

Annual Report 2013-14

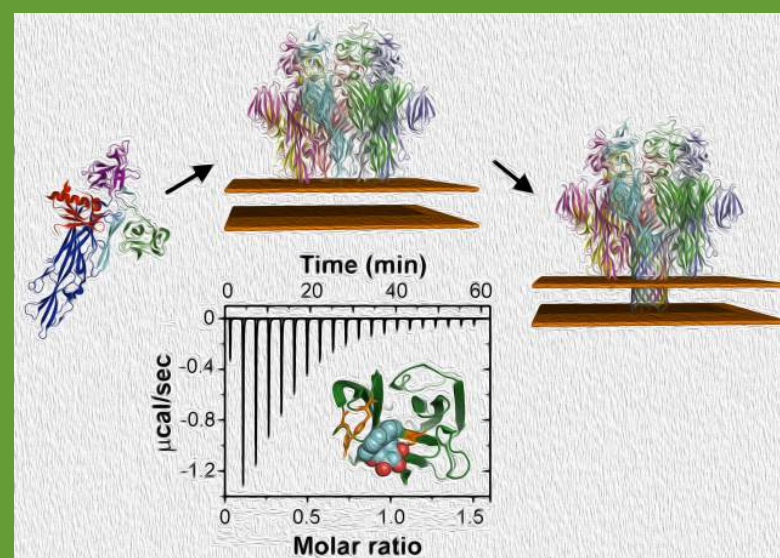
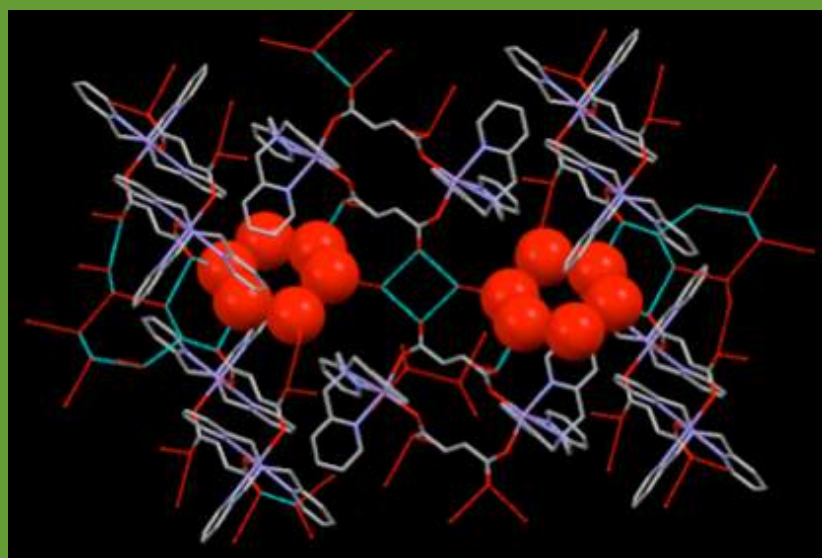
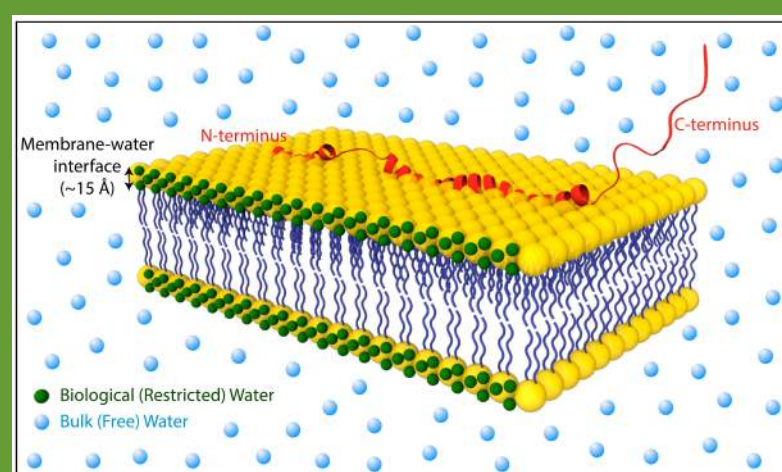
