shock waves, kinetic transport, biological flows and image processing.

Thattai described the recent developments in the field of synthetic biology, which borrows ideas from engineering to construct genetic networks from standardized parts. Over the past few years, researchers around the world have built amplifiers, flip-flops, and even oscillators using a handful of genes inserted into the bacterium E.coli. He reviewed these systems, and presented his recent work on using engineering principles to build cell-to-cell communication systems.

CONFERENCE PARTICIPANTS

166 from India
8 from abroad

ICTS INAUGURAL EVENT SATELLITE MEETINGS

PROGRAMME	**NEW DIRECTIONS IN APPLIED MATHEMATICS**
DATE	01 - 03 January, 2010
ORGANIZERS	V. Borkar, P. N. Srikanth and G. Rangarajan
VENUE	Indian Institute of Science, Bangalore

PURPOSE

The Workshop on New Directions in Applied Mathematics focused on highlighting some novel themes in applied mathematics that have dominated the applied mathematics landscape in recent years and are only beginning to take roots in the Indian mathematical community. Unlike the classical strands of applied mathematics that were dominated by continuum mechanics, numerical o.d.e. and p.d.e., etc., the newer developments have been spurred by recent developments in natural sciences, notably statistical mechanics and chemical dynamics, unique computational problems introduced by very large data sets, as well as problems arising from engineering disciplines of communications and computer science that are defining the tenor of the future through revolutions such as the internet. These have not only thrown open new issues, but whole new paradigms, spawning entirely new subject areas. To mention a few, complex systems, random graphs, analysis in very large dimensional spaces, and so on. The Workshop brought together some of the leading researchers in these frontiers to give a bird's eye view of their respective specialties and a roadmap for the future. It was hoped that this will spur some young Indian applied mathematicians to venture into such uncharted territories that have a lot of intellectual adventures to offer.

It was felt that many of the exciting new developments in this broad category have not taken root in India. One such being, the emerging 'Network Sciences' that draws upon random graph theory to model and analyze networks traffic modelling, and so on. There are many new challenges due to the data explosion in many domains calling for novel techniques for analyzing large data sets. Even in the traditional areas of dynamic systems partial differential equations and computational Mathematics, there is a feverish activity caused by new developments in other sciences.

With this in mind, it was decided to invite select representatives of the various research communities mentioned above, mostly the younger ones who are at the forefront of the revolution and have them give overview talks with a view to bring to light the Indian Research Community to these ideas. Since the intention was to spur research in India in these newer areas, a careful selection of the audience was made from students and young researchers across the country.

SPEAKERS AND TITLES OF TALKS

Srinivas Varadhan	Large Deviations. A survey
Kavita Ramanan	Measure-valued processes and stochastic networks
Probal Chaudhuri	Multiscale Approach in Supervised Statistical Learning
George Gonthier	Beyond the four-colour theorem: software engineering for mathematics
Piotr Indyk	Sparse Recovery Using Sparse Random Matrices

Chris Jones	Assimilating Data into Models: Nonlinearity versus Dimension
Govind Menon	Complete integrability and Burgers turbulence
Vasudeva Murthy	Dispersion and dissipation with the Hilbert transform: a tale of numerics and analytics
Eitan Tadmor	From particle to kinetic and hydrodynamic descriptions of flocking
Martin Wainwright	Estimation in high - dimensional statistical models: Some challenges and progress
Venkat Anantharam	Information-theoretic security
Marc Mezard	Typically hard constraint satisfaction problems and glasses
P. Vijaykumar	Optimal Space-Time Codes from Cyclic Division Algebras

PARTICIPANTS

87 from India
1 from abroad

PROGRAMME	**WORKSHOP ON HIGH ENERGY PHYSICS PHENOMENOLOGY (WHEPP XI)**
DATE	02 - 12 January 2010
ORGANIZERS	Subhendra Mohanty, Anjan Joshipura and Saurabh Rindani
VENUE	Physical Research Laboratory, Ahmedabad

PURPOSE

The WHEPP series of workshops, which is held every two years, was started in 1989 at TIFR, Mumbai with the purpose of bringing together phenomenologists from all over India and abroad to meet and set up working groups that would identify and work on important and relevant problems in High Energy Physics Phenomenology.

The 11th WHEPP workshop was held at Physical Research Laboratory from 2nd to 12th Jan, 2010 as a programme of International Centre for Theoretical Studies. WHEPP XI was attended by 146 participants from India and abroad. The participants identified new problems and initiated collaborative work in the following areas:

1. Astroparticle Physics & Cosmology
2. Non-perturbative QCD & QGP
3. Neutrinos & Beyond Standard Model
4. Physics at LHC
5. B-physics

SPEAKERS & TITLES OF TALKS

D.P. Roy	Why LHC
Rohini Godbole	Standard and non-standard Higgs at LHC
Arjun Berera	Dark matter

Mar Bastero-Gil	Inflation/CMB
Y.Y. Keum	Dark Energy and Particle Physics
George W.S. Hou	B Physics and the High Energy Frontier -(Super) B Factory/Tevatron (LHC)
T. Prokopec	The physics of the electroweak phase transition
Amol Dighe	Supernova neutrino oscillations: some recent insights
Sourendu Gupta	The critical point of QCD through lattice and experiment
Manfred Lindner	Neutrino masses and mixings now and in the future
Eduard Masso	Axions in cosmology and laboratory

PARTICIPANTS

122 from India
24 from abroad

PROGRAMME	**SCHOOL ON GLASS FORMERS AND GLASSES**
DATE	04 – 20 January 2010
ORGANIZERS	Srikanth Sastry, Michael Falk and Takeshi Egami
VENUE	JNCASR, Bangalore

PURPOSE

The nature of the glass transition remains one of the grand challenges at the intersection of condensed matter and statistical physics. A great deal of controversy still surrounds theories of glassy behavior, and the nature of the glass transition has been a principal focus of a substantial community of researchers. Investigations in the physics community are only beginning to expand to include other equally fundamental questions of relevance for the engineering of these systems. A number of recent developments make this an exciting time for understanding the physics of glasses in general, and metallic glasses in particular. New computational methodologies and increased computing power have made it possible to test the fundamental assumptions of well-developed theories. Furthermore, new experimental techniques have been developed for characterizing the structure of glasses, materials that were once considered simply "amorphous". But, perhaps most importantly, as a result of the great strides made by materials engineers, metallic glasses themselves have risen from obscurity to the threshold of application. The school was conceived with the idea that a fresh look at the connections between older theories, well studied glassy systems, and new problems, and new glassy materials, was of contemporary interest.

STRUCTURE

A three month workshop was proposed by the present organizers at the KITP in UC Santa Barbara to provide a suitable ground for such interactions. The workshop was held during April - July 2010. Beyond the workshop at KITP, the organizers had sought to envisage a longer cycle of interactions among the various participants on the interaction surrounding the KITP programme. Keeping in mind the student members of the community, two kinds of programmes to enhance interactions were discussed. One is an exchange programme for students. The second programme is a school a few months prior to the workshop in KITP, which can be used as a training programme not only for students wishing to

participate in the KITP programme but also a wider community of students. This school was held in JNCASR, Bangalore, India, with support from the ICTS. The goal of the School was to explore connections between traditional and more recent approaches to understanding glassy behavior, and in particular make contact between theories of glassy relaxation in super cooled liquids, and the study of mechanical behavior of glasses that has been pursued in the materials science community.

SPEAKERS & TITLES OF TALKS

C. Austen Angell	Broader aspects and grand challenges of the slow dynamics and glass transition problem
Gilles Tarjus	What is there to be explained about glasses and glassformers? Facts, questions, views
Walter Kob	1. Description of structure, dynamics and response in liquids: time correlations, transport quantities 2. Survey of theories of glassy behavior
Ranjini Bandyopadhyay	Experimental techniques 1: Rheology and dielectric spectroscopy
Jaydeep Basu	Experimental techniques 1: DSC, MDSC, Imaging techniques
Kenneth Kelton	1. Liquid and Glass Structures and Physical Properties 2. Nucleation of First-Order Phase Transitions
Peter H. Poole	Glass formation and crystal nucleation in supercooled liquids: insights from simulations
Srikanth Sastry	The potential energy landscape approach to understanding glass forming liquids
David Wales	Energy landscapes: From Clusters to Supercooled Liquids and Glasses
Chandan Dasgupta	1. Introduction to the theory of Spin Glasses 2. Density Functional theory of Structural Glasses
Subodh Shenoy	Seminar talk
Marc Mezard	Glasses and Replicas
Biman Bagchi	Dynamics of Dense Liquids - A Short Course on Mode Coupling Theory and Essential Pre-requisite
Kunimasa Miyazaki	Inhomogeneous mode coupling theory and Dynamical heterogeneity
Francesco Sciortino	Colloidal glasses and other glassy states in soft materials
Peter Sollich	Soft glasses, rheology and trap models
Lindsay Greer	1. Metallic Glasses I : Overview of mechanical properties 2. Metallic Glasses II : Shear banding and design for improved mechanical properties
Upadrasta Ramamurty	1. Continuum aspects of plastic deformation in amorphous alloys 2. Fracture and fatigue in amorphous alloys
Michael Falk	1. Phenomenological approaches to elasto-plastic properties of glasses: shear transformation zone theory 2. Simulating plastic localization in metallic glasses
Takeshi Egami	1. Elasticity and Anelasticity in Metallic Glasses: a Peek into Local Energy Landscape 2. Changes in the Structure due to Temperature and Relaxation 3. NMR and Raman Spectroscopy to Study the Structure and Dynamics of Glasses
Smarajit Karmakar	Seminar talk: Elasto - plasticity in amorphous solids
Jean-Louis Barrat	Inhomogeneous elastic response of amorphous solids Large deformations, rheology, plasticity
Ludovic Berthier	Dynamical heterogeneities: experimental and numerical results
S V Bhat	Seminar Talk
Giulio Biroli	The Random first order transition theory
Sarika M Bhattacharyya	Bridging the gap between Mode coupling theory and Random first order transition theory
Chiara Cammarota	Seminar talk

Robert Jack	1. Kinetically constrained models 2. Dynamical Facilitation: KCMs as realistic models
Bulbul Chakraborty	Statistical Approaches to Jamming and Stress transmission in Granular materials
Jorge Kurchan	1. Jamming 2. Aging
Greg McKenna	1. Structural Recovery in Glasses: Phenomenological Descriptions and Anomalous Behaviours 2. Structural Recovery in Glasses: Aging and Rejuvenation 3. Free Volume, configurational entropy and other aspects of the glass transition: Perspectives from engineering / experimental view.
Silvio Franz	1. Disordered Glassy Systems: a Step Beyond Mean Field 2. Glassy disordered systems beyond Mean Field: Hierarchical Model
Nicoletta Gnan	Seminar talk: Isomorphs in liquid state diagrams
Laurent Boue	Seminar talk: The glass transition: simple theory for a complex problem
S. Ranganathan	Icosahedral order: the link between quasicrystals and metallic glasses
Jaydeep Basu	X-ray & Neutron Scattering Studies of Microscopic Dynamics in Glasses
Ranjini Bandyopadhyay	Experimental Techniques 2: Dielectric spectroscopy and Light scattering
Stephen R Elliott	1. Chalcogenide glasses: transformation and change 2. Unstable Chalcogenide glasses & application of crystal nucleation: phase-change non-volatile memory

PARTICIPANTS

34 from India
8 from abroad

PROGRAMME	**INTERNATIONAL PROGRAMME ON QUANTUM INFORMATION (IPQI-2010)**
DATE	04 – 30 January 2010
ORGANIZERS	Arun K. Pati, Pankaj Agrawal, Lev Vaidman, Barry C. Sanders and Samuel L. Braunstein
VENUE	Institute of Physics, Bhubaneshwar, Orissa, India

PURPOSE

Quantum information science is one of the frontier area of science and technology. It is also an interdisciplinary area of research where scientists from physics, mathematics and computer science can contribute alike. One of the main goal is to see how well one can process information using laws of quantum theory. Quantum information theory aims to process information that is not amenable with classical devices. At the same time, this also provides new insights into the nature of quantum world. Quantum information processing includes quantum computation, quantum communication, quantum cryptography and various information processing tasks. Not only this provides fundamental arena to investigate quantum phenomena but also gives new technological benefits like quantum teleportation, remote state preparation and secure communications.

In this programme, experts from all over the world discussed various issues related to quantum information science and general quantum theory. The issues were: characterization and quantification of entanglement, quantum channels and quantum operations, role of entanglement in quantum algorithms and quantum computation, developing new quantum algorithms, understanding of capacities of quantum channels, and new communication tasks in the multi party case.

The aim of the one month programme was to have a fruitful interaction between leading experts of the field resulting in a better understanding of the subject. In addition, there were mini workshops, seminars and discussion meetings among all the participants.

SPEAKERS & TITLES OF TALKS

Director, IOP	Inauguration of School
A. Venugopalan	1. Introduction to Quantum Information and Computation
	2. Basic Quantum mechanics for Quantum Computing
	3. Qubits, Quantum Registers, Quantum Gates
R. Srikanth	1. Quantum Algorithms
	2. Quantum Error Correction
	3. Adiabatic Quantum Computing / Measurement-based Quantum Computing
	4. Physical Implementations of Quantum Computers
	5. Quantum Uncomputability and the Black Hole Information Paradox
G. S. Agrawal	1. Inauguration of Conference: Key Note Talk
	2. Detrimental Effects of Quantum Noise on Entanglement And How To Save Against It
V. Ravishankar	Generalized Deutsch Algorithms
R. Rangarajan	Developing Technologies for Scalable Quantum Computing
J. Gruska	1. Very simple Quantum Algorithms and Their De-quantization
	2. Classical versus Quantum Finite Automata
	3. Basics of Classical and Quantum Error Correction Codes
	4. From Quantum Informatics to a New Perception of Informatics
A. Pathak	1. Potential Applications of Nondestructive Discrimination of Orthogonal States

	2. Quantum Cryptography Protocols
S. Bose	1. Some Quantum Information Applications of Many-Body Systems
	2. Entangling the Ends of a Many-body System
A. K. Pati	1. Role of Entanglement in Quantum Computing
	2. Where is the missing Information?
I. Chattopadhay	On Characterization of Multiparticle Entangled States
R. Prabhu	Covariance matrix techniques to characterize entanglement in symmetric multiqubit systems
G. Gour	1. Basic Quantum Information Protocols
	2. Entanglement Quantification and Manipulation
	3. Quantum Channels
	4. Quantum Resource Theories
H. Brandt	Jacobi Fields in Riemannian geometry of Quantum Computing
D. Sarkar	1. Impossible Operations in the Quantum World-I
	2. Impossible Operations in the Quantum World-II
	3. Tutorial on Quantum Entanglement
A. R. P. Rau	Entanglement and Other Correlations
A. Sharma	An Information-theoretic Study of Four Level Atomic System
S. Ghosh	1. Shannon's Noiseless Coding Theorem
	2. Quantum Channels and Their Capacities
	3. Schumacher's Quantum Data Compression
	4. Analytical Proof of Gisin's Theorem for Three Qubits
A. Ericsson	1. Geometry of the Set of Quantum States
	2. SIC-measurements and Quantum States as Probabilities
H. Prakash	Quantum Teleportation
A. Shaji	Quantum Discord and other Measures of Nonclassical Correlations
T. Konrad	1. Monitoring of Single Quantum Systems
	2. Monitoring of Single Quantum Systems-II
	3. Entanglement in the Presence of Noise
Anil Kumar	Quantum Information Processing by NMR using nearest neighbour Heisenberg XY interaction
Usha Devi A. R.	1. Determining the whole Pure Symmetric n-qubit state from its parts
D. Goswami	Quest for Experimental Quantum Computation: Towards Spatiotemporal Control
G. Kar	1. Entanglement and Nonlocality
	2. Entanglement and Secret Key Distribution
	3. Quantum Non locality and secret key generation
P. Parashar	Reducible Correlations in Quantum States
M. Ericsson	Correlations and Geometric Phase
D. Rohrlich	1. Quantifying Entanglement
	2. Non-local Boxes and All That
P. Panigrahi	Non-Destructive Discrimination of Entangled States and its Applications
R. Nair	Expanding Universe, not Entanglement as The Origin of the Arrow of Time
S. Bandyopadhyay	Entanglement Cost of Nonlocal Measurements
M. Sarovar	Quantum Mechanical Features and Entanglement in Photosynthetic Light Harvesting
S. N. Sandhya	Tomography: Control and Characterization of Entanglement in Atomic Systems
S. Banerjee	1. Open Quantum Systems-I
	2. Open Quantum Systems-II
B. C. Sanders	1. Implementations of Quantum Information
	2. Machine Learning for Quantum Measurement
S. Sirisi	Entanglement Classes for Mixed, Symmetric Two Qubit States
J. Christian	Disproof of Bell's Theorem
V. Subrahmanyam	Entanglement in Many-Electron States
A. Lakshminarayan	Spin models, Quantum Chaos and Entanglement

U. Sen	Quest for Ultimate Security in Cryptography
A. Sen De	Quantum Information Methods in Complex Systems
H. Wiseman	1. Quantum EstimationÂ and Discrimination: Is Entanglement Necessary?
	2. Interpretations of Quantum Mechanics, and Bell's Theorem
	3. Platonic Love at a Distance: the EPR Paradox Revisited
C. S. Unnikrishnan	Seven Deadly Quantum Sins
S. R. Jain	Aharonov-Bohm effect and Qubits
L. Vaidman	1. Quantum Games
	2. Interaction-Free Measurements
	3. Time Symmetric Quantum Mechanics
	4. Where is the Quantum Particle between two Measurements?
	5. Many-World Interpretation of Quantum Mechanics
A. S. Majumdar	Information Processing by Single Particle Path-Spin Hybrid Entangled States
M. Zukowski	1. Bell's Inequalities and Communication Constraints
	2. Quantum Correlations: Their Message, Their Detection and Experimental Realisation
B. Galvan	Generalized Born's Rule
A. Patel	One on Spatial Search Using Quantum Random Walk
P. Ghose	A Simple Quantum Interrogation Method
K. Zyczkowski	How to Measure the Fidelity Between two Quantum States?
P. Joag	Entanglement Dynamics and Geometric Measure of Entanglement
Guru P. Kar	No Future for PR-Box

PARTICIPANTS

46 from India
3 from abroad

PROGRAMME	**INTERNATIONAL SCHOOL AND CONFERENCE ON COLD ATOMS AND IONS**
DATE	06 – 21 January 2010
ORGANIZERS	M. Mukherjee, B. P. Das, H.Juergen Kluge, B.N.Jagatap, B. Deb, A. Narayanan, P. Panigrahi, H. Ramachandran, S. Rangwala, B. Roy, K. Sengupta and C. S. Unnikrishnan
VENUE	School: Ramkrishna Mission Institute of Culture, Golpark, Kolkata Conference: Nest, Sankarpur, West Bengal

PURPOSE

Taking into consideration the enormous potential of the growing field of research in cold atoms and ions, the International School and Conference on Cold Ions and Atoms was organized to provide extensive exposure to the students in a challenging and cutting edge research frontier of today, engaging a wide scientific community across the world, thereby promoting extensive collaborations between different groups.

STRUCTURE

The international school and conference on cold ions and atoms covered a large number of topics on these two frontier areas of atomic, molecular and optical (AMO) physics. The conference on "Cold Atoms and Ions" in Shankarpur was held at a very high level on an international scale. The organizers provided a well balanced mixture of invited speakers from Europe, the United States and India, highlighted by the participation of 2 Nobel laureates. The Contributions gave a state of the art review of many recent advances in cold atom physics and provided hints for future developments. In addition, poster contributions presented mainly by students from India gave an overview of many experimental and theoretical achievements and projects in different research institutions and universities throughout India. The conference location at Shankarpur was equipped with all necessary facilities and provided a well suited environment for the participants.

The above conference, and the School in Kolkata, covered the following topics:

Symmetry Violations and Physics beyond the standard Model

There were two lectures in the school and three talks in the conference on fundamental symmetries and their violations. Dmitry Budker from University of California, Berkeley gave an introductory talk in the school on parity and its violations in atoms and molecules. He emphasized that there are two different kinds of parity violation in atomic and molecular systems- one due to the neutral weak current and the other due to the nuclear anapole moment. Dilip Angom from Physical Research Laboratory, Ahmedabad, gave a lecture at a basic level in atomic and molecular electric dipole moments (EDM's) arising from violations of parity and time-reversal (or CP) symmetries. Bijaya Sahoo from KVI, University of Groningen, Netherlands, gave a talk on the relativistic many–body theory of parity non conversation (PNC) in heavy atomic ions at the conference. Eric Cornell, Nobel Laureate from JILA, University of Colorado /NIST presented a novel method to measure the EDM of molecular ions in linear Paul (rf) trap in his talk at the conference.

Atomic Clocks

There were two talks on atomic clocks at the conference. Piet Schmidt from PTB, Germany gave a comprehensive talk on trapped ion clocks. Micheal Martin from JILA, Boulder, USA gave a talk on the current status of the strontium optical lattice clock.
Trapped and cooled ions:
The school covered three distinct topics on "ion trapping":
Basic principle of ion trapping,
Different cooling techniques from trapped ions, and
Quantum information processing as an application of ion traps.

At the conference the topic- 'trapped and cooled ions' constituted about 30% of the total number of talks. A wide range of topics were covered by world renowned leaders in the field, namely, Profs K Blaum, R Blatt, E Cornell, S Guibal, P.O. Schmidt and G Wreth.

SPEAKERS & TITLES OF TALKS
LECTURERS IN THE SCHOOL

A. Browaeys	Laser Cooling and Trapping
G. S. Agarwal	Simple Harmonic Oscillator as a model for matter wave interactions
G. Werth	1. Ion trap and applications
	2. Penning traps and Detection techniques
B. Deb	Cold molecules
S. A. Rangwala	Cold molecules
S. Guibal	1. Cooling mechanisms of trapped ions
	2. Single ion fluorescence and Quantum engineering
	3. Trapped two level atom coupled to laser light
D. Angom	Precision measurement of PNC and EDM with ion traps: proposal
J. K. Bhattacharjee	Bose Einstein Condensation (theory)

& K. Sengupta	
G. Shlyapnikov	Degenerate Fermi Gases (DeFG)
C. S. Unnikrishnan	Bose Einstein Condensation (experiment)
W. D. Phillips	Cold gases in optical lattices
D. Budker	Precision measurement of PNC and EDM with ion traps: proposal
A. Ekert	Applications: Basic introduction to quantum information and computation using cold atoms and ions; Experimental realization of ion trap quantum teleportation; Experimental realization of C-NOT gate
R. Blatt	Applications: Basic introduction to quantum information and computation using cold atoms and ions; Experimental realization of ion trap quantum teleportation; Experimental realization of C-NOT gate
H.J. Kluge	Precision nuclear measurements with ion traps: Masses, charge radii, beta-decay asymmetries etc.