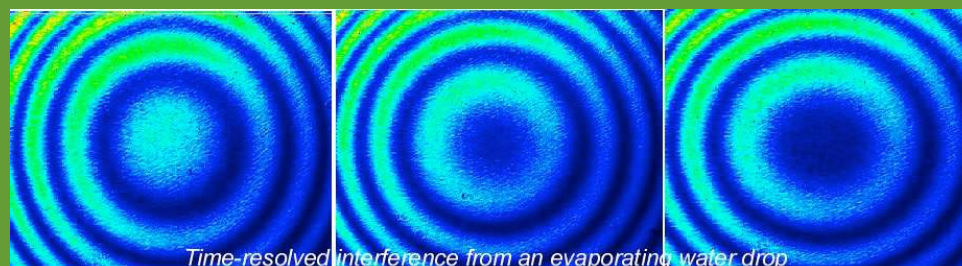
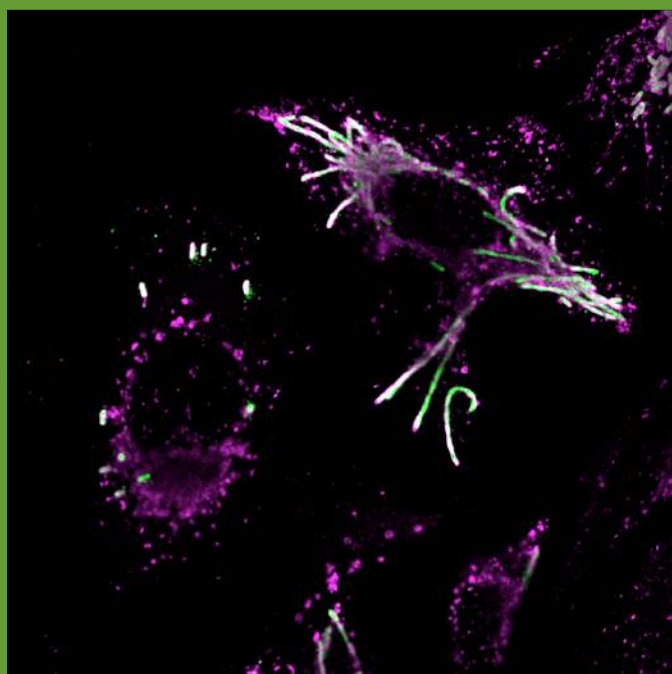
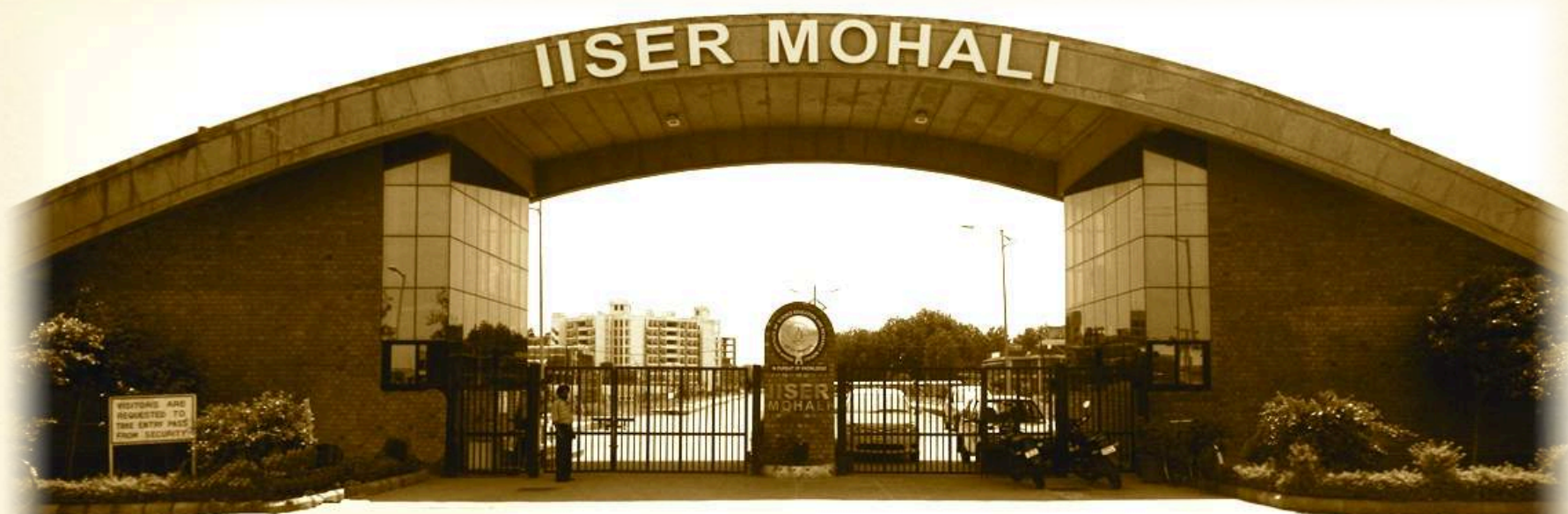