CONFERENCE SPEAKERS

G V Shlyapnikov	From Ultracold Atoms to Ultracold Molecules. Prospects for Novel Physics
K. Dieckmann	Ultracold Heteronuclear Molecules
W. D. Phillips	A Quantum Bose Gas in Two Dimensions
Y. Takahashi	Quantum simulator Using ytterbium
D Budker	Atomic and Molecular P- and P,T-Violation Experiments
B K Sahoo	Relativistic Many-Body Theory of Parity Nonconservation in Heavy Ions
E Demler	Magnetism of ultracold atoms
H R Krishnamurthy	Strong Coupling Expansions for Models of Ultra Cold Atoms in Optical Lattice Emulators
R. Blatt	Quantum Information Science with Trapped Ca+ Ions
A. Ekert	From multi-particle interference to quantum computers
A. Sen De	Distributed Quantum Information Processing
K. Blaum	Precision Penning trap mass measurements - Status and perspectives
I Spielman	Synthetic electromagnetic fields created with light
I Satija	Time-Reversal Invariant Topological Insulators With Ultra-Cold Atoms in Optical Lattices
A. Browaeys	Entanglement of two atoms using the Rydberg Blockade
E. Cornell	How round is the electron? Looking for an asymmetry of 10^{-15} femtometers
P. O. Schimdt	Optical Clocks and Quantum Logic Spectroscopy
M Martin	Sr lattice clock with 10**16 inaccuracy: characterization of fermionic collisions and future prospects
R. Sensarma	Non-equilibrium dynamics of strongly interacting ultracold atoms
S. Mukerjee	Coherent dynamics across quantum critical points
S. Guibal	Trapping and cooling large Sr+ ions clouds
S. Sinha	Exotic phases of ultracold Bosons and Fermions in an optical lattice
R. V. Pai	Supersolid and solitonic phases in the one-dimensional extended Bose-Hubbard model
C S Unnikrishnan	
G. Werth	
O. E. Mustecaplioglu	

PARTICIPANTS

75 from India
7 from abroad

PROGRAMME	**BREAKING BARRIERS FROM PHYSICS TO BIOLOGY**
DATE	09 – 11 January 2010
ORGANIZERS	G. V. Shivashankar, Jun Zhang, Stephane Fauve and Elisha Moses
VENUE	NCBS, Bangalore

REPORT

'Breaking Barriers: From Physics to Biology'was jointly organized by NCBS and ICTS (International Centre for Theoretical Sciences). It served as a satellite meeting of ICTS inaugural event. With conceptual discussion as well as formal and semi-formal presentations, the meeting provided a platform for rekindling old relations among various sciences. It aimed at initiating scientific collaboration between the scientists whose focus ranged over a diverse array of questions spanning from the physical to biological sciences. The meeting felicitated Albert Libchaber, who epitomized such collaborations by bringing a physicist's point of view into addressing deep and fundamental questions of nature.

CONFERENCE SPEAKERS

K Vijayraghavan
GV Shivashankar
Bruno Berge
Sebastien Balibar
Bernard Castaing
Oscar Mesquita
Mogens Jensen
Albrecht Ott
Roybar – Ziv
Masaki Sano
Benolt Dubertret
John Bechhoefer
Yamuna Krishnan
Hao Li
Jay Fineberg
Yves Couder
Chao Tanga
Gregoire Altan Bonnet
Maithreyi Narasimha
Joel Stavans
Oleg Krichevsky
Giovanni Zocchi
Qi Ouyang
Zoher Gueroui
Deborah Fygenson
Pierre Molho
Vincent Noireaux
Herve Isambert
Sandeep Krishna
Michael Elbaum
Jun Zhang

Laurent Bourdieu
James A. Glazier
Elisha Moses
Sriram Ramaswamy
Xiao - Lun Wu
Xiao - Zhong Wu
Hanna Salman
Timothy Gardner
Axel Buguin
Erez Braun
Tsvi Tlusty
Madan Rao

PUBLIC LECTURES

Stephan Fauve	Magnetic Field Reversals: The Geodynamo, Laboratory Experiments and Models
Stanislav Leibler	Microbial Population Dynamics: Examples of Analytic and Synthetic Paths

PARTICIPANTS

6 from India
30 from abroad

PROGRAMME	**THE 4TH ASIAN WINTER SCHOOL ON STRINGS, PARTICLES AND COSMOLOGY**
DATE	11 – 20 January 2010
ORGANIZERS	Amol Dighe, Rajesh Gopakumar, Hyung Do Kim, Nakwoo Kim, Hideo Kodama, Yasuhiro Okada, Sreerup Raychaudhuri, Tarun Souradeep, Tadashi Takayanagi and Gautam Mandal (Scientific Director)
VENUE	Fountain Hotel, Mahabaleshwar

REPORT

The School formed part of an ongoing series of Asian winter schools organized jointly by China, India, Japan and Korea. The previous schools had been held in Korea, Japan and China. School combines with the 4th edition of the Asian Schools on Particles, Strings and Cosmology held annually in Japan. This school was also a joint APCTP-CTS activity and replaces the 14th APCTP winter school on string theory.

The School covered various areas in String Theory, High Energy Physics and Cosmology. The audience consisted of senior graduate students as well as practicing researchers whose primary interest is in String Theory. The lectures covered a selection of basic areas as well as advanced topics at the forefront of current research.

SPEAKERS & TITLES OF TALKS

Andrew Strominger	String Theory and Black Holes
Liam McAllister	Inflationary Cosmology
Ignatios Antoniadis	Aspect of String Phenomenology
Ken Intrilligator	1. Supersymmetric Theories and the Phenomenology of SUSY Breaking
	2. Informal Discussion on SUSY gauge theories
H. Verlinde	String Phenomenology
Sean Hartnoll	Holographic Methods for Condensed Matter Physics
Shiraz Minwalla	Hydrodynamics and AdS/CFT
John Ellis	High Energy Physics Phenomenology
Laurence Yaffe	Finite Temperature Aspects of Ads/CFT

PARTICIPANTS

32 from India
64 from abroad

PROGRAMME	**EVOLUTION OF COMPLEX SYSTEMS**
DATE	13 - 15 January 2010
ORGANIZERS	Somdatta Sinha, Chandan Dasgupta and Raghavendra Gadagkar
VENUE	Indian Institute of Science, Bangalore

REPORT

The conference on "EVOLUTION OF COMPLEX SYSTEMS" was a Satellite Meeting of the ICTS Inaugural Event. India possesses a highly developed academic community in all disciplines of science, humanities and arts. It also is endowed with a cultural milieu encompassing classical knowledge derived over thousands of years of scientific, philosophical and artistic enquiries on one hand, and a vast array of traditional artistic and scientific knowledge developed by the magical potpourri of tribes of the Indian subcontinent on the other hand. Specialized meetings are regularly held in these different areas where experts delve into the details of their subject. So compartmentation of knowledge within specialized groups is a common feature. There has been a growing feeling that to reconstruct a system ("whole"), the groups need to interact and cross-talk for a cohesive understanding of the evolution and maintenance of nature and life around us. It is felt that cutting across scientific disciplines, evolution of an organised structure – biological, social, economic or cultural – all require linking multiple structural and functional entities in a non-random fashion that follow certain rules and have convergent features.

This conference was intended to bring multi-disciplinary perspective into diverse set of processes spanning different fields of inquiry in natural and social sciences, and to amplify the synergy and convergence of the underlying processes and ideas.

Biological systems are interesting examples of complex systems as they have highly modular organization with a large number of interacting components. They also are products of evolution through genetic and epigenetic processes – a feature of recurrent discussion among biologists and physicists. Several talks were by experimental and computational biologists, who discussed their work on systems spanning - gene networks to genome function.

Some of the talks were based on theoretical analysis of models developed to understand biological systems/ processes.

A multi-media talk on the evolution of Indian classical dance forms was presented with a live performer explaining the details of the specific forms and features of each type of dance, and the mixing and evolution of these forms that led to the trends in the modern dance forms (both in stage and cinema productions) were explained with video clips and analysis. This was a highly experimental talk and the speaker tried to lay down the basic robust features of the traditional form by indicating how innovators with heterogeneous knowledge/experience have introduced variability to evolve the new forms suitable to the modern taste and socio-economic environment.

The programme was well appreciated by all the participants who were of the opinion that such kind of interdisciplinary discussions not only help to identify one's work in a larger perspective, but also allows expanding the base of understanding specific system behaviour through learning methods and strategies from other areas. One can see the commonalities across diverse systems and thereby evolve a much broader

appreciation to ask deeper integrative questions on the evolution and functioning of complex systems. Such an approach, by its very nature, transcends any particular field. It was felt that such meetings should be organised regularly to bring workers from different disciplines in a common ground to be able to comprehend the commonalities that link artificial, human, and natural systems.

STRUCTURE

The meeting had 23 talks by researchers from physics, mathematics, biological sciences, economics, computer sciences, engineering, and fine arts. The participants came from different disciplines and were composed of primarily M.Sc. and Ph.D. students, and young faculty. Many students and faculty members from the IISc also attended. Some of the talks were also attended by school students and college professors.

SPEAKERS & TITLES OF TALKS

Sriram Ramaswamy	The complex collective dynamics of self-driven particles
Upinder Bhalla	Multiple cellular states emerge from simple chemistry and cellular traffic
Stefan Thurner	Darwins daemon and a mechanistic approach to evolution dynamics
B K Chakrabarti	Statistics of the Kolkata Paise Restaurant problem
Vidyanand Nanjundiah	The evolution of cooperation in social amoebae
Anindita Bhadra	The links and hubs of power in a wasp society
R E Amritkar	Synchronization of networks
Sunil Kothari	New directions in Indian dance
Didier Sornette	Black swans, Dragon-kings and predictions of crises in complex systems
Vikram Soni	Consequences of sudden species loss in an evolutionary model
Neo Martinez	Structure, stability and robustness of complex ecological networks
Harini Nagendra	Charting the complexity of forest change in human impacted forests
Priya Iyer	Theories for the evolution of the sexes
Amaresh Chakrabarti	Understanding and supporting evolution of engineering designs
K Ghosh Dastidar	On some aspects of price competition in a homogeneous product market - Evolution of cooperation, existence of equilibrium and other issues
Sanjay Jain	Formalizing the notion of innovation in an evolutionary model
M. Madan Babu	Structure, evolution and dynamics of transcriptional regulatory networks and its influence on genome organization
Vijay Srinivasan	Minimal metabolome- The canonical network of autotrophic metabolism and its analysis
Alain Pumir	Quantifying complexity of genetic interactions- Theoretical analysis of invertebrate phototransduction
Sumantra Chattarji	Differentiating safe from dangerous- From behavior to single neurons
G Rangarajan	Detecting functional connectivity in neuronal networks
Manindra Agrawal	Classifying complexity of problems algorithmically

PARTICIPANTS

59 from India
2 from abroad

PROGRAMME	**NON-EQUILIBRIUM STATISTICAL PHYSICS**
DATE	30 January - 08 February, 2010
ORGANIZERS	Debashish Chowdhury, Bikas K. Chakrabarti, Arun Grover, Amit Dutta and Satyajit Banerjee
VENUE	Indian Institute of Technology, Kanpur

PURPOSE

Macroscopic systems, strictly speaking, are never, in thermodynamic equilibrium. Although, over an appropriate window of time, they may appear to be in equilibrium. However, the foundation of non-equilibrium statistical mechanics (NESM) is not as well established as that developed by Maxwell, Boltzmann and Gibbs for systems in equilibrium. Moreover, the smaller the system is, the stronger are the fluctuations. Furthermore, at sufficiently low temperatures, quantum fluctuations give rise to additional interesting properties also in systems far from equilibrium. The main aim of the ICTS programme on "Non-equilibrium Statistical Physics" was to critically examine the foundations of NESM and to assess the recent progress in understanding physical phenomena in wide varieties of systems far from equilibrium.

The programme was organized in two parts. During the first 6 days (30 January-04 February, 2010), in the Instructional Workshop, lectures on frontier areas of research were delivered at a pedagogical level.

During the last 4 days of the programme (i.e., 05-08 February, 2010) a research level activity was held in the format of a Conference with the title 'Fluctuations in Living and Non-living Systems far from Equilibrium'. There were plenary lectures and invited talks where latest results were presented by the speakers.

STRUCTURE

This programme was part of the year-long celebration of the Golden Jubilee of IIT Kanpur. The chair of both the events was Prof. Debashish Chowdhury (IIT Kanpur), with co-chairs Prof. Bikas K. Charabarti (SINP, Kolkata) and Prof. Arun K. Grover (TIFR, Mumbai). The conveners of the events were Dr. Amit Dutta and Dr. Satyajit Banerjee from the Dept. of Physics, IIT Kanpur.

The programme hosted 75 speakers (with more than 30 from abroad) and about 60 Ph.D. students, in addition to several post-docs and young faculty members from India and abroad. The galaxy of esteemed speakers included a Nobel Laureate, elected members of various prestigious international and national academies, winners of important national and international awards, along with past and present presidents of the science academies and several directors of scientific institutes in India and abroad. The one-hour long lectures had a mix of colloquium level talks and overviews of the frontier areas. There were also half-an-hour long presentations which addressed specific issues at the forefront of research in Non –equilibrium aspects of classical statistical mechanics, Quantum Phase transitions, Biological Physics and Computer Science.

The variety of systems investigated under this general theme included noisy transport of proteins in living cells, Darwinian evolution in eco-systems and emergence of new species, extremely slow processes in soft and glassy materials, earthquakes and stock market, superconductivity and superfluidity under extreme conditions, non-equilibrium effects in new superconductors and magnetic materials, etc. The aim of this programme was to provide a multidisciplinary forum for exchange of ideas between theorists and experimentalists. Due to the breadth of the scope of the events, one found faculty members and students belonging to different departments in IIT Kanpur actively participating in the events. Faculty members

belonging to the departments of Mathematics, Chemical Engineering, Mechanical Engineering, Biological Science and Bio Engineering chaired quite a few sessions and one faculty member from chemical engineering department also delivered an invited talk.

The programme was inaugurated formally in the morning of January 30th. In the welcome address, the (acting) Director of IIT Kanpur briefly summarized the major contributions made by IIT Kanpur in the last 50 years. Prof. Spenta Wadia, Director of ICTS-TIFR, made a brief presentation on the vision of ICTS and some of its current activities. Prof. Anthony J. Leggett, a Nobel Laureate in Physics, delivered two lectures. His first lecture was an expanded version of his Nobel Lecture delivered at Stockholm. His second lecture was a public lecture named the "Niels Bohr Lecture" and was announced also as an Institute Lecture of IIT Kanpur. About 35 lectures of one-hour duration, delivered by leading experts from India and abroad, were named after eminent scientists (all deceased). In the concluding session, the programme was summarized by Prof. Bikas K. Chakrabarti (SINP, Kolkata), Prof. Deepak Dhar (TIFR, Mumbai) and Prof. G. Baskaran (Inst. Of Mathematical Science, Chennai).

SPEAKERS & TITLES OF TALKS

Udo Seifert	Stochastic Thermodynamics: Theory and Experiment
Pierre Gaspard	1. Ilya Prigogine Lecture: Microreversibility and time asymmetry in nonequilibrium statistical mechanics and thermodynamics 2. Out-of-equilibrium directionality and information processing in biophysical nanosystems
Gunter Schutz	1. Distinguished Colloquium: Statistical mechanics of extreme events 2. Condensation in temporally correlated zero-range dynamics
Jayanta K. Bhattacharjee	J. C. Bose Lecture: Centre or limit cycle? RG as a probe
Robin B. Stinchcombe	Rudolf Peierls Lecture: Universality, and Non-universal Dynamics in Non-equilibrium Systems
Spenta R. Wadia	Subrahmanyan Chandrasekhar Lecture: The Maldacena duality conjecture and applications
H. Eugene Stanley	John Kirkwood Lecture: Puzzling Physics, Chemistry and Biology of Liquid water
David Lacoste	Frontier Overview: Fluctuation relations for molecular motors
Anatoly B. Kolomeisky	1. Frontier Overview: Theoretical studies of coupled parallel exclusion processes 2. Spatial fluctuations strongly affect dynamics of motor proteins
Debashish Chowdhury	Frontier Overview: Modeling traffic with exclusion processes: from molecules to vehicles
Bulbul Chakraborty	Distinguished Colloquium: Fluctuations, Response, entropy and temperature in granular packings
H. R. Krishnamurthy	S. N. Bose Lecture: Ultra cold atoms in optical lattices as `emulatorsÂ´Â´ of quantum condensed matter systems
Gianni Blatter	John Bardeen Lecture: Cold atoms: Strongly correlated Bosons
Baruch Rosenstein	1. Neville Mott Lecture: Theory of nonequilibrium current carrying states in type II superconductors with artificial pinning array at matching magnetic field 2. Frontier Overview: Ballistic transport, chiral anomaly and emergence of the electron - hole plasma in graphene
Simon Bending	David Schoenberg Lecture: Vortex Ratchets in highly anisotropic superconductors
R. Shankar	Frontier Overview: Majorana Modes and Non-Abelian Anyons in Spin Systems
Leticia F. Cugliandolo	Distinguished Colloquium: Cooling rate dependencies in classical coarsening systems: extension of the Kibble-Zurek mechanism

Arup K. Raychaudhuri	K. S. Krishnan Lecture: Do precision physical measurements carry any value? Case study of measurements of thermal fluctuations in molecules of life
Jainendra K. Jain	Enrico Fermi Lecture: Fractional quantum Hall effect: Why should others care?
David Mukamel	1. P. Langevin Lecture: Effective long-range interactions in driven non-equilibriumÂ systems 2. Slow dynamics in systems with long-range interactions
Krishanu Ray	Frontier Overview: Traffic signals inside a cell: an update on kinesin-dependent intracellular transport and its regulation
Stephan Grill	Frontier Overview: Active Forces and Flows in the Establishment of Cellular Polarity
Sriram Ramaswamy	Sivaramakrishna Chandrasekhar Lecture: Nonequilibrium soft matter: self-propelled, drifting and stuck
Vincent Croquette	1. P. G. de Gennes Lecture: Brownian motion as a tool to study DNA molecular motors 2. Single molecule study of the T4 replisome
Jonathon Howard	Max Delbruck Lecture: Motor proteins as nanomachines: force, friction and fluctuations
Joachim Krug	1. Distinguished Colloquium: Record theory and applications: Global warming and market fluctuation 2. Ronald Fisher Lecture: Evolution of sexual and asexual populations on rugged fitness landscapes
Reinhard Lipowsky	1. Hermann von Helmholtz Lecture: Chemomechanical coupling of molecular motors 2. Multiscale motility of molecular motors
Tom Duke	1. A.V. Hill Lecture: Mechanosensation by critical oscillators 2. Force generation in the lamellipodium of crawling cells
Paul Matsudaira	1. D'Arcy Thompson Lecture: The design and mechanics of biological macromolecular springs 2. Distinguished Colloquium: The Mechanics of the Fastest Cellular Movement - The Contraction of the Vorticella convallaria Spasmoneme
Anthony J. Leggett	1. Expanded version of NOBEL Lecture 2003: Superfluid 3-He:the early days as seen by a theorist 2. Niels Bohr Lecture: Does the everyday world really obey quantum mechanics?
P. B. Sunil Kumar	Frontier Overview: Aster formation and rupture transition in semi-flexible fiber networks with mobile cross-linkers
Frank Jülicher	E.M. Purcell Lecture: Steering helical swimmers
T. V. Ramakrishnan	Homi Bhabha Lecture, organized jointly with TIFR: Homi J Bhabha: Growing Science and Doing Science
Sidney R. Nagel	Jean Perrin Lecture: Jamming and the Emergence of Rigidity
Eva Andrei	H. Kamerlingh-Onnes Lecture: Electronic properties of graphene
Thierry Giamarchi	J. H. Van Vleck Lecture: Physics in the one dimensional quantum world: the Luttinger liquid paradigm and beyond
Mustansir Barma	M.N. Saha Lecture: Entropy-Induced Ordering
Gautam I. Menon	Stretching Fluctuations and Loop Formation in Short Double-Stranded DNA molecules
Stefan Klumpp	Transcription of ribosomal RNA - a central task for rapid (bacterial) cell growth
G. V. Shivashankar	Spatio-temporal plasticity in genome organization within living cells
P. Ranjith	Dynamics of nucleosome assembly and disassembly
G. Baskaran	S. Pancharatnam Lecture: Phases and Phases on the road to Quantum Computation
Rahul Pandit	Satish Dhawan Lecture: Turbulence: A Grand Challenge
Kavita Jain	Quasispecies dynamics on correlated fitness landscapes

Roop Mallik	Tug-of-war between dissimilar teams of microtubule motors regulates transport and fission of endosomes
Anirban Sain	A biological mechanism that utilizes intrinsic curvature of filaments
Ajay K. Sood	C. V. Raman Lecture: Order and chaos in flow of Soft Matter
Chandan Dasgupta	Annesur Rahman Lecture: Growing length scales and their role in the growth of time scales in glass-forming liquids
Srikanth Sastry	Slow Relaxation and jamming in simple glass formers
Yogesh M. Joshi	Time-temperature superposition in soft glassy materials
Prabal K. Maiti	Structure and dynamics of water under nano-confinement
Raja Paul	In-silico reconstitution of spindle assembly: speed and error of search and capture
Sanjay Puri	Pattern Formation in Granular Materials
Surajit Sengupta	Micro-structure selection in solid-solid transformations: a space-time transition of particle trajectories?
Piers Coleman	Lev Landau Lecture: Qu-transitions: phase transitions in the quantum era
Gabriel Aeppli	Louis Neel Lecture: Quantum magnetism and non-Fermi liquids
Deepak Dhar	P, C. Mahalanobis Lecture: Growing sand piles: a model of proportionate growth
Abhishek Dhar	Heat conduction and phonon localization in disordered harmonic crystals
Sanjib Sabhapandit	Integer partitions and exclusion statistics
Pradeep K. Mohanty	Spatial Correlations in Exclusion Models corresponding to Zero Range Process
Satya N. Majumdar	Distinguished Colloquium: Understanding search trees via statistical physics
P. Das, C.V. Tomy, S. Ramakrishnan, A.K. Grover	Contributed talk : Observation of the Fishtail Effect and the magnetic relaxation measurements in Single Crystal of the superconductor $FeSe_{0.5}Te_{0.5}$
Sumedha, Bulbul, Chakraborty, M.F.Hagan	Contributed Talk: Role of GTP remnants in micro-tubule dynamics
Vivek Sharma, William Hancock, Jeffrey M.	Contributed Talk: Lithographic Approaches to Artificial Spindle Assembly Catchmark
Steffen Liepelt	Contributed talk: Kinetic networks of molecular motors
Sandhya P. Koushika	Contributed talk: Regulated distributions of mitochondria in neurons are dependent on motors and microtubules

PARTICIPANTS

26 from India
5 from abroad

PROGRAMME	**BUNDLES ON PROJECTIVE VARIETIES**
DATE	03 - 14 May, 2010
ORGANIZERS	Indranil Biswas, S. Subramanian, A. J.Paramaswaran and Vijaylaxmi Trivedi
VENUE	TIFR, Mumbai

PURPOSE

The programme was emphasized on vector bundles and its connections with other topics in algebraic and differential geometry. There were lecture series as well as individual research talks.

REPORT

The ICTS programme "Bundles on Projective Varieties", May 3-14, 2010, brought experts on the topic from across the world. Only a few lectures a day were scheduled so as to enable the participants and members of the school to interact. With regard to the research talks, each speaker was encouraged to give more than one talks, in the form of a general talk followed by more technical ones.

SPEAKERS & TITLES OF TALKS

U.N. Bhosle	Orthogonal bundles on hyperelliptic curves
J. Dos Santos	1. Tannakian categories of vector bundles-I
	2. Tannakian categories of vector bundles-II
	3. Vector bundles trivialized by proper morphisms and some applications-III
M. Kumar	Higher Chow groups and Beilinsosn's regulators.
J. Hurtubise	1. Eynard-Orantin invariants-I
	2. G-bundles on the plane-II
V. Munoz	1. Moduli spaces of pairs of bundles-I
	2. Torelli theorem-II
	3. Hodge Structures of moduli spaces of pairs-III
S. Subramanian	Mumford's example and a general construction
A. Dhillon	1. The Brawer group of a scheme-I
	2. Essential Dimension and bundle-II
Tomas Gomez	1. Introduction to the Geometric Langlands Programme-I
	2. Hecke transform for sumplectic and orthogonal bundles-II
N. Hoffmann	1. Loop groups and G-bundles-I
	2. The line bundles on moduli stacks of G-bundles on a curve-II
V. Balaji	Parahoric bundles & parabolic bundles
A. Hogadi	Brauer Group of the moduli space of stable PGL(n) bundles on a curve
G. Wilkin	1. Morse theory and stable pairs-I
	2. Morse theory and stable pairs-II
M. Logares	1. Parabolic U (2,1)-Higgs bundles-I
	2. Hodge numbers of SL(2,C) – character varieties-II
J. Amaros	Tangent vector fields in projective and Kachler manifolds
N. Nisture	Schematic Harder Narasimhan stratification
A. Parameswaran	Stability of Picard bundles in the compactified Jacobian of a nodal curve

PARTICIPANTS
3 from India

PROGRAMME	**NONLINEAR SCIENCES PERSPECTIVES 2010**
DATE	21 - 29 July, 2010
ORGANIZERS	Ram Ramaswamy, Arul Lakshminarayan and Neelima Gupte
VENUE	TIFR, Mumbai

PURPOSE
The conference, Perspectives in Non-Linear Dynamics PNLD 2010 was a satellite to STATPHYS 24, held in Cairns, Australia. This meeting was the third in a series, preceded by PNLD 2004 in Chennai and PNLD 2007 held in Trieste, Italy. The meeting highlighted nonlinear science research and proved to be a useful forum for the exchange of ideas, for presenting research, and for catalyzing research.