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Front cover art: Research from IISER Mohali, Image of lysosomes in HeLa cells, Time resolved interference from an evaporating water drop, Membrane pore-formation mechanism of *Vibrio cholerae* cytolysin, membrane bound synnuclein, Perspective view of the encapsulated cyclic hexamer of water



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Preface

In 2007, a little less than 7 years ago, IISER Mohali started functioning in a transit accommodation, rented from the Punjab government in Sector 26, Chandigarh with 25 students. They stayed in a nearby hostel, generously made available by NITTTR. The future was still unclear, since the land in Mohali was yet to be handed over.

In 2014, IISER Mohali functions fully in its own campus in Sector 81, forming a part of what is called the Knowledge City. There are currently 499 BS-MS students, 34 Integrated PhD students, with 171 PhD students on the rolls, and about 21 post-doctoral fellows. All the students reside in the hostels which were one of the first buildings to come up on campus. Two batches of BS-MS students have graduated, and the first batch of three PhD graduates have come out too! We now have around 70 faculty members on board. We are also supported by a lean administration. Looking back at those early days, we can say that IISER Mohali has indeed come a long way. However, we believe, there still is a long way to go.

The year (2013-14) that has gone by saw many new developments in the campus. The Visitors hostel was completed, and so was Hostel 8. The Health centre with a regular doctor and 2 nurses is a much required presence on campus. Although currently housed in a single room in the shopping complex, it would soon move into a full-fledged Health centre that is nearing completion. Thus with the completed buildings such as the Central Analytical Facility, the Hostels 5, 7 and 8, each with a capacity of 256, the Academic Block-I, the Shopping complex, the Lecture Hall complex including the 500 seater auditorium, the residential blocks ME, MI and MJ, the professors quarters and the Director's residence, a large part of Phase-I of construction has been completed.

During this period, IISER Mohali was a host to several conferences, and with time, as research activities become more fervent, this is bound to increase. The Annual Meeting of the Indian Academy of Sciences, Bangalore was hosted jointly by Panjab University, IMTECH and IISER Mohali. It was a great opportunity for the three institutes to come together. In addition, a symposium on Ubiquitin and Cellular processes, a National Crystallography meeting, a meeting organized by mathematicians

of IISER Mohali and IIT Ropar on the ‘Knot Theory and its applications’, a one day symposium on the ‘History of Chemistry in India’ on behalf of the Indian National science Academy, New Delhi and the annual meeting of the Astronomical Society of India where there were 300 participants, were hosted by the Institute in the last several months.

Research at IISER Mohali has picked up in a big way, with more than one hundred publications coming out in the last one year. Although there has been generous support from the Government of India, many faculty members, especially in the area of experimental sciences, have brought in their own funds, and many of them are also recipients of different fellowships. Apart from the individual pieces of equipment being purchased or built, a liquid helium plant has been set up recently. The Department of Chemical Sciences and the Department of Biological Sciences have set up several central facilities for common use.

One of the mandates of IISER Mohali is to involve in Outreach activities, and this year too we have been active in organizing a host of activities that include a Science teacher training program for school teachers of Punjab, “Meet a scientist” series with EDUSAT Punjab, student group visits, the National Science Day celebrations and the summer research program.