The programme aimed at exploring the following themes:
- Dynamical Systems Theory
- The interplay of noise and nonlinearity
- Evolving networks with complex topology
- Quantum Chaos and Quantum Information
- Recent developments in integrable systems
- Nonlinear science applications in
    - The life sciences (including Neuroscience)
    - Physical Sciences (particularly the science of real materials)
    - Engineering
    - Earth Sciences, Sociology and Economy.

STRUCTURE
The ICTS programme Nonlinear Sciences Perspectives, 21-29 July 2010 had two components. (i) A workshop on Quantum Chaos - held from 21 July to 25 July at IIT Madras, Chennai. (ii) The Conference, Perspectives in Nonlinear Dynamics PNLD 2010, held in Bangalore from July 26-29, 2010.

THE WORKSHOP
The workshop of the NLSP2010 programme, preceded the PNLD2010 conference and was held in IIT Madras from July 21 to July 24th, 2010. It was concentrated on one of the themes of PNL2010, namely "Quantum chaos and quantum information". It had 25 invited talks, of which 4 were in the nature of reviews. The workshop witnessed people of several different communities, in particular nonlinear dynamics / quantum chaos, quantum information and condensed matter physicists. There was strong participation of students, postdocs, young researchers from across India, as well as participation by several senior researchers interested in those broad themes. The number of such participants was 47.

Many talks addressed applications of quantum chaos and random matrix theories in novel settings, from qubits or quantum information, through stars and networks to Mesocopic Physics. Entanglement

formed a thematic meeting point for the varied communities. Two talks addressed specialized developments in random matrix theories, including a two-body random matrix ensemble that is of interest of all who study many body quantum physics.

THE CONFERENCE

The conference highlighted nonlinear science research, and turned out to be an extremely useful forum for discussing emerging research directions, and presenting current research. A special effort was made at this conference to highlight research carried out by young Indian researchers.
The scientific programme for the meeting consisted of 38 invited talks, 12 submitted talks, and also included a poster session. The conference attracted 100 participants from 12 countries.

SPEAKERS & TITLES OF TALKS
LECTURERS IN THE SCHOOL

Steven Tomsovic	Quantum Chaos: Origins and Developments
R. Simon	An Invitation to Quantum Information Science
O. Giraud	Multifractal Properties of Quantum Wavefunctions
Aditi Sen (de)	Distributed Quantum Information Processing
V. K. B. Kota	Two-Body Random Matrix Ensembles for Quantum Many-Body Chaos
M. S. Santhanam	Classically Induced Suppression of Energy Growth in A Chaotic System
M. Znidaric	Quantum Chaos in Quantum Information
Jiangbin Gong	Exploring Quantum Critical Systems via Driven Cold-Atom Systems
S. Lakshmibala	Recurrence Properties of Quantum Observables
Santosh Kumar	Jacobi Family of Crossover Random Matrix Ensembles: Theory and Applications
Sudhir Jain	Quantum Mechanics of Classically Non-Integrable Systems: Analytical Methods and Results
Pragya Shukla	Quantum Phase Transitions in Kicked Rotor with A Smooth Potential
J. Bandyopadhyay	Quantum Chaotic System as a Model of Decohering Environment
A. Buchleitner	Dynamical and Statistical Aspects of Quantum Entanglement
Arun Pati	Nonlinear Quantum Theory, Closed Time-Like Curves and No- Purification Of Mixed State
D. Braun	Quantifying Quantumness and the Quest for Queens Of Quantum
Ujjwal Sen	Frustration in Quantum Spin Models and a Quantum Information Perspective
Sibasish Ghosh	Dynamics of Entanglement Under The Influence of Local Heat Baths
D. Ullmo	The Mesoscopic Kondo Problem: Slave Fermion Mean Field Approach and Random Matrices
T. Dittrich	Semiclassical Phase-Space Propagation: A Versatile Analysis Tool for Complex Quantum Dynamics
S. Takahashi	To Higher Semiclassical Theory for Dynamics of Wavepacket
V. Subrahmanyam	Macroscopic Multi-Species Entanglement near Quantum Phase Transitions
K. Srihari	Decoding The Dynamical Information Embedded In Highly Excited Quantum States
B. Georgeot	Applications of Quantum Chaos Techniques, From Qubits to Stars and Networks
S. Lack	Dynamical Tunneling In Systems with A Mixed Phase Space

CONFERENCE SPEAKERS

Sarika Jalan	Universal spectral behaviour on complex networks: Application to gene expression profile.
Antonio Politi	Collective behavior in neural networks.
Theo Geisel	Phase Transitions towards Self-Organized Criticality in Neuronal systems
Sitabhra Sinha	Mind, Memory and Modules: Dynamics of Associative Recall in complex Networks with Mesoscopic Organization.

Nandini Chatterjee Singh	Categorization of sounds in the natural environment.
B. Kahng	First order Percolation Transitions
M. Carmen Romano	Traffic dynamics of translation: Modelling the synthesis of proteins.
Somdatta Sinha	Propagation of extrinsic perturbation in a multi-step biochemical pathway
Ulrike Feudel	Coagulation and fragmentation of inertial particles in chaotic advection and random flows
Denis Ullmo	Tunneling in non-integrable systems
Thomas Dittrich	Classical and Quantum chaotic pumps
Andreas Buchleitner	Transport, disorder and entanglement
Steven Tomsovic	Extreme statistics of random and quantum chaotic states
Marko Znidaric	Exact solution for a diffusive non equilibrium steady state of an open quantum chain.
Sergej Flach	Universal spreading of wave packets in disordered nonlinear systems
Mahendra K Verma	Bifurcation and chaos in Rayleigh-Benard convection
Amita Das	Collisionless stopping of current pulses in an inhomogeneous EMHD plasma
G. Ambika	Delay/anticipatory synchronization in nonlinear systems using variable delay and reset
K. Porsezian	Soliton induced supercontinuum generation in liquid filled photonic crystal fibers
Binoy Goswami	Role of coupling-induced new attractors in the master-slave synchronization
Punit Parmananda	Synchronization: The continuing saga
C. K. Chan	Synchronization in Growing Heterogeneous Media
Awadhesh Prasad	Universal occurrence of mixed-synchronization in counter-rotating nonlinear coupled oscillators
Gautam Sethia	The role of time delays in the synchronization of weakly coupled oscillator systems
Radha Balakrishnan	Immortal Solitons in a Strongly Repulsive Bose-Einstein Condensate
F. Atay	Synchronization and the emergence of novel dynamics
M S Santhanam	Extreme events on complex networks
Umeshkanta Singh, T R Krishna Mohan	Excitable nodes on random networks: Structure and dynamics, Dynamics of metastable breathers in nonlinear chains in acoustic vacuum
Syamal Dana, Sekhar Iyengar	Engineering synchronization of chaotic oscillators, Detection on nonlinearity and chaos in nonlinear plasma oscillations using continuous wavelet transforms
Janaki Balakrishnan, Bibhu Biswal	Dynamical instabilities and noise in sensory processes, Detection of unstable periodic orbits in biological time series
Manish Shrimali	Phase flip bifurcation in conjugate coupled systems, The role of the Jacobi
Partha Guha	Last Multiplier in isochronous systems
Ajay D Kacchvaha	Failure tolerance of load bearing hierarchical networks, Two dimensional
Anupam Gupta	turbulence with polymer additives
Abhijeet Sonawane	Stochastic switching between attractive and repulsive coupling leads to DP
Garima Saxena	universality class, Dynamical effects of integrative time delay coupling
Sanjay Sane	Investigating insect flight using multi-disciplinary approaches
G. Ananthakrishna	Correlation between stick-slip events and contact charging in dynamics of sliding friction at nano-scales
Chandan Das Gupta	Chaos in the Rheology of Complex Fluids
Amit Apte	Data assimilation and Interplay between nonlinearity and statistics
Kiran Kolwankar	Learning and structure of neuronal networks
V. Balakrishnan	Extreme value statistics in deterministic dynamics
Sutirth Dey	Dynamics of laboratory populations and metapopulations of Drosophila melanogaster
Thilo Gross	Eat the specialist: Some results on the stability of 100 billion food webs

Amitabh Joshi	Synchrony, constancy, and persistence in two- patch Drosophila metapopulations: effect of self and neighbour stability and migration rate on local and global patterns
Rama Govindarajan	Recent results on hydraulic jumps
Celso Grebogi	Fractal Skeletons: The Universality in Death by Starvation

PARTICIPANTS

100 from India
1 from abroad

PROGRAMME	**CONFERENCE AND SCHOOL ON NUCLEATION AGGREGATION AND GROWTH**
DATE	26 July - 06 August, 2010
ORGANIZERS	Srikanth Sastry, Surajit Sengupta
VENUE	Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru

PURPOSE

Planned as a satellite to STATPHYS 24, the overall scope of the conference was the conceptual understanding of nucleation, aggregation and growth phenomena with applications of experimental, theoretical and computational techniques to a diverse range of physical, chemical and biological systems. To maximize the benefits of interaction among participants, the programme was organized around a few focus areas, viz. soft matter systems, biological assembly, mechanical behaviour and non-equilibrium processes in solids. Nucleation, patterning, glass transition and gelation in colloidal suspensions, self assembly in macromolecular solids, active aggregation in biological systems, viral self assembly, protein crystallization, DNA assisted assembly, fracture and earthquakes, solid state nucleation and microstructures are some of the topics that were represented. This conference was a sequel to the NAG2007 held at the JNCASR during Jan 29 - 31 2007.

The conference was followed by a school addressing the broader theme of nucleation, aggregation and growth phenomena going beyond the specific themes of the conference.

SPEAKERS & TITLES OF TALKS
LECTURERS IN THE SCHOOL

Biman Bagchi	Understanding nucleation phenomena at large metastability: New approaches to an old problem.
M Muthukumar	Polymer Crystallization: New Concepts and Implications
Richard Bowles	Competitive nucleation in nanoparticle clusters
Yashodhan Hatwalne	Chiral Symmetry Breaking in Polymer Crystallites.
K.P.N. Murthy	Bond fluctuating lattice polymer.
Subir Das	Nucleation and Growth in Binary Mixtures: Revisiting symmetric cases.

Srikanth Sastry	Crystal nucleation in supercooled liquid silicon.
A. Lemaitre	Elementary Mechanisms of Deformation in Amorphous Solids: From Zero to Low Temperature
Shankar Ghosh	Desorption to delamination: dynamics of detachment in a thin film
K.P.S.S. Hembram	Development and Modelling of Nano-structures
Asok Sen	Intriguing Growth/Breakdown Dynamics and Strong Memory Aspect in the RRTN Model of Many Complex Systems of nature
P.B. Sunil Kumar	Shear induced ordering in branched living polymer solutions
Achille Giacometti	Self-assembly mechanism in proteins and nanocolloids
Aijaz Dhar	Refolding of Bovine Serum Albumin by Gemini Surfactants via Artificial Chaperone Protocol
David Reguera	Nucleation at extreme supersaturations
Sanjay Puri	Aggregation and Growth in Granular Mat
Deepak Dhar	Pattern formation in fast-growing sandpiles
David Weitz	Nucleation and growth of hard-sphere colloidal
Steve Granick	Janus Clusters - from Birth to Death
Erika Eiser	Flying Colloidal Membranes: DNA-Driven Self-Assembly
Willem Kegel	Self - assembly of colloidal molecules
Paddy Royall	Local structure in nucleation of hard spheres in experiments and simulation
D. Thirumalai	Protein Aggregation: From Oligomers to Fibrils
Jayant Udgaonkar	Collapse and cooperativity in protein folding and unfolding reactions
B. Ashok	Dynamics of vesicular nanotubulation
Edward Peter A.	Bio-inspired Design of Hierarchically Structured Polymer Adhesives
Maitreyi Narasimha	The importance of cellular interfaces in patterning tissues
Madan Rao	Active Patterning on a surface: Asters, Rings and Spindle

CONFERENCE SPEAKERS

David Reguera	Classical theories of nucleation
Charusita Chakravarty	Computational methods for the study of nucleation
Surajit Sengupta	Solid state nucleation
D. Thirumalai	1. Topics in Protein folding. 2. Protein folding and aggregation
Erika Eiser	Introduction to colloidal matter Experimental techniques
Jayant Udgaonkar	1. Nucleation in protein folding 2. Mechanisms of amyloid fibril formation
William Kegel	1. Glass transition in colloidal hard spheres 2. Complex colloids: equilibrium clusters and colloidal molecules.
Sanjay Puri	Kinetics of Phase Ordering, Domain Growth and Coarsening I: Kinetic Ising Models and Phenomenological Models.
A. Lemaitre	Instabilities and growth phenomena in solids
P. B. Sunil Kumar	Molecular Organization on Cell Membranes
S. Ramaswamy	Active matter Collective behavior of driven particles in condensed matter systems and biology
Gautam Menon	Active Matter: Molecular Motors, the Cell Cytoskeleton and Active Gels

PARTICIPANTS

37 from India
3 from abroad

PROGRAMME	**GEOMETRY TOPOLOGY AND DYNAMICS IN NEGATIVE CURVATURE**
DATE	02 - 07 August, 2010
ORGANIZERS	C S Aravinda, F T Farrell, J F Lafont, S K Roushon and Joseph Samuel
VENUE	Raman Research Institute, Bangalore

PURPOSE

This was an ICM Satellite Conference.
The conference intended to bring together mathematicians working in various aspects of negative curvature (and more generally, non-positive curvature) and to expose/introduce interested research students in India to these exciting recent developments.

STRUCTURE

A public lecture by Prof. P.B. Eberlein was on 4th August focusing on the theme of the conference and an open problems session on 6th August. Prof. Ravi Kulkarni of IIT, Mumbai, delivered the valedictory address on 7th August, the last day of the conference.

SPEAKERS & TITLES OF TALKS

Martin Bridson	Rigidity for Out(F) and actions of higher-rank lattices on free groups
Emmanuel Breuillard	Approximate Groups
Pallavi Dani	Filling invariants at infinity
Anne Thomas	Lattices in complete Kac-Moody groups
Marc Bourdon	Quasiconformal geometry and coxeter groups
Indira Chatterji	Median spaces and property (T)
Etienne Ghys	On cutting cloth, according to Chebyshev
Marc Burger	Higher Teichmuller spaces: from SL(2,R) to other lier groups
Tom Farrell	Space of negatively curved metrices; bundles with negatively curved fibres
Uri Shapira,	Dynamics and continued fractions
Mahan Mj	On discreteness of commensurators
Jayadev Athreya	Cusp Excursions on Parameter Spaces
Jens Heber	Cocompact isometry groups in nonpositive curvature
Mladen Bestvina	Groups acting on quasi-trees
Yves Benoist	Invariant subsets of finite volume homogeneous spaces
Gerhard Knieper	New results on harmonic manifolds
Igor Mineyev	Systems of complexes and the Hanna Neumann Conjecture
Enrico Leuzinger	The asymptotic Schottky problem
Igor Belegradek	Moduli spaces of metrics of nonnegative curvature
Francois Labourie	An algebra of observables for cross ratios
Shahar Mozes	Stationary measures, stiffness and equidistribution on the tours
Nimish Shah	Counting points on circles in orbits of geometrically finite hyperbolic groups
Chris Connell, Viktor Schroeder	Rigidity for maps and measures on Foliated spaces

Dave Constantine	Rank rigidity and frame flow in non-positive curvature
Frederic Paulin	Equidistribution, counting and arithmetic applications in hyperbolic manifolds
Keith Burns	Ergodicity of the Weil-Petersson geodesic flow
Alex Gorodnik	Diophantine approximation and automorphic spectrum
Jean-Francois Lafont	4-dimensional locally CAT(0)-manifold with no Riemannian smoothing
Peter Linnell	Approximating Betti numbers over arbitrary fields
Darren Long	Small subgroups of SL (3, Z)
Gerard Besson	Collapsing irreducible 3-manifolds with nontrivial fundamental group
Tadeusz Januskiewicz	Complex links in Kahler polyhedral
Ravi Kulkarni	Valedictory address & Concluding session

PUBLIC LECTURE

Patrick Eberlein	Ergodic behavior in Negative curvature

PARTICIPANTS

47 from India
20 from abroad

PROGRAMME	**GALOIS REPRESENTATIONS IN ARITHMETIC AND GEOMETRY**
DATE	10 - 13 August, 2010
ORGANIZERS	Anupam Saikia, Chandan Singh Dalawat, R. Sujatha and John Coates
VENUE	International Centre, Goa

PURPOSE

One of the basic problems in mathematics is the description of the absolute Galois group G of the field Q of rational numbers. This group is so large and complicated that conjecturally all finite groups can be realized as its quotients. Arguments in Galois cohomology reduce many of the fundamental questions of arithmetic geometry to the study of G.

A fruitful approach to understanding this group is through its representations; the study of one-dimensional representations constitutes global class field theory. Some forty years ago, a vast programme aimed at understanding all representations of G was advanced. More recently, some very precise conjectures about the 2-dimensional representations of G were put forward. Major success has been achieved in the past decades in proving these conjectures through the combined efforts of several mathematicians. With the potential of further advances and application of the theory, for example in Langland's philosophy, the conference was meant to benefit young researchers and students. This conference also brought together some of the people who have made seminal contributions to these developments.

SPEAKERS & TITLES OF TALKS

R. Greenberg	Iwasawa Theory and Projective Modules
B. Khan	Zeta and L-function of Voevodsky motives
S. Zerbes	Wach modules and modular forms
M. Kim	Diophantine geometry and non-abelian cohomology
P. Schneider	Thee SK_1 problem for completed group rings
C. Breuil	Hilbert modular forms mod p and local-global compatibility in the reducible case
T. Saito	Hasse-Arf theorem in higher dimension
M. Kakde	Main conjecture for totally real field
C.S. Rajan	Spectrum and arithmetic
J.M. Fontanie	Vector bundle and p-adic Hodge theory
K. Kedlaya	Towards a relative theory of (phi, Gamma)- modules
M.F. Vigneras	On the modulo p Satake isomorphism with weight
T. Yoshida	Affine Hecke algebra and samistable reduction of shimura varieties
F. Nuccio	Congruences between p-adic L-functions
P. Colmez	On the p-adic local langlands correspondence
J.P. Wintenberger	Extensions of Iwasawa modules

PARTICIPANTS

14 from India
30 from abroad

PROGRAMME	**GEOMETRIC TOPOLOGY AND RIEMANNIAN GEOMETRY**
DATE	12 - 15 August, 2010
ORGANIZERS	Siddhartha Gadgil, Harish Seshadri and Basudeb Datta
VENUE	Indian Institute of Science, Bangalore

PURPOSE

This was an ICM Satellite Conference. The aim of the conference was to expose research students and working mathematicians in India to the state of the art in these fields, to facilitate them to take up research problems in these areas. The conference comprised of one hour lectures by leading mathematicians in the two areas as well as a few short lectures. More informal interactions were also facilitated.

SPEAKERS & TITLES OF TALKS

Gerard Besson	Ricci flow on open 3-manifolds
Michael Usher	Deformations in Morse and Floer theory and applications to Hamiltonian dynamics
Ronald J. Stern	Pinwheel Surgery
Gaetano Siciliano	Equivariant Implicit function theorem with low regularity and applications to geometrical variational problems

Toshiki Mabuchi	Donaldson TianYaus Conjecture and its extremal
Aaron Naber	Lower Ricci Curvature, Convexity and Applications.
Andras Stipsicz	Topological Heegaard Floer homologies
Ronald Fintushel	Exotic group actions on smooth 4-manifolds
David Gabai	Topology of Ending Lamination Space
Michael Boileau	On commensurability classes of hyperbolic knot complements:
Sucharit Sarkar	Knot cobordisms and knot Floer homology
Stefan Friedl	Four manifolds with a free circle action: symplectic structures and the complexity of surfaces
Ciprian Manolescu	A combinatorial approach to Heegaard Floer invariants
Ramesh Sharma	Three dimensional Sasakian metric as a Ricci soliton represents the Heisenberg group
Mahan Mj.	Pattern Rigidity
Michael Hutchings	New obstructions to symplectic embeddings in four dimensions
Fernando Coda-Marquez	Deformations of the hemisphere that increase scalar curvature
Huijun Fan	Geometry of Section-bundle system (SBS)

PUBLIC LECTURE

Michael Hutchings	The mysterious geometry of soap bubbles

PROGRAMME	**ALGEBRAIC AND COMBINATORIAL APPROACHES TO REPRESENTATION THEORY**
DATE	12 - 16 August, 2010
ORGANIZERS	S. Viswanath, K. N. Raghavan, Punita Batra, Upendra Kulkarni, Vyjayanthi Chari, Kailash Misra and S Viswanath
VENUE	Indian Institute of Science, Bangalore

PURPOSE

The ICTS programme on "Algebraic and Combinatorial approaches to Representation theory" was a satellite conference of the International Congress of Mathematicians (ICM). It was held at the National Institute for Advanced Studies (NIAS), IISc, Bangalore.

The academic focus of the conference was the representation theory of Kac-Moody Lie algebras, vertex algebras, quantum groups, Hecke algebras and related objects. The conference brought together some of the leading research mathematicians from India and around the world, working on various aspects of this theme.

STRUCTURE

There were 32 talks in all, which touched upon a broad spectrum of topics -quantum groups, crystal

bases, categorification, toroidal and multiloop algebras, geometric representation theory, vertex algebras, cyclotomic Hecke algebras, Kazhdan-Lusztig bases, to name a few. The approaches presented were diverse, employing algebraic, combinatorial as well as geometric techniques.

There were approximately 75 conference participants, with 40 from India and the rest from abroad. The participants from India included research mathematicians from various Indian universities, as well as several Ph.D and MSc level students. Seven of the speakers were from Indian institutes. Participants from abroad included 25 speakers, and several graduate students and postdocs from universities in the US, Sweden, France and Croatia.

The conference had many front-ranking mathematicians and was attended by a large number of students and faculty members from India. The participants benefited from an illuminating exposition and gained exposure to research talks on problems of current interest and the tools and techniques used to solve them. In all, it was an intense and motivating conference.

SPEAKERS & TITLES OF TALKS

Kashiwara	Crystal bases of the quantized queer super-algebra
Achar	The enhanced nilpotent cone
Savage	Hecke algebras and a categorycation of the Heisenberg algebra
Okado	X=M for large rank
Nakashima	Geometric and Unipotent Bicrystals and Polyhedral Realization of Crystal Bases
Lauda	A categorication of quantum sl(2)
Parameswaran	Holonomy Group Schemes of Smooth Projective Varieties
Hernandez	Simple tensor products and quantum affine algebras
Jakelic	Tensor products and blocks of nite dimensional representations of quantum affine algebras at roots of unity
Moura	On the Characters of Minimal Affinizations of Quantum Groups
Rao	Representations of Toroidal Lie algebras
Lau	Representations of twisted toroidal Lie algebras
Adamovic	On triplet vertex algebras and their representations
Subrahmanyam	Quantum deformation of the restriction of Glmn(C) to GLm(C) GLn(C)
Adsul	Uq(glm) Uq(gln)-deformations of GLmn(C)-modules
Khandai & Graham	Weyl Modules for Multiloop Lie Algebras, The Centre of the Ariki-Koike Algebra
Datt	The ring of twisted tilting modules for quantum groups
Neher	Finite-dimensional irreducible representations of equivariant map algebras
Helminck	Cartan subspaces
Loktev	Weyl modules beyond two-variable case
Bakalov	Singularities, root systems, and W-algebras
Greenstien	Quantum folding
Fourier	Another basis and pattern for irreducible An modules
Jing	Realizations of Classical Toroidal Algebras
Scott	New graded methods in representation theory
Mathas	Cyclotomic quiver Hecke algebras of type A
Du	Representations of Ane Quantum Schur Algebras
Raghavan	Kazhdan-Lusztig cells and RSK bases
Feigin	GM a degeneration of ag varieties
Cheng	Representation theory of classical Lie superalgebras and super duality
Prasad	Combinatorics of nite abelian groups and the Weil representation
Miwa	

PARTICIPANTS

38 from India
40 from abroad

PROGRAMME	**AUTOMORPHIC FORMS AND NUMBER THEORY**
DATE	14 - 17 August, 2010
ORGANIZERS	Eknath Ghate, Pierre Colmez, Wee Teck Gan, Dipendra Prasad, Kenneth Ribet and Vinayak Vatsal
VENUE	India International Centre (IIC), Goa

PURPOSE

The goal of the conference was to bring together experts in the areas of automorphic forms and related areas of number theory. The conference, in particular, concentrated on representation theoretic and p-adic aspects of the theory of automorphic forms.

SCHEDULE

There were 20 lectures during the 4 day conference, which was attended by about 60 mathematicians, out of which about 30 were from India and 30 from abroad. All the scientific programmes of the conference were held in one place, which allowed ample time for discussion among participants.

SPEAKERS & TITLES OF TALKS

H.Hida	Hecke : elds and L-invariants
F.Andreatta	p-adic modular forms via p-adic Hodge-Tate theory
G.Henniart	A Satake isomorphism for mod p representations of reductive groups over local elds
A.Raghuram	Eisenstein cohomology and special values of Rankin-Selberg L-functions
G.Boeckle	Lifting mod p Galois representations under non-smooth local condi- tions
M.Dimitrov	Automorphic symbols, p-adic L-functions and control theorems for Hilbert modular varieties
I.Badulsecu	Speh representations of linear groups
C.Moeglin	Langlands L-functions and cuspidal automorphic representations of
classical	groups
G.Savin	Some results on representations of metaplectic groups
W.Gan	Automorphic forms and representations on the metaplectic group
D.Savitt	Generalizations of Serre's Conjecture
G.Pappas	Modules and coecient spaces for Galois representations
G.Muic	Modular Curves and Bases for the Spaces of Cuspidal Modular Forms
Anandavardhanan	A local global question in automorphic forms
O.Offen	Unitary periods

A.Ichino	Formal degrees and local theta correspondence
C.Zhu	Archimedean multiplicity one theorems
H.Loke	Automorphic representations of the non-linear two fold covers of tori
H.Darmon	p-adic weak harmonic Maass forms

PARTICIPANTS

11 from India
25 from abroad

PROGRAMME	**APPLICATION OF CONTROL THEORY AND OPTIMISATION TECHNIQUES IN BIOCHEMICAL PATHWAYS**
DATE	16 - 18 August, 2010
ORGANIZERS	Somdatta Sinha, M. Vidyasagar
VENUE	Hyderabad International Convention Centre (HICC), Hyderabad, India

PURPOSE

Over the past 25 years, tremendous progress in measurement technologies has advanced our understanding of the workings of biological systems dramatically - especially the molecular processes underlying cellular functions. By the middle of last century, scientists had experimentally shown that specific biochemical reactions inside the cell can be described by small control circuits, which possess feedback regulation to optimally adjust making and breaking of biomolecules. With the present ability of researchers to make hundreds or even thousands of simultaneous experimental measurements for system-wide study of intracellular processes, it has now become apparent that concepts of control theory play a central role in the global performance of these self-regulating biochemical systems and is one of the active principles by which living systems operate.

Biochemical pathways in the cell are responsible for processing environmental signals, inducing appropriate cellular responses and regulating internal events such as gene expression. Through elaborate mechanisms, they allow cells and entire orgranisms to perform their basic functions. The key role played by feedback in life are manifested in the homeostatic control and regulation of biochemical pathways, which break down nutrients and provide the cell with energy and materials and their appropriate timing in functions. Control theory is concerned with designing strategies that ensure the robust performance of a system by automatically adapting to changes in the environment. Several mathematical tools based on control-theoretic thinking have already begun making a contribution in the understanding of the robustness and evolvability in designs of real biochemical pathways. Some examples are the theory of monotone input-output systems, feedback control theory, etc. Optimization techniques are increasingly being applied to study biochemical pathway as it is assumed that biological organisms generally optimize their metabolic pathways for growth. Such applications are useful in pathway engineering.

The meeting "Application of control theory and optimisation techniques in biochemical pathways" was conceived as an ICTS programme to bring together bioloigists and mathematicians working in the above areas. It was a satellite to the International Congress of Mathematicians in 2010, and was partially supported

by the Department of Science and Technology (DST), India. The meeting purported to explore the close analogies between biochemical regulatory networks and engineered automatic control systems. Feedback, which is a central theme in such analogies and the role of stochasticity, common in intracellular setting, is a feature to be explored in connection to fault-tolerant systems in pathways. The conference proposed to discuss relevant mathematical foundations and model systems from biology that would enhance the interdisciplinary discussions.

The conference was planned on the topic of modeling the structure and function of biochemical pathways using the mathematical and engineering concepts and methods. Internationally renowned researchers, students and young scientists from different disciplines, from mathematics, physics, engineering and mathematical/computational biology to information sciences and health sciences, participated in the conference. Of the 63 persons who had applied for the conference, only 39 were selected. Participants included 14 research workers and students from Hyderabad,20 from other places of India and 14 from abroad, including researchers from the USA, UK, Singapore, Denmark and Nigeria. A few researchers from the Tata Consultancy Centre (TCS) also attended the talks.

The programme consisted of 25 talks of which seven were plenary talks of 45 min each, three overview tutorial talks of 45-60min duration, ten 30 min research talks, and five 15 min student presentations.

SPEAKERS & TITLES OF TALKS

Somdatta Sinha	Biochemcial pathways – an overview
M. Vidyasagar	Overview of basic concepts in control and regulation for non engineer
Eberhard O. Voit	Control and Optimization of lignin biosynthesis in plant cell walls
Antonis Papachristodoulou	Modelling and Analysis Tools for Biochemical Networks
Srinivas Pentyala	Control and optimization of physiological output by modulating allosteric regulators
Lalit S Khot	Hybrid Cybernetic Modelling for studying the behavior of metabolic systems towards the variation of its environment
Bernhelm Booss	Bavnbek – Intra cellular control of insulin secretion
J Krishnan	A mathematical modeling framework for elucidating signal transduction underlying chemorepulsion
Thanneer M. Perumal	In analyzing the complex dynamics of biochemical pathways
Sunil Noothi	Control systems in medical practice
Pablo Parrilo	Optimization Techniques – A tutorial
Radhakant Padi	Optimal blood glucose regulation of diabetic patients using single Network adaptive critics
Mukund Thattai	Signal and noise in gene networks
K V Venkatesh	Design and analysis of multiple feedback loops using synthetic genetic constructs
Suguna Challa	Correlation of metabolic network structure of extremophiles to optimal growth temperature
Sudip Kundu	Predicting rice (oryza sativa) metabolism
Ram Rup Sarkar	Study if signling pathways using constrained – based modeling techniques
Sridharan Srinath	Parameter identifiability of metabolic network models
Rahul Shaw	Application of G-Inverse in search of reactions feasible to the metabolism of a species
Mogens Hogh Jensen	Genetic Oscillations and Feed backs in NFkB, P- 53 and Wnt systems
Sanjay Jain	Structure and dynamics of feedback in the large scale genetic regulatory network of E.coli
Philip K. Maini	Role of feedback in some models for tumour growth
Lakshmi Kiran Kanchi	Modelling and analysis of biochemical pathways of glucose metabolism and cell cycle

Varun Giri	Using network topology to optimize molecular production in an artificial chemistry model
Murti V. Salapaka	Systems approaches for study of motor proteins

PARTICIPANTS

30 from India
15 from abroad

PROGRAMME	**GROUPS, ACTIONS, COMPUTATIONS 2010**
DATE	1 - 12 September, 2010
ORGANIZERS	Manoj Kumar, Juergen Mueller and Siddhartha Sarkar
VENUE	Harish-Chandra Research Institute, Allahabad

PURPOSE

This programme combined a workshop and a conference that covered a broad range of modern and currently very active areas of the theory of finite groups, encompassing computational techniques as well as applications. In particular, general techniques for matrix and permutation groups, the classification of and computations with p-groups, an introduction to finite simple groups, and actions of finite groups on Riemann surfaces were addressed.

The programme had two parts:
The Workshop, held during September 01-09, 2010, consisted of five series of four two-hour lectures each, aiming at introducing graduate students and young post-doctoral researchers to these fields. In particular, guided practical instructions to the use of the computer algebra system GAP were included.

The Conference, held during September 10-12, 2010, had experts in the above fields presenting new and recent results at the frontiers of current research. The intention was to disseminate both results and current problems across the borders between the various specialties, as well as to develop deep interest in the younger participants in these fields.

SPEAKERS & TITLES OF TALKS
LECTURERS IN THE SCHOOL

Gareth Jones	Automorphisms of Riemann Surfaces
Müller	1. Introduction and overview 2. Introduction to finite simple groups
O'Brien	Algorithms for p-groups
Neunhöffer	Computational group theory
Vikas Jadhav	Primitive Central Idempotents in Rational Group Algebras of Finite Abelian p-Groups
Arun Muktibodh	Infinite Camina Groups and Some New Group Structures
Brajesh Sharma	Pseudo-Cohomology of certain Symmetric Spaces

Viji Z. Thomas	On the Box-Tensor Product and the Nonabelian Tensor Product of Groups
Mahender Singh	Extension and Lifting of Automorphisms in Group Extensions

CONFERENCE SPEAKERS

Charles Leedham Green:	Computing in Matrix Groups : Some of the tricks
Jon Carlson	Computing with Basic Algebras
O'Brien	The Ore conjecture
Ayan Mahalanobis	The MOR Cryptosystems
Sergey Shpectorov	Majorana Representations of Groups
N.S.N. Sastry	Geometries for Groups of Low Rank
R.P. Shukla	On Some Sp(4,q)-modules
Rajat Kanti Nath	Commutativity Degree, its Generalizations and Classification of Finite Groups
Said Sidki	Around certain Experimentations in Combinatorial Group Theory
Akos Seress	Polynomial-time Theory of Matrix Groups
I.B.S. Passi	Hyperbolic Unit Groups
Ercan	A Fitting Length Conjecture without the Coprimeness Condition
Neunhöffer	Generalisations of Small Cancellation Theory
Gurmeet Bakshi	Computing the Wedderburn Decomposition of Finite Group Algebras
D.N. Verma	An Elementary Fresh Look at Representations of the Symmetric Groups; the Old Winein Lie-theorist's Vintage Bottle
Bill Unger	Constructing Representations
Felix Noeske	Computational Aspects in Local Representation Theory
Kay Magaard	Generating Systems for Quasi-simple Groups with an Application to Beauville Surfaces
Ashish Das	On Solutions of a Class of Equations in a Finite Group
Ramji Lal	Topological Gyrogroups, Gyrotransversals and Their Deformations
Müller	On p-Groups of Gorenstein-Kulkarni Type
Ravi Kulkarni	Dynamical Viewpoint and Group Representations

PARTICIPANTS

39 from India
4 from abroad

PROGRAMME	**ADVANCED SCHOOL ON LIVING MECHANICS – CELLS, TISSUES AND ORGANISMS**
DATE	28 October, 2010 - 08 November, 2010
ORGANIZERS	GV Shivashankar, Alexander Bershadsky, Maithreyi Narasimha, Madan Rao and Sriram Ramaswamy
VENUE	National Centre for Biological Science, Bangalore

PURPOSE

"Mechanical signaling" has emerged as an important regulator of cell biology and physiology. Forces, flows and vibrations can have remarkable influence on the properties of molecules (conformation and activity), cells (morphology, gene expression, fate), tissues and organs (form and function). How mechanical stimuli are generated, sensed and transduced in living systems and what their outcomes are on development and disease; are questions that are intrinsically interdisciplinary and have captured the interests not just of biologists but also engineers, mathematicians and theoretical physicists. They have necessitated the development of precision tools (optical, magnetic traps, nanopatterned and pressure sensitive substrates, high resolution imaging) to generate, measure or infer forces acting on living matter and observe their influence; a new way of thinking about and tinkering with old problems for the biologist (molecules as force sensors, generators or transducers) and an opportunity for interactions with theoretical physicists and mathematicians (rate equations phase diagrams, multiscale models, energy landscapes and networks describing mechanically driven living systems).

This programme brought together leading researchers engaged in understanding the active mechanical principles regulating an amazing diversity of biological systems over a variety of length scales (artificial membranes, single cells, tissues growing in their native context or on engineered substrates, pumping organs and whole animals) using experimental and theoretical interdisciplinary approaches. Its aims were threefold: i) training a broad group of students and postdoctoral researchers, especially from India, in this area at the interface of biology and the physical sciences and engineering; ii) informing about the most recent advances in this young and rapidly growing area and iii) nucleating an interest group in this area.

It included two kinds of talks: 75 minute presentations that combine pedagogy and research and 45 minute seminars which focused primarily on the speakers' latest results. The schedule also enabled leisurely and detailed scientific interactions over extended poster and discussion sessions. The programme expected to have approximately 40 speakers from around the world covering all aspects described above and around 50 students (chosen on the basis of a statement of purpose and recommendations) participating in the school. The school was conducted for two weeks,which, given its focus, intensity and timelines provided enough time to accomplish our objective.

SPEAKERS & TITLES OF TALKS

Thomas Lecuit	The subcellular mechanics of tissue morphogenesis
Gautam Menon	Motor-Microtubule Interactions: Transport and Pattern Formation
Upi Bhalla	Traffic rules
Ewa Paluch	Blebs, actin cortex mechanics and cell shape stability during cytokinesis
Maithreyi Narasimha	Good fences make good neighbours: On the importance of interactions at cellular interfaces in spatially patterning tissues

Ranjith Padinhateeri	Role of ATP-hydrolysis in the dynamics of actin filaments
Sriram Ramaswamy	Hydrodynamics of Active Matter (Friday Colloquium)
Debashish Chowdhury	Stochastic kinetics of molecular motors: from single-molecule enzymology to single motor mechanics
Roop Mallik	Stretching the Endosome A story of two Motors
Daniel Fletcher	Spatial organization of the actin cytoskeleton
Mohan Balasubramanian	Making Cell Division Machines
Srikanth Sastry	Energy landscape notions in the study of dynamics and mechanical response of condensed matter and biological systems
Ramaswamy Krishnan	Cellular mechanosensing: Fragile yet forceful
Alexandar Bershadsky	Crosstalk between cell adhesion and the cytoskeleton in regulation of cell shape and locomotion
Michael Kozlov	Modeling membrane shaping, fusion and fission by proteins
Martin Schwartz	Fluid shear stress signaling in atherosclerosis
Alexander Verkhovsky	Force transmission in migrating cells
C. T. Lim	Biomechanistic Insights into the Pathophysiology of Human Diseases
Michael Sheetz	Cell Mechanosensing by Protein Stretching Again & Again
GV Shivashankar	Nuclear mechanics & genome regulation
Linda Kenny/Ganesh	Complex Regulation by and of Two Component Systems
Anand /Yan Jie	Single-molecule studies of bio-molecular mechanics and interactions
Assaf Zemel	Cell shape, spreading symmetry, and the polarization of stress-fibers in cells
Thorsten Wohland	Fluorescence Correlation and Cross-correlation Spectroscopy
Fred MacKintosh	Active fluctuations and self-assembly in the cytoskeletal networks
Joe Howard	Beating of cilia and flagella
Paul Matsudaira	Structure and Mechanics of Tissue Migration
Emmanuel Farge	Mechanical Induction in Embryonic Development and Tumor Progression: Integrative Cues through Molecular to Multi-cellular Interplay
Rob Parton	New insights into the formation and function of caveolae
Ludger Johannes	Membrane invagination and scission in the clathrin-independent endocytosis of bacterial toxins and polyoma viruses
Pierre Sens	Cell motility and cytoskeleton fragility
Patricia Bassereau	Role of membrane curvature in membrane trafficking: a physical approach
Jay Groves	Spatial organization and the mechanics of signal transduction in cell membranes
Satyajit Mayor	Active remodeling of cortical actin regulates spatiotemporal organization of cell surface molecules a new paradigm for the construction of membrane domains in living cell membranes
Aurelien Roux	Mechanics of endocytosis: how proteins bend and break lipid membranes
Pramod Pullarkat	Mechanical properties of cells
Kundan Sengupta	Nuclear topology and transcriptional consequences of Aneuploid chromosomes
Shamik Sen	
Chaitanya Athale	
Namrata Gundiah	
Madan Rao	
Richa Rikhy	
Kripa Gowrishankar	

SPEAKERS FOR ORAL PRESENTATIONS

Dipanjan Bhattacharya
Adam Smith
Soumya Gupta
Shefali Talwar
Abhishek Kumar
Venkatesan Iyer
Shovamayee Maharana
Meghana C
Jan Bruges

PARTICIPANTS

64 from India
7 from abroad

PROGRAMME	**SCHOOL ON UNDERSTANDING MOLECULAR SIMULATIONS: THEORY AND APPLICATIONS**
DATE	03 – 13 November, 2010
ORGANIZERS	Amalendu Chandra, M. Ranganathan, N. N. Nair, Srikanth Sastry and Surajit Sengupta
VENUE	Indian Institute of Technology, Kanpur

PURPOSE

Molecular Simulations have become a very useful tool to analyze various phenomena in physical, chemical and biological systems. With the advent of better computational facilities, there has been a significant push towards a molecular level analysis. Many complex problems in condensed matter systems like protein folding are regularly investigated using molecular simulation techniques. This school aimed to provide the conceptual foundations and working knowledge of molecular simulations. The participants were also exposed to programming and other technical aspects of molecular simulation. In addition, applications ranging materials to biology were proposed to be showcased.

STRUCTURE

The ten day programme included lectures, tutorial and hands-on computer training sessions conducted by the experts in the field. The school also helped the young researchers and students go beyond the usual curriculum of molecular simulation and statistical mechanics practised in academic institutions.

SPEAKERS & TITLES OF TALKS

Daan Frenkel	Lecture
	i) Statistical Mechanics
	ii) Molecular Dynamics
Subir Das	Tutorial - Statistical Mechanics
	Lecture - Nonequilibrium MD simulation
S. Sastry	Tutorial

	i) Statistical Mechanics
	ii) Molecular Dynamics
S.Basu	Lecture - MD Amorphous Polymers
N.Nair	Computer Tutorial/Hands-on session - Molecular Dynamics
A. Chatterjee	Lecture - Monte Carlo Simulations
	Lecture - Advanced MC Simulations
	Computer Tutorial/Hands-on session – Parallelization
R. Madhav	Lecture - Data Analysis
	Computer Tutorial/Hands-on session - Monte Carlo Simulations
	Computer Tutorial/Hands-on session - MC- Advanced
S. Balasubramanian	Lecture - Interaction Potentials
	Tutorial - Interaction potentials
N. Nair	Tutorial - Programming Methods
	Computer Tutorial/Hands-on session - Advanced MD simulations
	Computer Tutorial/Hands-on session - Parallelization
J.K. Singh	Lecture - Monte Carlo simulations
	Computer Tutorial/Hands-on session - Monte Carlo simulations
S. Yashonath	Lecture
	i) MD of crystal structure transformations
	ii) Parallelization
	Computer Tutorial/Hands-on session - MD of crystal structure transformations
S. Sengupta	Tutorial - Finite Size effects
	Lecture - Finite size scaling
P. Apte	Lecture - Free Energy Calculations
A. Chandra	Computer Tutorial/Hands-on session - Advanced MD simulations
P. B. Sunil Kumar	Lecture
	i) MC- Advanced
	ii) Parallelization
S. Vemparala	Lecture - Biological Applications
	Computer Tutorial/Hands-on session -Biological Applications
R. Sankararamakrishnan	Lecture - Biological Applications
	Computer Tutorial/Hands-on session - Biological Applications
Brajesh Pandey	Lecture - Cluster Hardware
N. Nair/A. Chandra	Lecture - Future of MD simulations
DEP	Cluster Hardware Future of MD

PARTICIPANTS

76 from India

PROGRAMME	**NUCLEON-NUCLEON INTERACTION AND NUCLEAR MANY-BODY PROBLEM**
DATE	18 - 27 November, 2010
ORGANIZERS	Rajeev S. Bhalerao, Nilmani Mathur, Indranil Mazumdar, Subrata Pal, Amit Roy and Anthony W. Thomas
VENUE	Tata Institute of Fundamental Research, Mumbai

PURPOSE

This programme aimed to review the exciting new developments in our knowledge of the nucleon-nucleon (N-N) interaction and its applications to the nuclear many-body system. Nuclear Physics is undergoing a renaissance with the advent of new theoretical methods and several new experimental facilities. This programme was an effort to provide a common platform to the leading experts in the world for in-depth discussions and exchange of ideas. The primary topics of discussion pertained to different approaches to understand the N-N interaction, few-body problems in nuclear physics, nuclear physics with polarized beams and targets, no-core shell model, nuclear physics of neutron stars and electron scattering and photo-absorption reactions.The first four days of the programme were devoted to introductory and pedagogical lectures for Ph.D. students followed by more advanced lectures and discussions in the remaining days.

SPEAKERS & TITLES OF TALKS

R.K. Bhaduri	1. The two-body problem of trapped ultra-cold atoms
	2. Three-body problem and the Efimov effect - I
V.S. Bhasin	2-Body & 3-Body Scattering
S. Chakrabarty	Nuclear Physics of Neutron Stars
J. Vary	1. Realistic NN and NNN interactions and the nuclear single-particle basis
	2. Lab initio No Core Nuclear Structure Progress and Plans
	3. Ab initio nuclear theory -- recent progress and future prospects
E. Epelbaum	1. Effective field theory and nuclear forces
	2. Nuclear forces and light nuclei: recent developments
R. Machleidt	Have we finally cracked the nuclear force problem?
T. Clegg	Puzzling Over the Mysteries of the Few Nucleon Force
V. Belyaev	New nuclear clusters
F. Gross	Covariant Spectator Theory of nuclear forces
A.N. Mitra	Proton Dynamics with Direct qqq Force
V. Efimov	Giant Few-body Systems
A.R.P. Rau	Universal 1/r^2 potentials at short and long range in quantum physics
J.M. Richard	Model independent constraints on spin observables
L.D.Faddeev	Subramanian Chandrasekhar lecture:
	1. What Modern Mathematical Physics should be: A point of view
	2. Knot like solitons in 3-D world and their place in HEP and condensed matter theory
H. Weller	Nuclear Physics with Polarized rays Between 2 and 160 MeV
R. Schwengner	Study of dipole strength distributions at the ELBE accelerator
H. Arenhovel	Polarization observables and sum rules for electromagnetic reactions on the deuteron

A.K. Jain	Conservation of Isospin in the Fission of Heavy Nuclei
C. Elster	Few-Body Calculations in three dimensions?
A.W. Thomas	The effective hadron-hadron interaction in medium
S. Beane	Nuclear physics in the era of lattice QCD
T. Doi	Hadron-Hadron Interactions from Lattice QCD
H. Shimizu	Quark Nuclear Physics with a Photon Beam at Elphs Lab
S. Gupta	The phases of baryonic matter
S. Bhattacharya	Thermonuclear X-ray bursts from neutron stars
D. Bandyopadhyay	Neutron Stars : from the crust to the interior
R. Johnson	Theory of cross-section and polarization effects in A(d,p)B reactions with radioactive ion beams
E. Cunningham	The role of the N-N Tensor force and nuclear structure in intermediate energy nucleon-nucleus elastic scattering.
E. Piasetzky	High-Momentum components of the nuclear wave function: short range correlations, EMC effect, and the tensor part of the N-N Interaction
S. Kailas	Microscopic Optical Model Potential for Proton â€" Nucleus Interaction
S. Kistryn	Precision Studies of Three-Nucleon System Dynamics: Coulomb Force Effects in the Deuteron-Proton Breakup
R. Shyam	Hadronic and Electromagnetic Interactions as Probes for Strongly interacting matter

PARTICIPANTS

82 from India
24 from abroad

PROGRAMME	**ICTS CONDENSED MATTER PROGRAMME 2010**
DATE	12 - 23 December, 2010
ORGANIZERS	Arun Paramekanti, H. R. Krishnamurthy, Kedar Damle, Krishnendu Sengupta, Pratap Raychaudhuri, R. Shankar, Subroto Mukerjee, Vijay Shenoy, Vikram Tripathi and T. V. Ramakrishnan
VENUE	Infosys Campus, Mysore

PURPOSE

The main part of this programme was the 8-day Mysore Condensed Matter School. The first half of the school was conducted from Dec 13 to Dec 16, and the second half from Dec 19 to Dec 22. Each half of the school featured 3 lecture courses of 5 lectures each, which were held in the mornings. Afternoons were largely free for discussion, except for colloquia on topics related to the focus areas of the school. The intervening two days (Dec 17 and Dec 18) were devoted to a Condensed Matter Conference. Various researchers from India and abroad presented seminar on topics related to the theme of the school.