The students of IISER Mohali, it must be said, have largely maintained their focus on academics, and yet they have also organized and participated in several events within and outside IISER Mohali with great success. The annual cultural festival, INSOM-NIA, was well organized, attracting large participation from several nearby institutions. Many of the events were creatively done, and they bore testimony to the talent pool we have in our midst. With a Physical Instructor joining us recently, we hope to see greater activity in the sports front.

An important aspect of the IISER concept is to expose young minds, at the undergraduate level, to top class researchers, and thus fire their imagination early on. One can already see the beginnings of that, with their contribution to research publications, and in one case, a single authored patent by a third year undergraduate student. We have highlighted this aspect this year, in a separate section called Undergraduate research activities.

IISER Mohali has thus had an eventful 2013-14 and it was an enjoyable task collating data for this report. I would like to acknowledge the help and support of colleagues and students for all their inputs, suggestions and photographs. In particular I would like to thank Dr. P. Balanarayan, Dr. Abhishek Chaudhuri, Dr. Shravan Mishra and Dr. Alok Maharana for getting the report in the present shape. Dr Amit Kulshreshta deserves a special mention for his efforts in bringing out a Hindi version of this report.

Anand K. Bachhawat

Dean, Research and Development

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Board of Governors

Academic Senate

Research Advisory Committee

Board of Governors

Dr. K. K. Talwar (Chairman), Former Director, PGIMER, Chandigarh

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Shri Rakesh Singh, IAS (Member), Chief Secretary, Punjab Civil Secretariat, Government of Punjab, Chandigarh

Professor P. Balaram (Member), Director, Indian Institute of Science, Bangalore

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Dr. S. Ayyappan (Member), Secretary, Department of Agriculture Research and Education (DARE) and Director General, ICAR, Ministry of Agriculture, Government of India

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Shri Yogendra Tripathi (Member), Financial Advisor, Ministry of Human Resource Development, Department of Higher Education, Government of India

Professor N. Sathyamurthy, Director, IISER Mohali, Punjab

Professor Kapil Hari Paranjape, IISER Mohali, Punjab

Professor K.S. Viswanathan, IISER Mohali, Punjab

Dr. P. Bapaiah (Secretary), Registrar, IISER Mohali, Punjab

Academic Senate

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Professor Ashok Sahni (Member), Panjab University, Chandigarh

Professor S. V. Kessar (Member), Panjab University, Chandigarh

Dr. Girish Sahni (Member), Director, IMTECH, Chandigarh

Professor B. N. Goswami (Member), Panjab University, Chandigarh

Professor M. K. Surappa (Member), Director, IIT Ropar, Punjab

Professor Arun Grover (Member), Panjab University, Chandigarh

Dr. Rakesh Tuli (Member), Director, NABI, Mohali, Punjab

Professor K. K. Bhutani (Member), NIPER, Mohali, Punjab

Professor K. S. Viswanathan (Member), Dean Students, IISER Mohali, Punjab

Professor Kapil Hari Paranjape (Member), Dean Faculty, IISER Mohali

Professor Sudeshna Sinha (Member), IISER Mohali, Punjab

Professor Anand K. Bachhawat (Member), Dean R&D, IISER Mohali, Punjab

Professor Purnananda Guptasarma (Member), IISER Mohali, Punjab

Professor Jasjeet Singh Bagla (Member), IISER Mohali, Punjab

Professor Ramesh Kapoor (Member), IISER Mohali, Punjab

Professor C. G. Mahajan (Member), IISER Mohali, Punjab

Professor Arvind (Member), IISER Mohali, Punjab

Professor I. B. S. Passi (Member), Honorary Professor, IISER Mohali, Punjab

Dr. Sanjay Mandal (Member), IISER Mohali, Punjab

Dr. N. G. Prasad (Member), IISER Mohali, Punjab

Dr. Chanchal Kumar (Member), Dean Academics, IISER Mohali, Punjab

Dr. Anu Sabhlok (Member), IISER Mohali, Punjab

Dr. P. Bapaiah (Secretary), Registrar, IISER Mohali, Punjab

Research Advisory Committee

Dr. S. Sivaram, NCL Pune (Chairperson)

Dr. S. Rath, NII Delhi

Professor H. S. Mani, CMI Chennai

Professor Rajendra Bhatia, ISI Delhi

Professor Jasjeet Singh Bagla, Dean Research and Development, IISER Mohali (Convener) (upto Dec. 31, 2013)