The topics of the lecture series along with the names of the instructors is given below.

• Dynamics of quantum systems - Diptiman Sen (IISc)

- Mott insulators - T. Senthil (MIT) and Mohit Randeria (Ohio State University)
- Heavy fermions - Piers Coleman (Rutgers University)
- Topological insulators - Ashvin Vishwanath (UC Berkeley)
- Cold atoms and Feshbach resonances - Leo Radzihovsky (U. Colorado, Boulder)
- 1D systems - Leonid Glazman (Yale University)

REPORT

The feedback obtained from the students and postdocs suggests that they benefitted as much from the pedagogical lectures as from the opportunity to interact with the lecturers and other speakers. The combination of school lectures and conference talks achieved the intended goal of exposing the students to the fundamentals and latest developments in the frontier areas of research in condensed matter physics.

SPEAKERS & TITLES OF TALKS

Andrew Green	Are itinerant electron quantum critical points intrinsically multi-critical?
Vivek Aji	Local quantum criticality
David Logan	Electronic transport in carbon nanotube quantum dots
Bruce Normand	Dynamics and thermodynamics of the two-chain spin ladder: theory and experiments in BPCB:
Diptiman Sen	Dynamics of quantum many-body systems
T. Senthil/ M. Randeria	Doped Mott insulators
Sudipta Bandopadhyaya	Study of magnetic properties of Mn doped ZnO samples
Lara Benfatto	Recent developments on the Kosterlitz-Thouless theory in quasi-2D superconductors
Fabien Alet	Short-range Valence Bond physics : old wave-functions, new results
Nicolas Dupuis	Non-perturbative renormalization-group approach to the Bose-Hubbard model
Sankalpa Ghosh	Ultra cold atoms in optical lattices in presence of artificial magnetic field
Karlo Penc	Ordering in SU(N) Heisenberg models
R. Ranganathan	A need for single unique mechanism for the phenomenon of Negative Thermal Expansion in solids
Daniel Podolsky	The longevity of Higgs oscillations in condensed matter
Sumathi Rao	Spin-polarised scanning tunneling microscopy of helical Luttinger liquids
Premi Chandra	The J1-J2 Model, Nematic Fluctuations and the Pnictides
Carlos Lobo	Metastability and Decay Processes in Fermi Gases
Arghya Taraphder	The curious case of 2H-TaSe2: revisiting the transition metal dichalcogenides
Arnab Sen	Fractional spin textures in a classical spin liquid
Indranil Paul	Interplay of magnetic structural transitions in iron-based superconductors
Ravindra Bhatt/Keith Slevin	Critical parameters from generalised multifractal analysis at the Anderson transition
David Pekker	Ultracold Atoms
S. Ganapathy	Spectroscopy of novel electron solid phases
Rajesh Narayan	Infinite randomness and
Piers Coleman	Heavy Fermions
Goutam Dev Mukherjee	Solids under extreme conditions of pressure and temperature
Surendranath Mishra	Lattice size induced local moment formation - some studies with nuclear method
Subhasis Sinha	Ultracold atoms in the presence of synthetic gauge field
Priya Mahadevan	Should increased delocalization destabilize charge ordering?
Ganpathy Murthy	Quantum Hall Bilayer at nu=1 in a Periodic Potential
Ashvin Vishwanath	Topological Insulators
Bimalandu Deb	Controlling Atom-Atom interactions in cold Atoms by laser and static Electric fields
Ying Ran	Z2 spin liquid in the Hubbard Model on Honeycomb lattice

Sugata Ray	Electron correlation and Disorder
Leonid Glazman	One Dimensional quantum liquids
Leo Radzihovsky	Cold Atoms and Feshbach Resonances
Sushanta Dattagupta	1. Decoherence due to telegraph noise in an Aharanov-Bohm ring 2. Landau-Ginzburg study of domain structure and dynamics in ferrelectric films
Sourin Das	Spin quadrupoletronics: moving spin anisotropy around
Indra Dasgupta	Strongly correlated systems: Role of Spin-Orbit interaction
Subhabrata Dhar	Ferromagnetism in lightly Gd doped GaN: The role of defects
Roderich Moessner	Irrational charge
Amit Dutta	Quantum criticality and fidelity susceptibility
Nic Shannon	Quantum Ice
Aashis Clerk	
Prabuddha Chakraborty	
Pascal Simon	
Sudhanshu Mandal	
Arindam Ghosh	
Aveek Beed	
Sanjay Sarkar	

PARTICIPANTS

95 from India
7 from abroad

PROGRAMME	**SCIENTIFIC DISCOVERY THROUGH INTENSIVE DATA EXPLORATION**
DATE	02 - 11 February, 2011
ORGANIZERS	Amit Apte, Vivek Borkar, Vijay Chandru, Ravi Kannan, Ravi S. Nanjundiah, Roddam Narasimha and J. Srinivasan
VENUE	JNCASR, Bangalore

PURPOSE

There has been an explosion of data available for scientific investigations, generated through observations, new experiments, and numerical simulations. At the same time, there are sophisticated models of complex systems, based partially on physical principles, but increasingly also based on the data. The main aim of the meeting was to bring together researchers who work on understanding the interplay between data, theories and models to resolve scientific questions.

The programme had four keynote presentations and about twenty invited presentations by eminent researchers such as Tim Palmer, Michael Mahoney, Tony Cass, Ian Foster, Alok Choudhary, Srinivas Aluru, Ravi Kannan, Umesh Waghmare, and many others. They represented the following fields of research which make essential use of large data sets.

1. Computer science and statistical methods
2. Life and health sciences

3. Earth sciences
4. Astronomy
5. High energy physics
6. Materials science and chemistry

There was enthusiastic participation from the industry as well as government labs. CDAC, CRL, GE, Infosys, IBM, Microsoft, Intel participated. There was a special session highlighting the work being done by the industry in the field of research using large data. A session was organized for the student participants to present their work. The participants presented a broad spectrum of problems ranging from bio-sciences to oceanography.

There were two panel discussions,"Development and Deployment of Infrastructure for Scientific Computing in India,'' chaired by N. Balakrishnan (IISc) and on "Computational Genomics,'' chaired by Niranjan Nagarajan (Genome Institute of Singapore).

There was a general consensus on (i) the inadequacy of the existing computational infrastructure for research using large data, and (ii) the necessity of a comprehensive plan for developing such an infrastructure, as well as trained manpower which is most important for the effective use of data. Many essential recommendations had emerged from this meeting, which are listed in programme website (see http://www.icts.res.in/media/uploads/Programme/Files/ICTS_DataSciReport_2011.pdf) had been proposed for implementation.

PANEL DISCUSSION ON COMPUTATIONAL GENOMICS

This special panel discussion followed after the talk by Niranjan Nagarajan "Data integration in Computational Biology.'' It was organized to provide a forum for conference attendees and expert panelists to debate and discuss issues regarding computational challenges in biology and genomics and the unique role that Indian engineers and scientists can play in this increasingly data-intensive field. The panelists were Prof. Sowdhamini of NCBS-TIFR, Bangalore, Prof. Nagasuma Chandra of IISc, Dr. Hariharan of Strand Life Sciences, Bangalore, Dr. Nagarajan of Genomics Institute of Singapore, and Prof. Aluru of Iowa State University.

The discussions began with a brief introduction of the panelists and their areas of interest - Prof. Sowdhamini and Prof. Chandra being biologists who have increasingly relied on computational tools for their work; Dr. Hariharan providing an industrial perspective and Dr. Nagarajan and Prof. Aluru the perspective of academics who work extensively in computational genomics. Some of the topics discussed included, modes of interaction for computer scientists and biologists in the field, role of multi-level modelling ideas in genomics, the lack of adoption of parallel algorithms as a solution to challenges in computational biology, and funding modes in Indian science. Overall, the panelists felt that the discussions were thought-provoking and made the session more interactive.

PANEL DISCUSSION ON "DEVELOPMENT AND DEPLOYMENT OF INFRASTRUCTURE FOR SCIENTIFIC COMPUTING IN INDIA"

This panel discussion was part of the ICTS programme ``Scientific discovery through intensive exploration of data'' which was held during 02-11 February 2011: Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore.

The aim of this second panel discussion was to explore the special scientific computing and infrastructure requirements of scientists in India working on the data intensive sciences. The broad areas include Atmospheric Sciences, Biological Sciences, Physics and Astrophysics. The infrastructure that is being referred to includes 1) hardware, software, and services for scientific computing, modeling and simulation, 2) management of large databases including mirroring of large public databases available in different countries around the world, and 3) dedicated high-speed networks to interconnect all of these.

The panelists were -

1. Prof. N. Balakrishnan, IISc, Bangalore: Panel Chair
2. Dr. Sharat Babu, CDAC, Bangalore
3. Dr. Tony Cass, CERN, Geneva
4. Dr. Leena Chandran-Wadia, ORF, Mumbai
5. Dr. Gregory Cole, GLORIAD, Tennessee, U.S.A
6. Dr. Vasant Jain, GE, Bangalore
7. Prof. E.D. Jemmis, IISER, Thiruvananthapuram
8. Prof. Nagasuma Chandra, IISc, Bangalore
9. Dr. A. Paventhan, ERNET, Bangalore
10. Dr. Satyendra Rana, TCRL, Pune
11. Dr.Yogish Sabharwal, IBM, Bangalore

The discussion was convened by Amit Apte (CAM-TIFR), Leena Chandran Wadia, ORF, Mumbai and Ravi S. Nanjundiah IISc, Bangalore.

The panelists and other participants discussed various aspects of computational and network infrastructure with specific emphasis on

- Shared and local Infrastructure
- Role of government bodies
- Role of industry
- Entrepreneurship
- Training and capacity building efforts

The specific recommendations arising out of this discussion can be found on programme website (see http://www.icts.res.in/media/uploads/Programme/Files/ICTS_DataSciReport_2011.pdf)

SPEAKERS & TITLES OF TALKS

Tony Cass	Keynote lecture: Worldwide Data Distribution, Management and Analysis for the LHC Experiments
Vijay Natarajan	Based Methods for Visualization
Vijay Chandru	Intelligence in the Era of Data intensive life sciences
Michael Mahoney	Keynote lecture: Algorithmic and statistical perspectives on large-scale data analysis
Soumen Chakrabarti	1. Annotating, indexing and searching the Web of objects, attributes and relations 2. Learning to rank in vector spaces and social networks
Gyan Bhanot	How the availability of large data sets is enabling discovery in clinical cancer biology and population genetics: two case studies
Ravi Kannan	Sampling on the Fly
Umesh Waghmare	Multi-scale modeling and simulations of ferroelectric phase transitions
Yashwant Gupta	Some Challenges in Signal Processing and Computing in Astrophysics
P. P. Divakaran	Yuktibhasha and the Origins of Calculus
Alok Choudhary	High performance data mining: an essential paradigm for knowledge discovery
Niranjan Nagarajan	1. Biology as a data-driven science: from a trickle to a flood 2. Data integration in computational biology - can we be hypothesis free?
Tim Palmer	Keynote Lecture: Uncertainties in Predicting our Future Weather and Climate - From Inadequate Data to Fundamental Physics
Ian Foster	Keynote Lecture: What the cloud really means for science
Ramesh Hariharan	Sequencing the Genome and what it tells us

Ram Sasisekharan	Data Management, Integration and Mining strategies for Glycomics – A rapidly evolving paradign in the post-Genomics Era
Sandeep Sirothia	1. Astronomy: A multidimensional view 2. TIFR GMRT Sky Survey - A Case Study
Srinivas Aluru	Next-gen sequencing: Data intensive com- puting in Biosciences
Andreas Dress	Topological Proteomics
Jayant Haritsa	1. Mutating Database Engines to be Bio-friendly 2. Indexing Techniques for Biological Data
Vipin Chaudhary	Data Intensive computing architecture and discovery initiative
G. Bala	Climate modelling and the challenges in dealing with massive datasets

PARTICIPANTS

55 from India
2 from abroad

PROGRAMME	**ASIAN SCHOOL ON LATTICE FIELD THEORY**
DATE	14 - 25 March, 2011
ORGANIZERS	Sinya Aoki, Saumen Datta, Rajiv Gavai, Sourendu Gupta, Shoji Hashimoto, Kazayuki Kanaya, Nilmani Mathur, Atushi Nakamura
VENUE	TIFR, Mumbai

REPORT

This school aimed to cover a variety of topics in modern day lattice field theory. Important basic topics were covered in extensive courses, while shorter courses pertained to newly developing techniques and methods. It was beneficial to doctoral students at all levels of their research work.

SPEAKERS & TITLES OF TALKS

R. Narayanan	Chiral Fermions on the Lattice
M. Peardon	1. Correlation Functions and Noise Reduction Methods 2. Hadron Spectroscopy on the Lattice
K. Ishikawa	Fermions, Algorithms and Parallelization
Pushan Majumdar	Multilevel Algorithms
S. Aoki	Baryon Interactions on the Lattice
Saumen Datta	1. Large Nc gauge theories 2. Correlation Functions at Finite Temperature
K. Kanaya	Finite Temperature QCD on the Lattice
F. Sugino	Supersymmetry on the Lattice
A. Nakamura	QCD at finite chemical potential on the lattice
N. Mathur	Excited baryons, mesons and exotics on the Lattice

STUDENT SEMINARS

Santanu Mondal	Various aspects of chiral anomaly in lattice QCD with Wilson-like Fermions: finite volume and cutoff effects
Debashish Banerjee	Quasi-static probes of the QCD plasma
Parikshit Junnarkar	Strangeness content of the proton from lattice QCD
Michael Lujan	Electric polarizabilities from lattice QCD
Sayantan Sharma	Computing higher-order susceptibilities in QCD
Indrakshi Raychowdhury	Prepotentials for SU(3) Lattice Gauge Theory
H. Saito	Phase structure of finite temperature QCD in the heavy quark mass region
Taichi Kawanai	Charmonium-nucleon interaction from lattice QCD
	The QCD Phase Diagram

PARTICIPANTS

18 from India
20 from abroad

PROGRAMME	**RADIATIVE CORRECTIONS FOR THE LHC: 1. ADVANCED SCHOOL**
DATE	04 - 11 April, 2011
ORGANIZERS	Rahul Basu, Prakash Mathews, Andreas Nyffeler and V. Ravindran
VENUE	Saha Institute of Nuclear Physics, Kolkata

REPORT

The era of the Large Hadron Collider (LHC) at CERN, Geneva has begun. While the LHC detectors will be able to measure fundamental scattering reactions with unprecedented experimental precision, it is clear that the interpretation of these high-quality data demands an equally high precision in the theoretical predictions. In order to connect the observed phenomena with the underlying theoretical models, one needs a precise understanding of the involved processes at the quantum level. Since the Standard Model and most theories of New Physics are quantum field theories, one has to reliably calculate processes with many external particles and also include loop corrections from strong and electroweak interactions and from within the New Physics scenarios.

The main objective of the programme was to develop expertise in India and getting young researchers from India interested in the subject of radiative correction which is at the forefront of current international research and is particularly relevant for the experiments carried out at the LHC. The advanced school introduced the students to the basics and more advanced topics of this subject by means of pedagogical lectures, tutorials and hands-on computer sessions. The J.C. Bose Memorial Lecture, a public lecture, entitled QCD for the LHC, was delivered by Prof. Keith Ellis. Later, some of the students were also invited to attend the RADCOR 2011 symposium. The RADCOR symposium is an international meeting which takes place every two years in Europe, USA or Asia and takes stock of the recent developments in the application of quantum filed theory to particle physics phenomenology. At RADCOR 2011, the latest results in the field of radiative corrections were presented by expert from

leading research institutions and universities around the world. Also, some of the young scientists from India had an opportunity to present their recent work.

The programme received logistic and administrative support from HRI, SINP and IMSc.
The school was well attended and had 54 registered participants (inclusive of the lecturers): 32 were students and postdocs: 15 were faculty participants, and 7 were lecturers. Most participants came from all over India and two of the lecturers and three students came from abroad. There were 35 participants from outside the city of Kolkata and rest from the various institutions in Kolkata.

SPEAKERS & TITLES OF TALKS

Sunanda Banerjee	Inaugural Talk
Andreas Nyffeler	Basics of perturbative QCD
V. Ravindran	QCD radiative corrections to scalar particle production at Hadron Colliders
Suvrat Raju	On-shell methods in Quantum Field Theory for tree-amplitudes
Rikkert Frederix	Advanced methods for radiative corrections at the LHC (Part-2)
Keith Ellis	1. Modern tools for Collider predictions in QCD: Calcutta lectures
	2. J.C. Bose Lecture: QCD for the LHC
Anuradha Misra	Introduction to Resummation at colliders
Rajesh Gopakumar	AdS/CFT and applications to scattering amplitudes in gauge theories

PARTICIPANTS

48 from India
6 from abroad

PROGRAMME	**INTERNATIONAL SCHOOL ON TOPOLOGY IN QUANTUM MATTER**
DATE	29 June - 13 July, 2011
ORGANIZERS	J. K. Jain, H. R. Krishnamurthy, R. Shankar and V. Shenoy
VENUE	Indian Institute of Science, Bangalore

REPORT

One of the most exciting developments in recent years has been the appreciation of the role of topology in quantum condensed matter, which provides fundamental insight into measurable quantities that are insensitive to details. This summer school consisted of mini-courses on the concepts in mathematical topology, quantum Hall effect, topological insulators and topological quantum computation. The lecturers were renowned scientists involved in forefront research in these areas. There were several colloquia on related topics and also included a public lecture by Klaus von Klitzing, discoverer of the Quantum Hall Effect and winner of the 1985 Nobel Prize in Physics.

The school was aimed at students who were interested in pursuing research in physics. Though it was expected that the students have an earlier exposure to elementary quantum mechanics, an attempt was

made to keep the course as self contained as possible by including a substantial amount of preparatory material during the first week. The lectures were followed by home assignment problems and tutorials.

SPEAKERS & TITLES OF TALKS

Nitin Nitsure	Mathematical Concepts in Toplology
Diptiman Sen, R. Shankar	Preliminary Physics Concepts
R. Shankar	Mathematical Concepts in Toplology (Tutorial)
S.R. Hassan	Preliminary Physics Concepts (Tutorial)
J. Jain	(Colloquium)
Jainendra Jain	Quantum Hall Effect (Lecture)
Shun-Qing Shen	Topological Insulators (Lecture)
K. Von Klitzing	1. Public Lecture - How long is 1 meter? From ancient length units to modern concepts in metrology 2. Colloquium - 30 years of quantum Hall effects
Ying-Hai Wu	Quantum Hall Effect (Tutorial)
Wen-Yu Shan	Topological Insulators (Tutorial)
S. Shen	(Colloquium)
Steven H. Simon	1. Topological Quantum Computation (Lecture) 2. (Colloquium)
Rahul Roy	1. Topological Quantum Computation (Tutorial) 2. (Colloquium)

PARTICIPANTS

76 from India

PROGRAMME	**DATA ASSIMILATION RESEARCH PROGRAMME**
DATE	04 - 23 July, 2011
ORGANIZERS	Amit Apte, S. M. Deshpande, Christopher K. R. Jones, A. S. V. Murthy, Ravi S. Nanjundiah, Roddam Narasimha, Mythily Ramaswamy and J. Srinivasan
VENUE	Centre for Applicable Mathematics-TIFR and Indian Institute of Science, Bangalore

REPORT

Data assimilation (DA) is a powerful and versatile method for combining observational data of a system with its dynamical model to generate state estimates. These techniques are essential for numerical weather and climate predictions. Applications of DA to many other scientific and engineering disciplines are emerging rapidly. DA is inherently interdisciplinary in nature and requires close collaborations and interactions between researchers in atmospheric sciences, in nonlinear dynamics and complex systems, and in applied mathematics and statistics.

The Data Assimilation Research Programme (DARP) was primarily aimed at developing an interest within

the academic and scientific community in pure and applied research related to DA, in order to form a group of researchers, developers and users of data assimilation systems.

The "Monsoon School on Mathematical and Statistical Foundations of Data Assimilation" along with the "International Conference on Data Assimilation," which were held at the TIFR Centre for Applicable Mathematics and the Indian Institute of Science, respectively, were the initial set of activities of DARP.

The school was conducted in two parts. The first part, held from 04-12 July, consisted of compact courses, tutorials and hands-on laboratories which are detailed below. During the second part, 18-23 July, the participants conducted short projects.

The list of topics covered in the school are as follows.

1. Introduction -- the need for data assimilation
2. Mathematical and statistical methods for assimilation
    a. nudging, optimal interpolation
    b. variational methods
    c. Kalman filtering and related methods
    d. Statistical sampling techniques
3. Basic introduction to nonlinear dynamics and data assimilation for nonlinear systems
4. Applications to atmospheric, oceanic problems (including basic introduction to modelling)

The international conference took place from 13-15 July and consisted of invited and contributed talks during the three-day period in the middle of this monsoon school.

During the international conference, the presentations focused on new mathematical developments related to DA as well as applications in many operational studies such as those for the Indian ocean and regional weather forecasting by researchers from within and outside India. The conference also gave a chance to the participants to present their ongoing work on data assimilation and discuss it with a wide international audience.

The last week of the school was spent in projects that focused on implementing five specific data assimilation schemes, namely back and forth nudging, variational method, particle filtering, ensemble Kalman filter, and gradient descent. They worked with Lorenz model and data sets generated from that model. The main aim was a comparison of all these methods using one model, in order to give the participants a chance to understand in detail exactly how to implement these methods and use them in practical applications. The projects were supervised by the lecturers of the school and generated intense interaction between the participants themselves and with the lecturers.

SPEAKERS & TITLES OF TALKS
LECTURERS IN THE SCHOOL

Sulochana Gadgil	Prediction of the Indian Monsoon
Spenta Wadia	ICTS - A New Initiative in Indian science
Christopher Jones	Overview of Approaches to Data Assimilation
Amit Apte	1. Basic setup of tutorials and matlab
	2. Ensemble (Transform) Kalman Filter
Lakshmivarahan	1. Introduction to inverse problems
	2. 3D-var and iterative techniques for nonlinear problems
	3. Inverse problems: satellite observations; interpolation
	4. Kalman filtering
Elaine Spiller	1. Basic Introduction to Probability and Simulations
	2. Brief Introduction to Probability and Simulation: Part 2- Monte Carlo and Importance Sampling

	3. Brief Introduction to Probability and Simulation: Part 3 - Bootstrapping and Particle Filter
	4. Tutorial - Random variables and sampling
	5. Tutorial - Monte Carlo and Importance Sampling
Eric Kostelich	1. Dynamical systems and uncertainty
	2. The local ensemble transform Kalman filter
David Dewitt	1. Introduction to Dynamical Models and Theory Behind Seasonal Forecasting
	2. Seasonal Forecasting: Physical Parameterization, Model Bias, Initialization and Skill Evaluation
Didier Auroux	1. Nudging methods in geophysical data assimilation: Part 1 -- Standard nudging and asymptotic observers
	2. Nudging methods in geophysical data assimilation: Part 2 -- Optimal nudging and comparisons
	3. Nudging methods in geophysical data assimilation: Part 3 - Back and forth nudging
	4. Nudging methods in geophysical data assimilation: Hands-on lab
Lenny Smith	1. The Geometry of Data Assimilation in Maths, Physics, Forecasting and Decision Support
	2. The Geometry of Data Assimilation 2: gradient descent (GD) and indistinguishable states importance sampler (ISIS)
Emma Suckling	Gradient descent

CONFERENCE

Didier Auroux	Diffusive Back and Forth Nudging algorithm
D Jagadheesha	Some observations on retrieval of geophysical parameters from GPS-RO derived refractivity
Hariharan Narayanan	Testing the manifold hypothesis
Akila S	An Application of Extended Kalman Filter for Spacecraft Orbit Estimation
Sanjoy Mitter	Duality between estimation and control
A. Mudambi	Kalman Filter Design By Tuning Its Statistics Or Gains?
S. Lakshmivarahan	Forward Sensitivity Approach to dynamic data assimilation
Chakravarthy Balaji	Towards a multi-satellite radiance assimilation in regional models for track forecasting of tropical cyclones
Elaine Spiller	Particle filter for glider data assimilation
Emma Suckling	Gradient descent for the point vortex model
M. Vanninathan	Models of Fluid-Structure Interaction and Exact Controllability
P.N. Vinaychandran	Indian ocean modelling: opportunities and challenges for data assimilation
A S Vasudeva Murthy	Data assimilation of wind field at Kalpakkam
Pradeep Thapliyal	Atmospheric parameters from Indian Geostationary Satellites for assimilation in NWP model
C.V. Srinivas	Impact studies with Data Assimilation using Nudging and 3D VAR on the simulation of few Atmospheric Systems
Chris Jones	Assimilation of Lagrangian data
A. Chandrasekar	3D-VAR assimilation studies over the Indian ocean region: results of impact studies
Lenny Smith	Model error and data assimilation
K. Karmeshu	Nonlinear Stochastic Modelling, Critical Phenomena and Entropy
Mythily Ramaswamy	Optimal control problem for Burger's equation

PARTICIPANTS

60 from India
2 from abroad

PROGRAMME	**RADIATIVE CORRECTIONS FOR THE LHC: 2. RADCOR 2011 SYMPOSIUM**
DATE	26 - 30 September, 2011
ORGANIZERS	Rahul Basu, Prakash Mathews, Andreas Nyffeler and V. Ravindran
VENUE	Radisson Resort Temple Bay, Mamallapuram, India

REPORT

The academic programme commenced with review talks by two experimental particle physicists, Dr. Judith Katzy (DESY, Hamburg, Germany) from the ATLAS collaboration and Dr. Marci Pieri (UC San Diego, USA) from the CMS Collaboration. In their review talks of 45 minutes duration each, they presented the latest results which had been obtained at the LHC.

It was followed by 46 theory talks of 25 minutes each, where mostly foreign participants, but also a few young Indian scientists, presented their latest results on radiative corrections, mostly related to physics at the LHC. All major research groups around the world working in the field had sent some representative and the participants got an excellent overview of the current status of the subject.

SPEAKERS & TITLES OF TALKS

D.P. Roy	1. Results from Experiments
	2. Parton distribution functions
Judith Katzy	Recent results from ATLAS
Marco Pieri	Recent results from CMS
Valerio Bertone	NNPDF in the LHC era
Jumpei Fujimoto	1. Photon structure function
	2. The GRACE project - QCD, SUSY, Multi-loop
Tsuneo Uematsu	1. Photon Structure in Supersymmetric QCD,
	2. Resummation
Norihisa Watanabe	Mass effect on the photon structure functions
Asmita Mukherjee	Generalized parton distributions of the photon
Konstantin Chetyrkin	1. Multi-leg processes
	2. R(s) and Z decay in O(alpha_s^4): complete results
Andreas van Hameren	Hard multi-particle processes at NLO QCD
Stefano Pozzorini	NLO QCD corrections to hadronic WWbb production
Sebastian Becker	Multiparton NLO corrections by numerical methods
Christoph Englert	Results in precision multiboson+jet phenomenology
Ambresh Shivaji	Multi vector boson production via gluon fusion at LHC
Michele Caffo & Tsuneo Uematsu	Higher Order Automation & Monte Carlo
Tord Riemann	1. New results for algebraic NLO - Tensor reduction of Feynman integrals
	2. Infra-red structure of amplitudes
Gudrun Heinrich	1. Automated one-loop calculations with Golem/Samurai
	2. Multi-loop methods
Tom Melia	Weak Bosons and Jets at the LHC
Philipp Maierhoefer	A recursive one-loop algorithm for many-particle amplitudes
Andreas von Manteuffel	Reduze 2 and Top quark pair production at two loops

Bennie F. L. Ward	1. Exact Amplitude-Based Resummation in Quantum Field Theory 2. Higher Order Automation & Monte Carlo
Nicola A Lo Presti	Large-x resummation in semi-inclusive e^+ e^- annihilation
Matthias Neubert	1. Top, Drell-Yan, Higgs 2. Precision Collider Physics from SCET - Electroweak Boson Production at Small q_T
Pietro Falgari	The top-pair total cross section at NNLL order
Maximilian Stahlhofen	NNLL top-antitop production at threshold
Giancarlo Ferrera	Higher order QCD corrections for the Drell-Yan process
Nikolas Kauer	Signal-background interference in gg to H to VV
Mikhail Rogal	Top mass effects in scalar and pseudo-scalar Higgs bosons production at NNLO for hadron colliders
Maria Herrero	Heavy Majorana neutrino effects on MSSM-M_h
Scott Alan Yost	Herwiri2: CEEX Electroweak Corrections in a Hadronic MC
Valentin J Hirschi	MadLoop in aMC@NLO
Michael Kubocz	Alternative subtraction method in QCD using Nagy-Soper scheme
Simon Badger	One Loop Amplitudes for Multi-Jet Production
Stephan Buehler	Precise inclusive Higgs predictions using iHixs
Johannes Bluemlein	1. O(alpha_s^3) Contributions to the Heavy Flavor DIS - Wilson Coefficients at general Values of N 2. Why Precision ?
Carsten Schneider	Symbolic Summation for Particle Physics
Abilio de Freitas	Two-Loop QED Operator Matrix Elements with a Massive External Fermion Line
Andreas Nyffeler	Radiative corrections at low energy
Janusz Gluza	Theoretical improvements for luminosity monitoring at low energies
Robert Szafron	Rho-gamma mixing and e^+ e^- vs. tau spectral functions
Gauhar Abbas	Improving the phenomenology of K_{l3} form factors with analyticity and unitarity
Lorenzo Magnea	1. The infrared structure of gauge amplitudes in the high-energy limit 2. Beyond the Standard Model at NLO
Franz Herzog	Disentangling Singularities with Non-linear Mappings - A new method for NNLO computations
Jonathan R. Gaunt	Double Parton Scattering Singularity in One-Loop Integrals
James Currie	Antenna Subtraction in pQCD at NNLO
Lorenzo Magnea & Janusz Gluza	Beyond the Standard Model at NLO
Swapan K Majhi	NNLO QCD corrections to the resonant sneutrino / slepton production at LHC
Irene Niessen	NNLL resummation for squark-antisquark production
K. Sridhar	KK Gluons at NLO
Subhadip Mitra	Production of KK-gravitons in association with a boson via gluon fusion in the LHC
Anurag Tripathi	W^+ W^- production at LHC at NLO in extra dimension models
Satyajit Seth	Graviton plus vector boson production to NLO QCD

PARTICIPANTS

29 from India
41 from abroad

PROGRAMME	**ADVANCES IN NUCLEAR PHYSICS (ANUP)**
DATE	07 - 18 November, 2011
ORGANIZERS	V. Nanal, R. Palit and R.G. Pillay
VENUE	International Center, Goa

REPORT

Nuclear physics research is focused on exploring the science of atomic nuclei, its relevance in understanding processes like supernova and addressing open questions about fundamental symmetries of nature. A finite nucleus is a unique mesoscopic system composed of strongly interacting neutrons and protons. Investigation of its structure at varying angular momentum, isospin and temperature provides new insight about the dynamics involved in the variety of emergent phenomena in this many-body system. With the advent of new accelerator facilities in India and worldwide, it is now possible to explore nuclear properties at limits of binding. This has thrown open a wide forum of novel nuclear physics problems in different length scales. The goal of this programme was to identify and understand the problems that need to be addressed in the area of nuclear structure and reaction with the present and upcoming accelerator facilities which would provide stable and radioactive ion beams.

The programme consisted of two parts: a two day workshop (Nov. 7-8, 2011) featuring open research problems at forefront followed by a school (Nov. 9-18, 2011) aimed to introduce young researchers to exciting developments in the field of nuclear physics. The school was planned to provide an introduction to stable and RIB physics at the graduate level and focus on some of the novel features of the structure and dynamics of exotic nuclei.

SPEAKERS & TITLES OF TALKS

R.G. Pillay	Overview of Nuclear Physics Research Programmes of PLF, Mumbai
M. Carpenter	Gammasphere Current Status: Future Reach
R. Palit	INGA goes Digital: Recent Results & Future Possibilities
J. Gerl	Status and Perspectives of FAIR and NUSTAR
V.M. Datar	Non-accelerator based Nuclear Physics
T. Nakamura	Probing Neutron-halo Nuclei by Breakup Reactions
P.K. Pujari	Targets for nuclear reaction studies
S. Santra	Reaction mechanisms involving weakly bound projectiles
S. Mandal	Multi-nucleon transfer and their effect on the mechanism of near barrier fusion reaction
A. Shrivastava	Influence of weak binding and exotic structure in reaction with weakly bound nuclei near the Coulomb barrier
T. Aumann	Status of R3B – Technical developments and experiments
P. Egelhof	Exotic Nuclei Studied By Direct Reactions at Low Momentum Transfer- Recent Results and Future Perspectives at FAIR
M. Rejmund	Recent results using VAMOS spectrometer
S.S. Ghugre	Level Structure of ^{32,34}P: What do we learn about the $f_{7/2}$ –$p_{3/2}$ energy gap?
M. Saha-Sarkar	Nuclei in the upper sd shell and evolution of sd-fp shell gap
R.P. Singh	Nuclear structure studies through Coulomb excitations
S. Bhattacharyya	Single-particle and collective excitations in transitional nuclei
S. Triambak	Isospin symmetry in nuclear physics: Some precise comparison between theory and experiment

U. Datta-Pramanik	Exploring Exotic island in Nuclear landscape
A. Chatterjee	Summary & Concluding Remarks

PARTICIPANTS

44 from India

PROGRAMME	**FRONTIERS OF COSMOLOGY AND GRAVITATION**
DATE	01 - 23 December, 2011
ORGANIZERS	Subhabrata Majumdar, B.S. Sathyaprakash, Tejinder Pal Singh & Tarun Souradeep
VENUE	IUCAA, Pune and Holiday Inn, Mobor Beach, Goa

REPORT

This comprehensive programme consisted of :

(i) A School on Cosmology and Gravity Waves, for graduate students and young researchers to be held in Pune (1 - 11 Dec).

(ii) An International Conference on Gravitation and Cosmology [ICGC2011] to be held in Goa (14 - 19 Dec).

(iii) A Workshop on Gravitational Wave Astronomy in Pune (20 - 23 Dec).

The International Conference on Gravitation and Cosmology [ICGC] is held once every four years in India, to discuss the latest research advances in the fields of relativity, gravitation and cosmology. The Silver Jubilee ICGC-2011 was the seventh conference of its kind in this series, and was attended by about 250 scientists, fifty percent of which were from abroad.

The International Scientific Organizing Committee was chaired by Prof. Tarun Souradeep of IUCAA, Pune and the Local Organizing Committee was chaired by Prof. T. P. Singh of TIFR, Mumbai.

The conference started with two Keynote addresses, each of one hour duration. In addition, there were sixteen Plenary Lectures, each of 45 minutes duration, covering diverse topics in quantum gravity and string theory; theoretical and astrophysical aspects of black hole physics; cosmology, large scale structure and early Universe; and gravitational wave detection – theory and experiment.

The conference served as a major focal point for the gathering of international researchers in the field of gravity wave experiments, and a pivotal topic for discussion was the possible initiation of LIGO-INDIA – a project for the installation of a gravity wave detector in India, which will then serve as an important component of long-baseline world-wide linked gravity wave detectors.

A new feature of the conference was the inclusion of three dedicated Mini-Sessions on topical issues, Gravity as an emergent phenomenon (T. Padmanabhan); Dark Energy (Varun Sahni); and Astronomy with a global network of gravitational wave detectors (B. S. Sathyaprakash). Each session was three hours long and consisted of mini-plenary talks followed by an extended discussion.

There were three parallel sessions: (i) Classical General Relativity and Gravitational Waves; (ii) Cosmology; (iii) Quantum gravity and early universe. The three sessions had a total of about 75 talks and 100 posters. In order to encourage a high standard of poster presentation, the organizing committee awarded three best-poster prizes.

SPEAKERS & TITLES OF TALKS
LECTURERS IN THE SCHOOL

E. Komatsu	Cosmology Basics, Non-Gaussianity
N. Padmanabhan	Baryonic Accoustic Oscillations
D. Pogosyan	Cosmological perturbation theory
D. Baumann	Inflation
D. Scott	CMB Temperature & Polarization Theory
L. Boyle	GW in cosmology basics
A. Evrard	Clusters, simulations and theory
S. Bose	GW Detection
M.Bruni	Cosmological Back Reaction

CONFERENCE SPEAKERS

Pankaj S. Joshi	Inaugural Remarks : IAGRG President
Kip Thorne	Keynote Lecture: Black Hole research: A New Golden Age
P. James E. Peebles	Keynote Lecture: The Natural Science of Cosmology
Spenta R. Wadia	The International Centre for Theoretical Sciences - An introduction
Robert Kirshner	Exploding Stars and the Accelerating Universe
Mihalis Dafermo	The Black Hole Stability Problem
Eric Adelberger	Laboratory Tests of Gravity from Micron to Galactic Scales
Dipankar Bhattacharya	Observational Evidence of Relativity in an Around compact stars
Abhay Ashtekar	The Big Bang and the Quantum
Bernard Schutz	Gravitational Waves: Astronomy for the 21st Century
J. R. Bond	Probing the Cosmic Theory of Early and late Universe Physics
Luis Lehner	Membranes and Black Holes: From jets to cosmic censorship
Shiraz Minwalla	Fluid Dynamics from Gravity
Stan Whitcomb	Laser Interferometer Gravitational Wave Detectors: Advancing toward a global network
Francois Bouchet	Cosmic Microwave Background Anistropies: Status & Prospects
Rafael Sorkin	Geometry from order and number: Casual sets
Masaru Shibata	Coalescence of Binary Neutron Stars and Black Hole Neutron Star Binaries
Priyamvada Natarajan	The formation of the first black hole in the Universe
David Wands	Primordial Non-gaussianity from Inflation
Gary Horowitz	Using General Relativity to Study Superconductivity
John Ellis	Particle Physics and Cosmology in Light of the LHC

PARTICIPANTS

168 from India
135 from abroad

PROGRAMME	**THE ICTS CONDENSED MATTER PROGRAMME 2011**
DATE	09 - 22 December, 2011
ORGANIZERS	Ravin Bhatt, Kedar Damle, H.R. Krishnamurthy, Subroto Mukerjee, Mohit Randeria, Vikram Tripathi and N.S. Vidhyadhiraja
VENUE	Indian Insitute of Science, Bangalore

REPORT

The ICTS Condensed Matter Programme 2011 (ICMP 2011) consisted of a 10 day Winter School (December 9 to December 18) followed by a 4 day International Conference (December 19 to December 22). The school had four lecture courses focusing on the core of modern condensed matter physics, while the conference featured four days of talks at the very forefront of this subject. It was delivered by a cross-section of internationally eminent speakers. Moreover, the school also conducted tutorial lectures, evening colloquia and a few research seminars.

Prof, T.V. Ramakrishnan, an Emeritus Professor of Physics, DAE Homi Bhabha Professor Banaras Hindu University and Distinguished Associate, Centre for Condensed Matter Theory, Department of Physics, IISc-Bangalore was felicitated at this event.

SPEAKERS & TITLES OF TALKS CONFERENCE

H.Krishnamurthy & Spenta Wadia	Welcoming Remarks
C N R Rao	Multiferroic and Magnetoelectric Oxides
Peter Littlewood	Polariton Condensation and Collective Dynamics
A K Sood	Femtosecond Spectroscopy of electron and Phonon relaxation in iron pnictide superconductors
D D Sarma	The curious case of NiS
Sriram Shastry	Extremely Correlated Fermi Liquids
Antoine Georges	Strong correlations from Hund's rule coupling
Mohit Randeria	Viscosity of Strongly Interacting Fermi Systems
Zahid Hasan	Topological Surface States in Topological Insulators and Superconductors
Ashvin Vishwanath	Topological Phases in Correlated Solids
Jay Deep Sau	The return of Majorana : the end of a 75 year-old search? - looking for Majorana fermions in condensed matter systems.
G Baskaran	Quantum Spin Liquids - A Status Report
Krishnendu Sengupta	Dynamics of ultracold atoms in optical lattices
Arun Paramekanti	Chiral Mott insulator of bosons in a fully frustrated boson Hubbard model
Pinaki Majumdar	Thermal fluctuations in Fermi superfluids
E Muller-Hartmann	Wannier functions for hybridizing states of transition metal oxide chains and ladders
Arghya Tarapdher	Preformed excitons and charge-density waves in transition metal dichalcogenides
D E Logan	Two-channel Kondo physics in impurity chains and rings

Pratap Raychaudhuri	Phase fluctuations and pseudogap state in a disordered conventional superconductor, NbN
S Ramakrishnan	Strongly correlated superconductivity in non-magnetic d-band superconductors
K Maiti	Dichotomy of pseudogap and SDW phase in CaFe2As2 - an ARPES study
S Sebastian	Nodal pocket yielding multiple quantum oscillation frequencies in the underdoped cuprate YBa2Cu3O6+x
Maurice Rice	A Phenomenological Theory of the Anomalous Pseudogap Phase in Underdoped Cuprates
Sasha Finkelstein	Quantum kinetic approach to the calculation of thermal transport and the Nernst effect
Chandan Dasgupta	Phenomenological Theory of Superconductivity in the Cuprates
S Ramasesha	Correlated Electronic Structure of Some Conjugated Electronic Materials
R N Bhat	Two small new pieces in a tale of two gaints
Sudhanshu Mandal	Anderson Enigma in Disordered Superconductors
Arindam Ghosh	Non-Universal Conductance Fluctuations in Graphene
A K Raychaudhuri	Ferromagnetic insulating state : Is it an electron glass
Vikram Tripathi	Transport in dilute magnetic semiconductor heterostructures
G V Pai	Tunable spin Current in a Quantum Wire Network
R Shankar	Anomalous Quantum Hall states in an optical lattice
V B Shenoy	Fermions in synthetic non-Abelian gauge fields

PARTICIPANTS

133 from India
27 from abroad

PROGRAMME	**INTERNATIONAL NONEQUILIBRIUM WINTER SCHOOL**
DATE	27 December – 11 January, 2012
ORGANIZERS	Sushanta Dattagupta, Yuval Gefen, Amit Ghosal, Ganpathy Murthy, Sanjay Puri, Sriram Ramaswamy, Krishnendu Sengupta, Nayana Shah and Subhasish Sinha
VENUE	IISER, Kolkata

REPORT

A convergence of theoretical and experimental advances in recent years has led to the insight that dynamics out of equilibrium, both classical and quantum, especially quantum phase transitions, gives rise to physics quite distinct from that of equilibrium systems. The goal of this Winter School was to take students and others who wish to learn about this subfield from the basics to the frontiers. Several sets of pedagogical lectures by pioneers in the field had been interspersed with short talks and poster sessions about current

advances in Nonequilibrium Condensed Matter Physics. Lecture topics started with the foundations of classical and quantum transport, quantum quenches near phase transitions, the Keldysh technique, driven systems, glasses, active systems and gauge/gravity methods.

SPEAKERS & TITLES OF TALKS

Sushanta Dattagupta	Foundations of Classical Nonequilibrium I-V
Yuval Gefen	Foundations of Quantum Transport I-V
Marcos Rigol	Seminar Talk: Generalized Thermalization in an Integrable Lattice System
David Mukamel	Driven Systems I-III
Pradeep Mohanti	Seminar Talk: Phase Transition in an Exactly Solvable Extinction Model
Deepak Dhar	Seminar Talk: Pattern formation in fast-growing sandpiles
Diptiman Sen	QPT and Quantum Quenches 1- IV
Aditi Mitra	The Keldysh Formalism I- IV
Abhishek Dhar	Seminar Talk: Additivity principle in three-dimensional deterministic systems
Igor Gornyi	Nonequilibrium Bosonization I-IV
Alexander Altland	Fluctuation Theorems I-III
Leticia Cugliandolo	Glassy Systems I-IV
Sumit Das	AdS/CFT in Nonequilibrium I-IV
Adrian Feiguin	1. Density Matrix Renormalization Group I-II (Pedagogical talk) 2. Real-time dynamics of strongly correlated systems with the density-matrix renormalization group (Seminar Talk)
Hans Kroha	Seminar Talk 1. Perturbative Non-equilibrium Renormalization Group for Strongly Interacting Quantum Dot Systems 2. Josephson and Rabi Oscillations in Bose-Einstein Condensates Far from Equilibrium
Krishnendu Sengupta	Seminar Talk: Ultracold atoms as quantum emulators: A “dynamical” perspective
Amit Dutta	Seminar Talk: Fidelity, fidelity susceptibility and quantum quenches
Ard Louis	Seminar Talk: Multiscale modelling of turbulent liquids
Benjamin Doyon	1. The nonequilibrium steady-state density matrix (Pedagoical talk) 2. Exact low-energy results for non-equilibrium steady states (Seminar talk)
Carlos Bolech	Seminar Talk: Dynamics and quasi-stability in two-component imbalanced atomic mixtures
Nayana Shah	Seminar Talk: Dynamics of superconducting nanowires
Subir Sachdev	The superfluid-insulator quantum phase transition: field theory vs. holography
Sanjay Puri	Kinetics of Phase Ordering I-III

PROGRAMME	**WORKSHOP ON HIGH ENERGY PHYSICS PHENOMENOLOGY XII**
DATE	2-15 January, 2012
ORGANIZERS	Amol Dighe, Rohini M Godbole and Sreerup Raychaudhuri
VENUE	Fountain Hotel, Mahabaleshwar

REPORT

WHEPP-XII is part of the series of International workshops on Particle Physics that is held every two years. The main focus is particle physics phenomenology and its relation to both formal theory and experiment. The first week was devoted to Cosmology, Astroparticle Physics and Nonperturbative Methods in Strong Interaction Physics, while the second part was devoted to Model Building, Collider Phenomenology, Neutrino Physics and B-Physics

SPEAKERS & TITLES OF TALKS

Ramanath Cowsik	An Introduction to the Study of Galactic Matter and Dark Matter
Anne Green	Overview of Dark Matter Searches and Astrophysical Uncertainties
Jajati K. Nayak	Electromagnetic Probes for Heavy-Ion Collisions
Subhendra Mohanty	Aspects of recent Higgs
Koushik Dutta	Inflation and Supergravity
Narendra Sahu	Asymmetric dark matter in the context of durect search
Christian Schmidt	QCD Bulk Thermodynamics, and Critical Behavior from Lattice Simulations
Victor Roy	Transport Properties of QCD Matter
Pravabati Chingangbam	Scale-dependent primordial non-gaussianity in CMB
Suratna Das	Primordial non-gaussianity
Arunansu Sil	Sneutrino Inflation
M. Padmanath	Hadronic screening masses above and immediately below the deconfinement transition
Nikhil Kartick	A comparative study of screening
Anjan Sen & Debasish Majumdar	Aspects of accelerating Universe
Swagato Mukherjee	1. QCD in strong magnetic fields 2. Freeze-out condition from lattice and experimental data
Soumini Choudhury	Galactic Dark Matter
Abhishek Kumar	Neutrino Dark Matter
Reetanjali Maharana	Very High Energy Neutrinos from GRBs
Hiranmaya Mishra	Kinetics of chiral transition – a toy model
P.S. Saumia	Using the CMBR tools for flow analysis in heavy ion collisions
Akhilesh Nautiyal	Warm Inflation
Sourendu Gupta	Freeze-out and fluctuation
Emilian Dudas	Supersymmetric Model Building
Dilip Kumar Ghosh	Status and Prospects of Low Energy Supersymmetry
Zakaria Chacko	Flavour and Dark Matter
Alejandro Ibarra	Status of Lepton Flavour Violation

Eric Zimmerman	Results from Neutrino Oscillation Experiments and status of oscillation parameters
Werner Rodejohann	1. Tribimaximal lepton mixing: models, deviations and alternatives 2. Neutrinoless double beta decay
R. Sekhar Chivukula	Alternate Scenarios for Electroweak Symmetry Breaking
K. Huitu	Stop NLSP in cMSSM
Prolay Kumar Mal	Asymmetry in Top-antitop production at the LHC
Sanjib Agarwalla	Expectations from Future Neutrino Experiments
Shamayita Ray	Bimagic Baseline and Low Energy Neutrino Factory
P. Gambino	Semileptonic B-decays
Sunanda Banerjee	New Physics Searches at Colliders
Tomasz Skwarnicki	LHCb - recent results and future prospects
Ulrich Nierste	Constraining new physics with flavour
Alakabha Datta	New Physics in B -> VV
Joern Kersten	SUSY Dark Matter
Eung Jin Chun	Neutrino mass models at the LHC
Aoife Bharucha	Renormalisation of Chargino/Neutralino Sector
Dominik Stoeckinger	Current Status of Muon g-2
Prakash Mathews	The LHC as a QCD Machine
Shrihari Gopalakrishna	Warped extra dimensions and LHC signatures
Pratishruti Saha	
Bhavik Kodrani	
Sunando Patro	
R. Srikanth Hundi	
Dipan Sengupta	
Kirtiman Ghosh	
Swarup Kumar Majee	
Liliana Velasco-Sevilla	
Soumitra Nandi	
Diptimoy Ghosh	

PARTICIPANTS

36 from India
112 from abroad

PROGRAMME	**NETWORK SCIENCE IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCE**
DATE	2-13 January, 2012
ORGANIZERS	V. Anantharam, Vivek Borkar, Devdatt Dubhashi, Anurag Kumar, Madhav Marathe, G. Rangarajan and Devavrat Shah
VENUE	Indian Institute of Science, Bangalore

REPORT

The new and emerging field of Network Science is based on the simple observation that large human engineered systems (e.g., communication networks, information networks, social networks, etc.) and

natural systems can be modeled as networks of entities. Hence, it is possible that common principles can be brought to bear on the analysis, design and control of such systems. In addition, insights gained from networks in one domain could be brought to bear on understanding networks in other domains.