Professor Anand K. Bachhawat, Dean Research and Development, IISER Mohali (Convener) (Jan. 1, 2014 - present)

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Administration and Faculty

Administration

Director
Professor N. Sathyamurthy

Dean Faculty

Professor Anand K. Bachawat
(upto Dec. 31, 2013)

Professor Kapil Hari Paranjape
(Jan. 1, 2014 - present)

Dean Academics
Dr. Chanchal Kumar

Dean Students

Professor Arvind
(upto Dec. 31, 2013)

Professor K. S. Viswanathan
(Jan. 1 2014 - present)

Dean Research and Development

Professor Jasjeet Singh Bagla
(upto Dec. 31, 2013)

Professor Anand K. Bachhawat
(Jan. 1, 2014 - present)

Registrar
Dr. P. Bapaiah

Assistant Registrars

Shri Sandeep Ahlawat

Shri Mukesh Kumar

Deputy Librarian
Dr. P. Visakhi

Executive Engineer cum Estate Officer
Shri Praveen Kumar Srivastava

Honorary Counsellor
Mrs. Suguna Sathyamurthy

Counsellor
Ms. Yogeet Brar

Wardens (Boys)

Dr. S. Arulananda Babu

Dr. Chandrakant Aribam
(Jan. 1, 2014 - present)

Dr. Dipanjan Chakraborty
(Aug. 1, 2013 - present)

Dr. N. G. Prasad
(Apr. 1, 2013 - Dec. 31, 2013)

Wardens (Girls)

Dr. Anu Sabhlok
(Apr. 1, 2013 - Dec. 31, 2013)

Dr. Arunika Mukhopadhyay

Dr. H. K. Jassal
(Jan. 1, 2014 - present)

Dr. Rachna Chaba
(Aug. 1, 2013 - present)

Security Officer
Shri G. S. Multani

Medical Officer
Dr. Gurpreet Singh

Medical Consultant
Dr. S. K. Aggarwal

Lady Medical Consultant
Dr. Virpal J. Singh

Advisor Landscape and Horticulture
Dr. J. S. Bilga

Scientific Officer
Dr. Paramdeep Singh Chandi

Software Engineer
Ms. Garima Kaushik

Assistant Engineer (Electrical)
Er. Atul Kadwal

Assistant Engineer (Civil)
Er. Rajeev Kumar

Deputy Librarian
Dr. P. Visakhi

Physical Education Instructor
Shri Kirpal Singh

Personal Assistants

Ms. Poonam Rani

Ms. Yashoda Negi

Personal Secretary
Ms. Amandeep Saini

Accountants

Shri Sachin Jain

Shri Raman Kumar

Library Information Assistants

Shri Peeyush Dwivedi

Shri Shameer K. K.

Technical Scientific Assistants

Shri Rakesh Kumar

Shri Ramesh Kumar

Software Assistant
Ms. Sangeetha Gurusamy

Scientific Assistants

Shri Ranjith Kumar Kongari

Shri Bhavin R. Kansara

Technical Assistant
Shri Triveni Shanker Verma

Lab Technicians

Shri Mangat Ram

Shri Tejinder Kumar

Shri Anupam Pandey

Ms. Shikha Gupta

Lab Assistants

Shri Balbir Singh

Shri Inderjit Singh

Shri Ganesh Lal Meena

Shri Prahlad Singh

Shri Kamlesh Satpute

Office Assistants

Shri Mansa Ram Gupta

Ms. Neena Kumari

Shri Tarandip Singh

Ms. Deepika

Shri Gaurav Kumar Sharma

Shri Charanjit Singh

Data Entry Operators

Shri Sukhpreet Singh

Ms. Bhupali Sharma

Peon
Shri Bhopal Singh

Staff Nurses

Ms. Jaspreet Kaur

Shri C. Periyasamy

Faculty

R. Vijaya Anand (Assistant Professor, Chemistry) Synthetic Organic Chemistry

Chandrakant S. Aribam (Assistant Professor, Mathematics) Number Theory

Arvind (Professor, Physics) Quantum Information Theory, Quantum Optics

S. Arulananda Babu (Assistant Professor, Chemistry) Synthetic Organic Chemistry

Kavita Babu (Assistant Professor, Biology) Neurobiology

Anand K. Bachhawat (Professor, Biology) Glutathione and Sulphur Metabolism in Yeasts