For the past few years, Network Science has been an exploding research area transcending disciplinary boundaries, receiving the attention and inputs from leading figures in mathematics, physics, biology, engineering, and many other disciplines. With this in view, the IISc Mathematics Initiative (IMI) is planning a special year on network science during 2011-2012. In conjunction with this, an ICTS School (02 - 06 Jan, 2012) and Workshop on Network Science (09 - 13 Jan, 2012) was planned at IISc. The purpose of this event was to take stock of the current developments and trends, to build bridges across disciplines in the Indian research community interested in networks research, and to alert and expose young students and faculty to the potentialities. While "Network Science" can be very broadly defined, the scope of this event was limited to the domains arising in Electrical Engineering and Computer Science, and various related tools from Mathematics.

SPEAKERS & TITLES OF TALKS
LECTURERS AT THE SCHOOL

Ayalvadi Ganesh	Rumours, epidemics and consensus on networks
Andrea Montanari	Inference and learning in Ising models
Devavrat Shah	Rumours, epidemics and consensus on networks
Eva Tardos	Network Games, Learning, and the Price of Anarchy or Stability
Jean Walrand	Resource Allocation in Networks

Plenary Speakers

Francois Baccelli	Performance of P2P Networks with Spatial Interactions of Peers
Deepak Dhar	Vibrational Spectrum of Spider-Web Networks
P. R. Kumar	Real-time wireless networking
Sanjoy Mitter	Towards a Theory of Layered Architectures for Communication and Control
Alan Willsky	Distributed Algorithms for Graphical Models

Invited Speakers

Shivani Agarwal	Ranking on Graphs: A Machine Learning Approach
Eitan Altman	New Game Theoretic Models in Networking
Shalabh Bhatnagar	Actor-Critic Algorithms and an Application to Vehicular Traffic Control Prasanna
Chaporkar	Stability and Power Control in Limited Information Based MAC
Noshir Contractor	Using Multi-theoretical Multilevel Models to Understand and Enable Communities
Onkar Dabeer	Scheduling Tweets in a Campaign
Moez Draief	Reaching Consensus through Probabilistic Polling
Massimo Franceschetti	Human matching behavior in social networks: an algorithmic perspective
David Gamarnik	Statistical physics methods in combinatorial optimization, inference and graphical games
Niloy Ganguly	Stability Analysis of Real-World P2P Networks
Srikanth Iyer	Non- Uniform Random Geometric Graphs with Location Dependent Radii
Krishna Jagannathan	Queue length asymptotics under heavy-tailed traffic: Why CSMA is more robust than max-weight scheduling
Rahul Jain	Multi-player Multi-Armed Bandits: Combinatorial and Decentralized Settings
Jeff Johnson	Hypernetworks in complex multilevel systems
Aditya Karnik	How to spread a rumor?
P. Vijay Kumar	Regenerating Codes for Distributed Storage
Marc Lelarge	Applying the cavity method to design efficient load balancing schemes

D. Manjunath	Load Balancing and Routing Games with Admission Price
Madhav Marathe	Science and Engineering of Co-evolving Networks: Population Dynamics and Epidemics
Ravi Mazumdar	Canada Robust Resource Sharing in Networks: Insensitivity and Tractability
Y. Narahari	Influence Limitation in Multi-Campaign Social Networks: A Game Theoretic Approach
Vinod Prabhakaran	Secure Coordination
Alexandre Proutiere	Decentralized Optimization: A Simulation Approach
Gaurav Raina	Design of a rate controlled transport protocol
B. Ravindran	Exploring Small World Property in Reinforcement Learning
F. Vega-Redondo	Social networks and the process of "globalization"
Sujay Sanghavi	Finding the Graph of Cascades and Games
Atul Saroop	Building Fast Crawlers for Social Networks
Sanjay Shakkottai	Large Deviations of Wireless Scheduling: Incomplete State Information and Optimality
Vinod Sharma	Modelling and analysis of p2p IPTV systems
Aravind Srinivasan	Maximal Independent Sets in Networks
Rahul Vaze	Percolation in the Information Theoretically Secure Wireless Network Graph N.
Viswanadham	Emerging Market Network Chains

PARTICIPANTS

109 from India
9 from abroad

PROGRAMME	**SCHOOL AND WORKSHOP ON COCOMPACT IMBEDDINGS, PROFILE DECOMPOSITIONS AND THEIR APPLICATIONS TO PDE**
DATE	3-12 January, 2012
ORGANIZERS	Adimurthi, K. Sandeep, Ian Schindler and Kyril Tintarev
VENUE	CAM -TIFR, Bangalore

REPORT

Convergence of functional sequences, in many cases, cannot be directly obtained from compactness properties, but requires a structural analysis of the defect of compactness. While concentration compactness techniques have been widely adopted since the 1980's, more powerful methods have been developed in the last 15 years and applied by mathematicians working in different disciplines of analysis. The concentration argument plays a central technical role in elliptic PDE theory, geometric analysis, as well as in the analysis of NLS, wave and Navier-Stokes equations. The original description of concentration in terms of singular weak limits for sequences of measures has been supplemented by more detailed profile decompositions. Formalization of the latter on the functional analytic level in terms of wavelet bases and cocompact imbeddings relative to a given group has been used to investigate increasingly diverse non-compact invariances involved in the loss and recovery of compactness. Concurrently, formation of profiles

based on wavelet bases, measure-based concentration compactness, and adjacent approaches, such as blow-up methods, continue to develop and are broadly applied. This programme brought together experts in elliptic, dispersive, and geometric PDE, with experts in adjacent branches of analysis, and graduate students from India and abroad. It combined lectures on current research with mini-courses for students.

SPEAKERS & TITLE OF TALKS

Kunnath Sandeep	Concentration compactness principle
Vanninathan	Interpolation Spaces
Frederic Robert	1. Concentration phenomena for some elliptic nonlinear equations 2. Signchanging blowup for scalar curvature type equations
Chang-Shou Lin	1. The existence of self-dual non-topological solutions in the Chern-Simons-Higgs model 2. Bubbling solutions for Abelian Chern-Simons-Higgs model on a torus known results and open problems
Filomena Pacella	1. Symmetry of solutions of semilinear elliptic equations 2. Solutions of Lane Emden problems in tubular neighborhoods of manifolds
P.N. Srikanth	Semilinearly perturbed elliptic equations with solutions concentrating on a 1 dimensional orbit
Kyril Tintarev	1. Weak continuity properties of the Trudinger-Moser functional 2. Cocompactness: concentration compactness in terms of functional analysis
Monica Clapp	1. Multiple solutions to the BahriCoron problem in domains with nontrivial topology 2. Symmetries in variational problems
Manuel del Pino	Minimal surfaces and the Allen-Cahn equation
Juan Dávila	Solutions with point singularities for a MEMS equation with fringing field
Ignacio Guerra	Ground states for a semilinear elliptic equation with mixed Sobolev growth
Frank Pacard	Sign changing solutions for the nonlinear Schrödinger equation
Roberta Musina	1. Weighted biharmonic operators, Rellich potentials and lack of compactness 2. On the Sacks-Uhlenbeck approach to noncompactness
Monica Musso	Critical problems in R2
Claudio Bonanno	Solitons and vortices for nonlinear field equations
Jérome Vétois	Bubble tree decompositions for critical anisotropic equations
Angela Pistoia	On the stability of the Paneitz-Branson equation
Olivier Druet	Stability issues for systems of elliptic PDEs
Rowan Killip	1. The cubic KleinGordon equation in two dimensions 2. Inverse Inequalities
Pierpaolo Esposito	1. Singular meanfield equations on compact Riemann surfaces 2. Blow-up phenomena in two-dimensional problems
Monica Visan	1. The energy supercritical nonlinear wave equation 2. Linear and nonlinear profile decompositions for the Schrodinger equation
Marco Ghimenti	Existence, stability, concentration properties and dynamics of solitons in Nonlinear Schrodinger Equation in presence of a strong nonlinearity
Stephane Jaffard	1. Oscillation spaces and beyond: New function spaces defined by wavelet conditions 2. Some interplays between multifractal analysis and functional analysis
Gianni Mancini	Sharp exponential inequalities and extremal functions
Hajer Bahouri	On the lack of compactness of some critical Sobolev embedding
Emmanuel Hebey	Static KGMP equations in closed manifolds
Stefanella Boatto	The Poisson equation, the Robin function and singularities' dynamics: a hydrodynamic approach

PARTICIPANTS

43 from India
7 from abroad

PROGRAMME	**SCHOOL ON MATHEMATICAL FINANCE**
DATE	16- 27 January, 2012
ORGANIZERS	Freddy Delbaen, Srikanth K. Iyer, Sandeep Juneja and Ronnie Sircar
VENUE	TIFR, Mumbai

REPORT

The financial markets worldwide have seen a tremendous growth in the last four decades. This was driven largely by financial innovation riding on complex pricing and hedging formulas provided by pioneering developments in mathematical finance. Mathematical finance also contributed strongly by providing quantitative models for investment in portfolio of assets and in managing diverse and complex market, credit and operational risks. Financial derivatives were introduced in Indian markets in 2000. Since then they have grown tremendously in trade volume. However, India currently lacks a critical mass of researchers and practitioners adept in further developing and implementing sophisticated ideas in mathematical finance.

To facilitate growth of research in this area a two week long school and a workshop on Mathematical Finance sponsored by ICTS was conducted. Top luminaries in the field of mathematical/computational finance and financial economics taught short courses to interested researchers and potential researchers bringing them to the frontiers of research in financial mathematics.

There were introductory lectures in probability and mathematical finance on the first few days. Thereafter, during January 18-21 and January 23-26, over a period of seven days, international experts conducted lectures, each of duration five hours, in their areas of expertise. On the last two days, January 26-27 there was a research workshop where the speakers and other guests presented their research.

SPEAKERS & TITLES OF TALKS

Freddy Delbaen	1. Introductory Lecture
	2. Monetary utility functions and capital requirements
Ronnie Sircar	Overview
Mrinal K. Ghosh	1. Discrete time finance
	2. Continuous time finance
	3. Pricing defaultable bonds in a Markov modulated market
Rajeeva Karandikar	1. Review of Basic probability, joint distributions, conditional probability, conditional distribution.
Dilip Madan	1. Leavy and Sato processes calibrated and applied to problems of capital allocation and risk management using the theories of conic finance and nonlinear expectations
	2. On pricing contingent capital notes
Peter Carr	1. FX Options: challenges and opportunities
	2. Recent developments in static hedging
Dmitry Kramkov	1. Arbitrage-Free Pricing, Optimal Investment and Equilibrium
	2. Integral representation of martingales and endogenous completeness of financial models
Kay Giesecke	1. Credit risk with point processes
	2. Large portfolio asymptotics for loss from default

Nizar Touzi	Optimal stochastic control and Backward SDEs
Srikanth Iyer	Pricing credit derivatives in a Markov modulated reduced form model
Krishanu Maulik	Tail Behavior of Randomly Weighted Sums
Gopal Basak	Foreign capital inflow, exchange rate dynamics and potential financial crisis
Soren Asmussen	Finite horizon ruin probabilities
Suresh Kumar	Credit portfolio management using exponential utility
Kshama Fernandes	Estimating the distribution of default instances for microfinance loans
Garud Iyengar	An axiomatic approach to systemic risk
Vivek Borkar	Risk-constrained Markov decision processes
Ratul Lahkar	Logit dynamic and price dispersion

PARTICIPANTS

20 from India
65 from abroad

PROGRAMME	**RANDOM MATRIX THEORY AND APPLICATIONS**
DATE	17 January - 1 February, 2012
ORGANIZERS	Justin David, Abhishek Dhar, Rajesh Gopakumar, H. R. Krishnamurthy, Manjunath Krishnapur, Satya Majumdar, Govind Menon and Sanjib Sabhapandit
VENUE	Indian Institute of Science, Bangalore

REPORT

Random matrix theory has found usage in a wide variety of problems in mathematics and physics. The purpose of this meeting was to bring together a diverse group of mathematicians and physicists working in some of the many areas that connect with random matrix theory. The programme consisted of a school with introductory lectures on random matrix theory in both mathematics and physics. It was followed by a conference that consisted of a broader range of topics to highlight the latest research developments.

SPEAKERS & TITLES OF TALKS

Carlo Beennakker	Random matrix theory of topological insulators
Nick Ercolani	Conservation Laws of Random Matrices
Kedar Damle	Distribution of Andreev conductance in the limit of large number of transverse channels
Satya Majumdar	Top Eigenvalue of a Random Matrix: A tale of tails
Kurt Johansson	The Brownian tacnode
Yan Fyodorov	Characteristic Polynomials of Random Matrices, Disordered Landscapes, and 1/f Noises
Tomohiro Sasamoto	Height distributions for the KPZ equation
Pragya Shukla	Universality in Complexity: a Random Matrix view-point
Gregory Schehr	Extreme value statistics of non-intersecting Brownian motions : from random matrices to 2d Yang-Mills theory on the sphere

Maciej A. Nowak	Multiplication law and S-transform for non-Hermitian random matrices
Gautam Mandal	Phase diagram of Yang-Mills theories on tori and a new AdS/CFT dual for deconfinement
Xavier Viennot	Combinatorics of orthogonal polynomials and exclusion processes in physics
Philippe Biane	Brownian motion on matrices and Segal-Bargmann transform
Pierpaolo Vivo	The index distribution for Gaussian and WIshart random matrices
Arul Lakshminarayan	Random Matrix Theory and Entanglement: On the spectra of the partial transpose
Sudhir Jain	Non-Hermitian Random Matrix Theory and Applications
Asok K. Sen	Mesoscopic Fluctuations and concommitant Unusual Level Spacing Distributions in 1D Disordered Systems
Arup Bose	Patterned Random Matrices
Nivedita Deo	Random Matrix Models of RNA Folding
Ofer Zeitouni	Noise Stabilization for non normal matrices
Balint Virag	

PARTICIPANTS

42 from India
16 from abroad

PROGRAMME	**UNIFYING CONCEPTS IN MATERIALS: JA KRUMHANSL SCHOOL & SYMPOSIUM 2012**
DATE	30 January- 8 February, 2012
ORGANIZERS	Madan Rao, Srikanth Sastry, Surajit Sengupta and Subodh R. Shenoy
VENUE	School: 30 Jan – 5 Feb, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore Symposium: 6-8 Feb, National Centre for Biological Sciences (NCBS), Bangalore

REPORT

It has become increasingly clear in recent years that the concept of a 'material' goes well beyond its origins in hard condensed matter or material science. Functional materials, such as shape memory alloys, show complex multiscale patterns of elastic domain walls. Glassy and driven materials involve nonequilibrium states of matter that go beyond conventional thermodynamics. Granular materials show stress propagation along force chains, jamming and intriguing connections with the physics of amorphous solids. Living cells and tissues are active materials displaying unique mechanical properties in their steady state, and in their response to stresses.

The presently distinct fields of condensed matter physics, materials science, biological physics, and statistical mechanics, have close foundational links, and James A Krumhansl (1919-2004) had long

advocated dissolving intellectual phase separations between them. In this interdisciplinary spirit, an international symposium self-organized by volunteers, is held every four years. With 'materials' interpreted in this broader sense, a 10-day JA Krumhansl School and Symposium (JAKS-2012), focusing on a search for "Unifying Concepts in Materials" was held in Bangalore.

The 7-day School at JNCASR, and 3-day Symposium at NCBS, had four themes:
1. Functional materials
2. Glassy/ driven materials
3. Granular materials
4. Biological/ soft materials

This programme was designed to educate young people and to bring together active researchers, for an interdisciplinary cross-fertilization of ideas on unifying concepts in materials.

SPEAKERS & TITLES OF TALKS

M.R.S. Rao	Inauguration and welcoming the participants
Abhinandanan	Functional Materials I & III
Kumaran	Granular Materials I & II
Waghmare	Functional Materials II & IV
Corey S O'Hern	1. Granular Materials III & IV
	2. The contact percolation transition in athermal particulate systems
Lemaitre	1. Glassy/Driven Materials I & II
	2. Elementary mechanisms of plastic deformation in amorphous materials
Bowick	Soft Materials I & II
Voigtmann	1. Glassy/Driven Materials III & IV
	2. Yielding dynamics of glass-forming materials
Mike Cates	Soft Glassy Rheology followed by general discussion on Glassy/Driven Materials
Avadh Saxena	Unifying concepts in physics, biophysics and materials science
T. V. Ramakrishnan	Emergence of d-wave like superconducting order in a Ginzburg- Landau like theory for superconductivity in the cuprates
Bulbul Chakraborty	Statistical mechanics of jamming of frictional grains
Devang Khakhar	Dense granular flows: Rheology and segregation
Kaushik Bhattacharya	Peeling adhesive tape: A case study for understanding the effective properties of heterogenous materials.
G Ananthakrishna	Correlation between stick-slip events and contact charging in dynamics of sliding friction at nano-scales
David Rodney	Exploring the potential energy landscape of materials: from defected crystals to metallic glasses
Claus Heussinger	Jamming and glassy dynamics in driven particulate systems
Ludovic Berthier	Rheology of disordered materials from soft glasses to jammed solids
John C Crocker	Dissecting the molecular determinants of cellular rheology and stress fluctuations
Mahesh Bandi	Shock-driven jamming and periodic fracture at particulate interfaces.
Michael E Cates	How different are polymer glasses from simple glassy fluids?
Paul A Janmey	Mechanical communication between cells and substrates
Cristina Marchetti	Collective dynamics of active matter: from self-propelled particles to migrating cell layers.
Shobo Bhattacharya	Amorphous to amorphous transition in athermal particle rafts
Rajesh Ganapathy	Grain boundary dynamics In colloidal crystals
Rahul Pandit	Early Krumhansl interactions at Cornell

Eran Bouchbinder	Nonequilibrium thermodynamics of driven glassy materials
Praveen Chaddah	Glass-like arrested states across first-order magnetic transitions
Xiaobing Ren	A glass form of martensite: Strain glass and strain-glass transition
Turab Lookman	Heterogeneity and phase transformations in materials: from Krumhansl to now
Oliver Kastner	MD simulations study of microstructure formation during martensitic transformations
U Ramamurthy	Fracture in amorphous alloys: in search of a length scale
Dhananjai Pandey	Magnetoelectric coupling and isostructural phase transitions in the solid solutions of the multiferroic $BiFeO_3$ with ferroelectric $BaTiO_3$ and $PbTiO_3$
Peter D Entel	Functional properties of magnetic Heusler alloys from an ab initio point of view
Lluis Manosa	Materials for eco-friendly refrigeration
Mehmet Acet	Relationship of the elemental properties of Fe and Mn to magnetostructural transition related multifunctionality in martensitic Heusler alloys

PROGRAMME	**EVOLUTIONARY ORIGINS OF COMPARTMENTALIZED CELLS**
DATE	19 February – 2 March, 2012
ORGANIZERS	Frances Brodsky, Satyajit Mayor and Mukund Thattai
VENUE	National Centre for Biological Sciences, Bangalore

REPORT

This programme was a follow-up to a meeting held at the Kavli Institute for Theoretical Physics in the Spring of 2010. This 2-week programme dealt with the ancient origins of the eukaryotic compartmentalized cell plan. Surprisingly little is known about this key phase of the evolution of life on earth. Eukaryotes began to diverge from bacteria during the global oxygenation event 2.5 billion years ago, but all living eukaryotes share a more recent common ancestor dating from about 1 billion years ago. Data from modern eukaryotic genomes, as well as exciting recent studies of rudimentary compartments in bacterial cells, might allow us to reconstruct the intervening 1.5 billion year period during which quintessential eukaryotic features emerged: the nucleus, compartmentalized organelles, the cytoskeletal machinery, and vesicle traffic.

The programme brought together two ingredients: (1) The cell biology and biophysics of intracellular compartments and vesicle traffic. (2) The evolution of key molecular players involved in generating and maintaining intracellular compartments. There were pedagogical tutorials (on cell biology and phylogenetic techniques) as well as a three-day conference in which experts from around the world discussed the current understanding of eukaryote origins. This programme hoped to benefit biophysicists interested in cell biological mechanisms; cell and evolutionary biologists interested in eukaryote origins; and bioinformaticians or computational biologists interested in modern phylogenetic techniques. The programme was intended to provide graduate students and post-doctoral researchers possible research directions in this rapidly accelerating field.

SPEAKERS & TITLES OF TALKS

S. Pfeffer	Tutorial: Eukaryotic membranes: nuclear transport, secretion and endocytosis
M. Duncan & M. Robinson	Tutorial: Molecular basis of membrane traffic (coats and membrane bending)
M. Balasubramanian, D. Devos, J. Fuerst	Tutorial: Shared cytoskeletal and traffic machinery of prokaryotes and eukaryotes
S.Mayor, M. Munson	Tutorial: Lipid traffic and membrane fusion mechanisms
P. Parham	Public lecture: Boosting Eurasian Immunity by Alliance and Dalliance of Humans, Ancient and Modern
F. Brodsky, P. Parham	Tutorial: Introduction to the immune system
M. Bettencort-Dias, A. Turkewitz	Tutorial: Centrosome roles in cell cycle, cilia and signaling
M. Lynch	Public Lecture: Mutation, Drift, and Evolution at the Subcellular Level

PROGRAMME	**INDIVIDUALS AND GROUPS**
DATE	22- 21 May, 2012
ORGANIZERS	Vidyanand Nanjundiah, Lok Man Singh Palni
VENUE	G.B. Pant Institute of Himalayan Environment and Development, Almora, Uttarakhand

REPORT

This programme concerned with cooperative phenomena in biological groups; common structural features behind the phenomena was proposed to be highlighted. Specifically, the aim was to focus on aspects of group behaviour that cannot be understood from the functioning of its constituent units in isolation, aspects that demand group-level 'emergent' properties to be invoked. The formal part of programme consisted of lectures and short tutorials.

It is common in biology for more than one potential or actual unit of reproduction to form part of a larger whole that is composed of similar or dissimilar units. In many cases the whole displays group-level traits that are not seen in its constituents. One looks for explanations of a particular trait in terms of proximate causes, namely the underlying physics and chemistry, and separately in terms of the evolutionary history of the group. In general, within-group effects disfavour cooperation between units and between-group effects favour cooperation. Genetic relatedness among group members can influence the outcome.

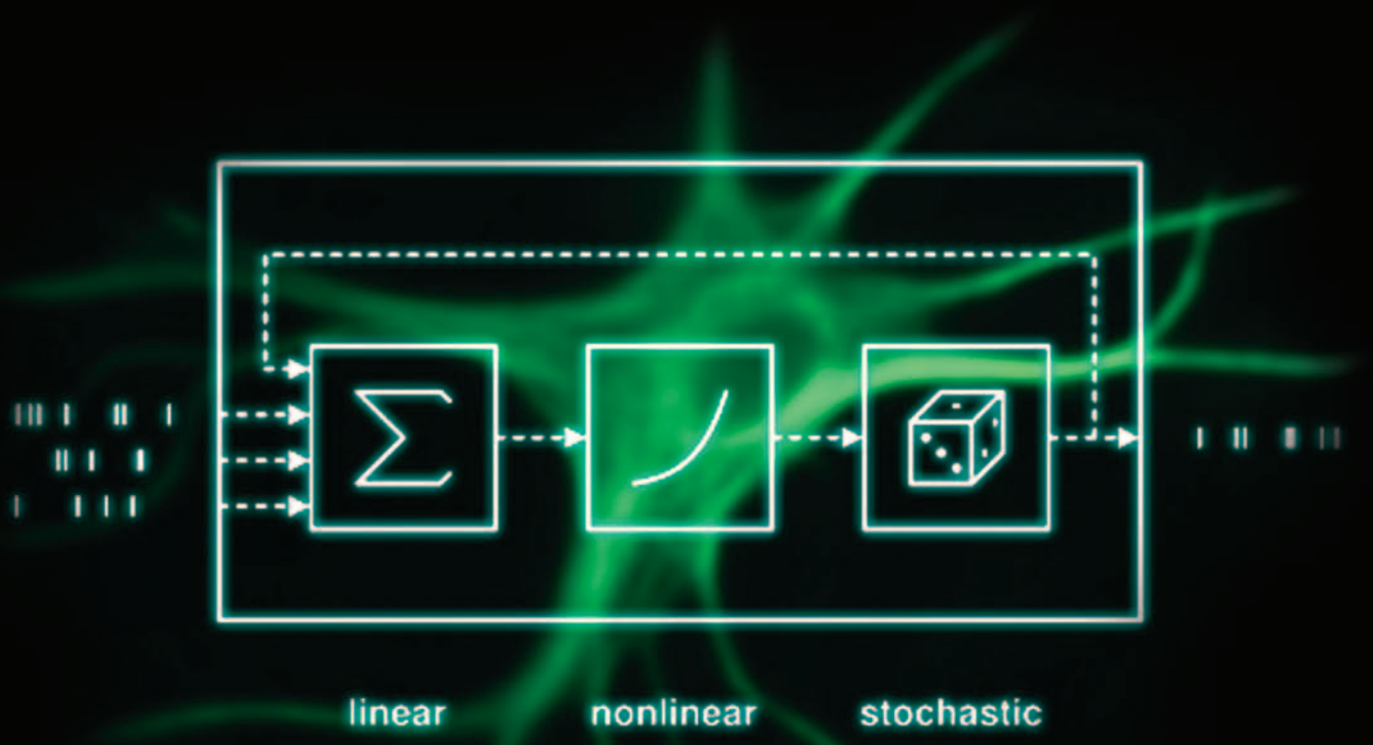
The programme began with overviews of how the individual versus group distinction is tackled in physics and chemistry. Next, different levels of biological organisation was considered ranging from molecules to genes, proteins, metabolic pathways, cells, organisms and ecological communities. Various phenomena were examined which included collective oscillations, the reliability and stability of genetic and metabolic networks, multicellular development, normal and pathological social behaviour among cells and organisms and, finally, multi-species interactions.

SPEAKERS & TITLES OF TALKS

Cihan Saçlioglu, Önder Pekcan and V. Nanjundiah	Introduction to group behaviour in physical, chemical and biological systems
B. Houchmandzadeh	1. Modelling large complex systems (Tutorial Talk) 2. Selection for 'common good producers'
J. Hofmeyr	1. Metabolic control analysis (Tutorial Talk) 2. The cell as a molecular marketplace
V. Nanjundiah	Non-autonomy, social selection and cooperative groups
Albert Goldbeter	Interacting oscillatory modules
Ayse Erzan	An ensemble approach to the evolution of complex systems
Paul Rainey	1. Bottlenecks, exclusion rules and the evolutionary genetics of bet-hedging 2. Evolutionary transitions, life cycles and the emergence of multicellularity
Mohinish Shukla	1. Cognition (Tutorial talk) 2. Social cognition and learning
Patrick Bateson	1. Nature, nurture and epigenetics (Tutorial talk) 2. Good arguments for group selection
S. Mahadevan	The genotype-phenotype relation
Mohammad Tariq	Global regulation of gene activity during development of a multicellular organism
Marta Linde-Medina	Multi-primordia development and emergence
Gopal Pande	Pseudopodium – the "false foot" that keeps biology on the move
Kei Inouye	Mechanism of cell movement in multicellular environments
Ellen Clarke	1. The history of 'the individual' in biology (Tutorial talk) 2. The concept of the individual in biology
Vishwesha Guttal	An evolutionary game theoretic approach to study individual behaviors to collective animal motion
Jacques van Helden	1. Network topology and network behavior (Tutorial talk) 2. Relationship between topology and behaviour of molecular interaction networks
Silvia De Monte	On the emergence of social groups
Carlos Sonnenschein	From the cell to cancer: An emerging evolutionary perspective
A. Rangarajan	Cancer as a group phenomenon
Prakash Kulkarni	Protein Regulatory Networks, Evolution and Cancer: the role of Intrinsically Disordered Proteins
D. Wloch-Salamon	Social behaviour in Saccharomyces cerevisiae populations
Clement Nizak	Multicellular development of social amoebae as a model system to study the evolution of groupsize and division of labour
Renee Borges	Costs and benefits of a group in multitrophic interaction systems
K. R. Shivanna	Biotic pollination: How plants achieve conflicting demands of attraction and restriction of floral visitors
Kunihiko Kaneko	Characterising biological robustness and plasticity through consistency principle in hierarchical levels
A. Chattopadhyay	Restricted collective dynamics in cell membrane
Telmo Pievani	From Individuals to Groups: Darwinian Pluralism as a toolkit for the explanation of cooperative behaviours
George Katsiaficas	Individual and Group: Some Comparative Cultural Observations

PARTICIPANTS

41 from India
7 from abroad



“Our minds – the behavior of our brains – can be explained by the interaction of nerve cells (and other cells) and the molecules associated with them.”

- Francis Crick

RECENT ACTIVITY

PAN ASIAN NUMBER THEORY WORKSHOP AND CONFERENCE

Date: 17 - 27 July, 2012

Organisers: J. Coates, Soumen Maity, A. Raghuram, Anupam Saikia and R. Sujatha

Venue: IISER, Pune

Purpose

Humanity's interest in the Theory of Numbers began in the antiquity in Asia, and from there passed to Greece and the Arab world, and then on to the West. The aim of the annual Pan Asian Number Theory (PANT) Conferences is to encourage research in Number Theory in present day Asia, and especially to foster collaborations among young Asian Number Theorists. This ICTS programme will incorporate the fourth PANT Conference, the previous conferences having been held in Korea (2009), Japan (2010) and China (2011). The Conference itself, consisting of about 20 one hour invited lectures, will take place over four days July 23 -27, 2012, inclusive. It will be preceded by an Instructional Workshop from July 17-22, aimed at presenting in detail for graduate students and non-specialists what is known about the Bloch-Kato conjectures for the Riemann zeta function at the odd positive integers. No self-contained account of this work exists at present in the literature, and the workshop hopes to fill this gap. A detailed and comprehensible account of the full proof will be presented at the workshop. The final day of the Workshop, meant as a transitional day into the Conference, will feature a series of three lectures on some major topic of current research in Number Theory.

SUBRAHMANYAN CHANDRASEKHAR LECTURES

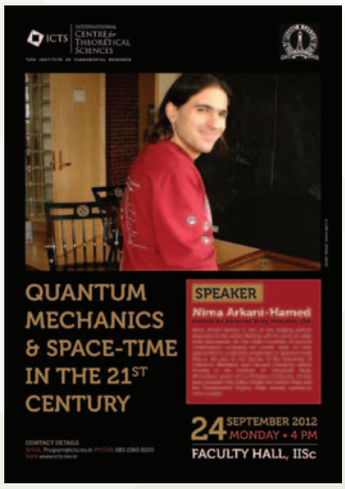
SCATTERING WITHOUT SPACE TIME

Speaker: Nima Arkani Hamed, Institute for Advanced Study, USA
Date: 25- 27 September 2012
Venue: IISc, Bangalore

PUBLIC LECTURE

QUANTUM MECHANICS & SPACE-TIME IN THE 21ST CENTURY

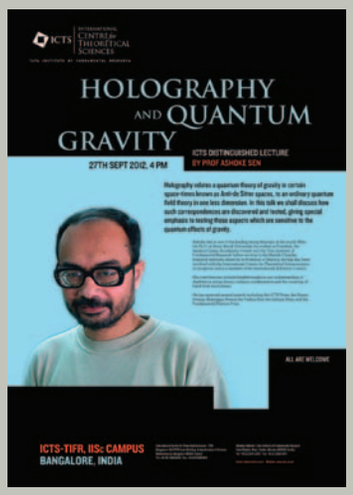
Speaker: Nima Arkani Hamed, Institute for Advanced Study, USA
Date: 24 September 2012
Venue: IISc, Bangalore



ICTS DISTINGUISHED LECTURE

HOLOGRAPHY & QUANTUM GRAVITY

Speaker: Ashoke Sen, Harish-Chandra Research Institute, Allahabad
Date: 27 September, 2012
Venue: IISc, Bangalore



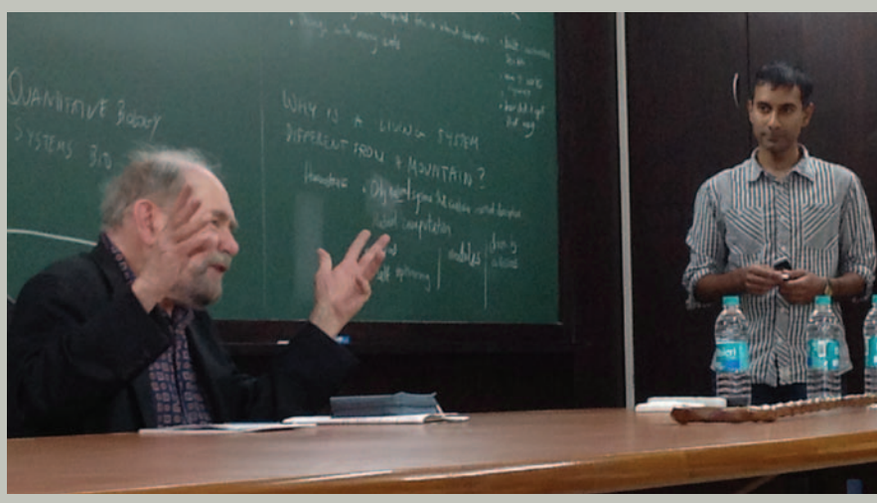
Abstract

Holography relates a quantum theory of gravity in certain space-times known as Anti-de Sitter spaces, to an ordinary quantum field theory in one less dimension. In this talk we shall discuss how such correspondences are discovered and tested, giving special emphasis to testing those aspects which are sensitive to the quantum effects of gravity.

DISCUSSION MEETING

THE ROLE OF THEORY IN BIOLOGY WITH PROF. SYDNEY BRENNER

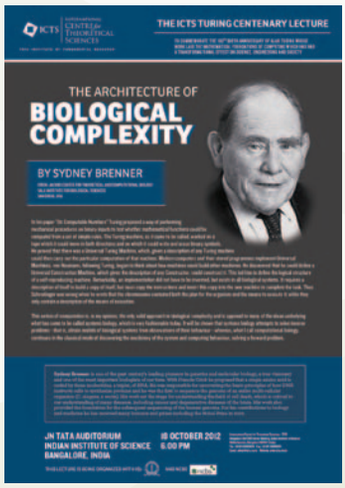
Organizers: Mukund Thattai, Spenta Wadia
Date: 18 October, 2012
Venue: ICTS, Old TIFR Centre bldg, IISc, Bangalore



ICTS TURING CENTENARY LECTURE

THE ARCHITECTURE OF BIOLOGICAL COMPLEXITY

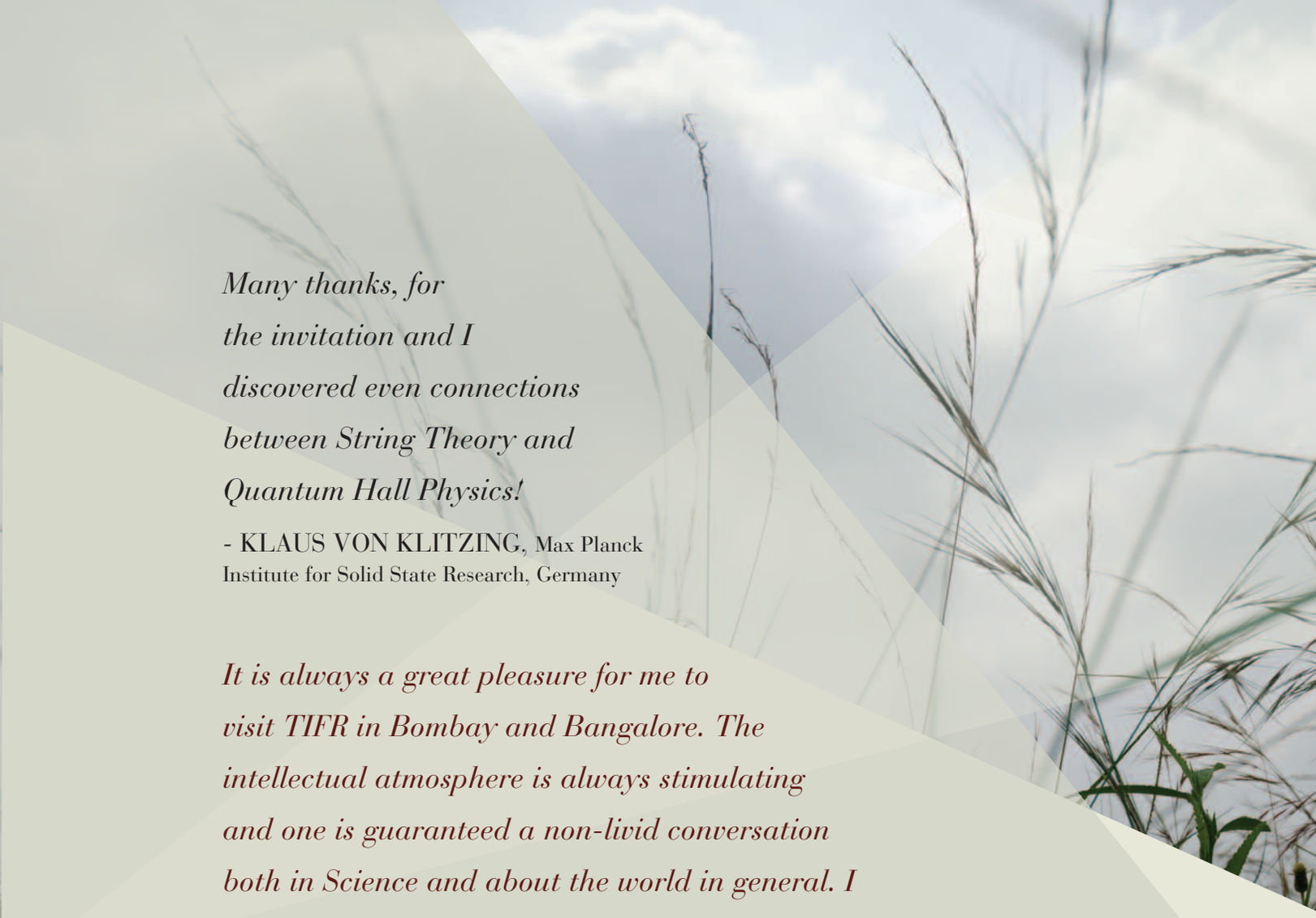
Speaker: Sydney Brenner
Date: 18th October, 2012
Venue: IISc, Bangalore



Abstract

In his paper "On Computable Numbers" Turing proposed a way of performing mechanical procedures on binary inputs to test whether mathematical functions could be computed from a set of simple rules. The Turing machine, as it came to be called, worked on a tape which it could move in both directions and on which it could write and erase binary symbols. He proved that there was a Universal Turing Machine, which, given a description of any Turing machine could then carry out the particular computation of that machine. Modern computers and their stored programmes implement Universal Machines. von Neumann, following Turing, began to think about how machines could build other machines. He discovered that he could define a Universal Construction Machine, which given the description of any Constructor, could construct it. This led him to define the logical structure of a self-reproducing machine. Remarkably, an implementation did not have to be invented, but exists in all biological systems. It requires a description of itself to build a copy of itself, but must copy the instructions and insert this copy into the new machine to complete the task. Thus Schrodinger was wrong when he wrote that the chromosome contained both the plan for the organism and the means to execute it; while they only contain a description of the means of execution.

This notion of computation is, in my opinion, the only valid approach to biological complexity and is opposed to many of the ideas underlying what has come to be called systems biology, which is very fashionable today. It will be shown that systems biology attempts to solve inverse problems - that is, obtain models of biological systems from observations of their behaviour - whereas, what I call computational biology, continues in the classical mode of discovering the machinery of the system and computing behaviour, so1ving a forward problem.



Many thanks, for the invitation and I discovered even connections between String Theory and Quantum Hall Physics!

- KLAUS VON KLITZING, Max Planck Institute for Solid State Research, Germany

It is always a great pleasure for me to visit TIFR in Bombay and Bangalore. The intellectual atmosphere is always stimulating and one is guaranteed a non-livid conversation both in Science and about the world in general. I hope to be able to spend more time here in the future.

- SANJOY MITTER, Massachusetts Institute of Technology, USA

It was a pleasure and honor to visit TIFR and give the Ramanujan lectures. The hospitality was fantastic and I learned a lot scientifically and otherwise. Good luck in continuing to make this centre a major one in mathematics.

- PETER SARNAK, Princeton University & Institute of Advanced Studies, USA

This has been a wonderful meeting. Both because of the wide variety of interesting talks on subjects I am not usually exposed to and because of the exciting atmosphere surrounding the founding of a new institute. Thank you for your warm hospitality and many good wishes to the future of ICTS !

- MICHAEL GREEN, University of Cambridge, UK

VISITOR'S COMMENTS

This was a great conference and a great beginning. ICTS offers enormous opportunity and I am sure that Indian science community will make full use of it.

- ASHOKE SEN, Harish-Chandra Research Institute, Allahabad

With my best wishes for unparalleled success.

- K.R. SREENIVASAN, Courant Institute of Mathematical Sciences, New York University, USA

It has been a wonderful experience to attend this meeting that has been lively with very interesting science and very interesting physicists. I think this is a sample of the things to come and I wish ICTS and its members the best!

- ELIAS KIRITSIS, Crete Centre for Theoretical Physics, University of Crete, Greece

Thanks to the remarkable activity of ICTS.
Rahul Pandit and I were able to organize a workshop on the future of advanced computations with participants from all over the world. I am very grateful to those who let this come to life in the great environment of the IISc.

- URIEL FRISCH, National Centre for Scientific Research, France

I believe in a brilliant future for the ICTS, and the support of the world community will be at its disposal. With many thanks for a wonderful conference and the warm hospitality.

- EDOUARD BRÉZIN, École Normale Supérieure, Paris

Thank you very much for your very efficient hospitality. I had a very productive and enjoyable time in India at IISER- Kolkata, HRI Allahabad, TIFR Mumbai and IISc Bangalore. Good luck with the new building, which I am eagerly awaiting.

- SUBIR SACHDEV, Harvard University, USA

FEEDBACK

The school part of the programme (NSEECS) was excellent in content. The lecturers, especially A. Ganesh, put in great efforts to make their lectures understandable to an audience with rather diverse backgrounds. I benefited much from the school. The talks in the workshop were of variable quality and overall it could have been more interesting.
The organization was flawless. I was only a local participant, but let me quote from a conversation with a speaker from France who told me "In all of France, I have never seen such perfect organization anywhere"! By this he meant arrangements w.r.t the lecture hall, accommodation, food, taxi and availability of help at all times. That is quite an achievement (our research is yet to elicit such high praise!). Thanks to ICTS and IISc Mathematics Initiative (IMI) for this wonderful programme.

- MANJUNATH KRISHNAPUR, Dept. of Mathematics, Indian Institute of Science, Bangalore

I really enjoyed this workshop (NSEECS).
Programme: The programme was very well thought out, with lectures on complementary themes and people with aligned yet not identical interests. Almost all the speakers gave really good talks.
Arrangements: The logistics and arrangements were very comfortable and easy to navigate. I heard this from several non-Indian colleagues as well.

- SUJAY SANGHVI, University of Texas - Austin, USA

Back in Florence, I would first want to thank you for your very efficient help in making the conference be such a pleasant and productive experience.

- FERNANDO VEGA-REDONDO, European University Institute, Italy

The programme (NSEECS) was very well organized, the arrangements were excellent. The lecture room was adequate.

- JEAN WALRAND, University of California - Berkley, USA

Thanks a lot for organizing a stimulating workshop (NSEECS), for the excellent local arrangements, and for inviting me. I benefited much from the event, and believe the same to be true for many other attendees as well.

- ARAVIND SRINIVASAN, University of Maryland, USA

What went well: Excellent lectures and tutorial sessions. Very helpful instructors. Material was coherent. The organizers made every attempt to ensure participants were getting the most out of the school. We could have as many events of this format as possible in the sciences and math.
What could be improved: 3 weeks might be a bit long. Can we use saturdays and sundays and maybe bring it down to 2 weeks?

- PARTICIPANT, (DARP)

Extremely well organised! A pleasure to see the range of speakers, and the range of topics that were covered. The event (NSEECS) was unique in its structure and should be encouraged for future events.

- GAURAV RAINA, IIT Madras, Madras

We are happy to attend such an unusual meeting, and anticipate more such multidisciplinary conferences that have such excellent talks and tutorials.

- PARTICIPANT, (APPLICATION OF CONTROL THEORY AND OPTIMISATION TECHNIQUES IN BIOCHEMICAL PATHWAYS)

The workshop (NSEECS) was a great success both scientifically and in terms of the organisation. I have very much appreciated the support received during my stay. As for the programme, I believe fewer talks would have made it even more agreeable.

- MOEZ DRAIEF, Imperial College London, UK

I attended the meeting "Network Science in Electrical Engineering and Computer Science" for two days, and regret that I could not participate in the entire workshop. I found the programme was well conceived, and the lectures very well presented. The audience participation was good, and there were good questions at the end of talks. I think my own presentation was a bit removed from the main thrust of the workshop, but even so, I found that people were interested in the work, and I found several interesting problems that other people were studying. On the whole, I think it was a good, well organized workshop.

- DEEPAK DHAR, TIFR, Mumbai

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Numerical Simulation: Luciano Rezzolla, Christian Reisswig (Max Planck Institute for Gravitational Physics - Albert Einstein Institute)
Scientific Visualisation: Michael Koppitz (Max Planck Institute for Gravitational Physics and Zuse Institute Berlin)

Page 91
Simulation: NASA/Goddard Numerical Relativistic Astrophysics Group
Scientific Visualization: Chris Henze, NASA/Ames

Page 170
Artist: Gunnar Grah
Source: Bernstein Center Freiburg

"Most amazing is this realization that everything that exists in the universe came from a common origin. The material of your body and the material of my body are intrinsically related because they emerged from and are caught up in a single energetic event. Our ancestry stretches back through the life forms and into the stars, back to the beginnings of the primeval fireball. This universe is a single multiform energetic unfolding of matter, mind, intelligence, and life. And all of this is new. None of the great figures of human history were aware of this. We are the first generation to live with an empirical view of the origin of the universe. We are the first humans to look into the night sky and see the birth of stars, the birth of galaxies, the birth of the cosmos as a whole. Our future as a species will be forged within this new story of the world."

-Brian Swimme

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