Jasjeet Singh Bagla (Professor, Physics) Cosmology, Astrophysics

P. Balanarayan (Assistant Professor, Chemistry) Computational and Theoretical Chemistry

Samarjit Bhattacharyya (Assistant Professor, Biology) Neurobiology

Rachna Chaba (Assistant Professor, Biology) Bacterial Genetics and Physiology

Dipanjan Chakraborty (Assistant Professor, Physics) Soft Condensed Matter or Statistical Physics

Kausik Chattopadhyay (Assistant Professor, Biology) Structure-Function Studies on Pore-Forming Protein Toxins

Abhishek Chaudhuri (Assistant Professor, Physics)
Soft Condensed Matter Physics

Angshuman R. Choudhury (Assistant Professor, Chemistry) X-Ray Crystallography

Rhitoban Ray Choudhury (Assistant Professor, Biology) Evolution Genetics and Genomics

Adrene F. D’cruz (Assistant Professor, Humanities and Social Sciences) English Literature

Kavita Dorai (Associate Professor, Physics) Biomolecular NMR, Quantum Computing

Krishnendu Gangopadhyay (Assistant Professor, Mathematics) Groups, Geometry and Dynamics

Samrat Ghosh (Assistant Professor, Chemistry) Materials Chemistry

Purnananda Guptasarma (Professor, Biology) Protein Engineering and Structural Biochemistry

Manjari Jain (Assistant Professor, Biology) Behavioural Ecology and Evolutionary Biology

Harvinder Kaur Jassal (Assistant Professor, Physics) General Relativity and Cosmology

Ramandeep Singh Johal (Associate Professor, Physics) Statistical Physics, Thermodynamics, Quantum Theory

Ramesh Kapoor (Professor, Chemistry) Inorganic Chemistry

Rajeev Kapri (Assistant Professor, Physics) Statistical Mechanics

Sudesh Kaur Khanduja (Professor, Mathematics) Valuation Theory

Amit Kulshrestha (Assistant Professor, Mathematics) Quadratic Forms, Central Simple Algebras, Related Structures

Chanchal Kumar (Associate Professor, Mathematics) Algebraic Geometry, Combinatorial Commutative Algebra

Sanjeev Kumar (Assistant Professor, Physics) Condensed Matter Theory: Correlated Electron Systems, Disordered Systems

C. G. Mahajan (Professor, Physics) Atomic / Molecular Spectroscopy

Alok Kumar Maharana (Assistant Professor, Mathematics) Algebraic Geometry

Lolitika Mandal (Assistant Professor, Biology) Hematopoiesis, Cardiogenesis, Molecular Pathways in Stem and Progenitor Cell Development in *Drosophila*.

Sanjay Mandal (Associate Professor, Chemistry) Organometallic Chemistry, Nanomaterials, X-Ray Diffraction

Sudip Mandal (Assistant Professor, Biology) Mitochondrial Regulation of Cellular Function

Shravan Kumar Mishra (Assistant Professor, Biology) Ubiquitin-Related Modifiers and RNA Splicing

Arunika Mukhopadhyaya (Assistant Professor, Biology) Immunology

Samrat Mukhopadhyay (Associate Professor, Biology and Chemistry) Protein Folding, Misfolding, Prion and Amyloid Biology

S. K. Arun Murthi (Assistant Professor, Humanities and Social Sciences) Philosophy of Science

Santanu Kumar Pal (Assistant Professor, Chemistry) Liquid Crystals, Interfacial Phenomena, Colloid and Gel Chemistry, Chemical and Biological Sensing, Nanoscale Science and Engineering

Yashonidhi Pandey (Assistant Professor, Mathematics) Algebraic Geometry

Shashi Bhushan Pandit (Assistant Professor, Biology) Computational Structural Biology, Metabolomics

Kapil Hari Paranjape (Professor, Mathematics) Geometry

N. G. Prasad (Associate Professor, Biology) Evolutionary Genetics

V. Rajesh (Assistant Professor, Humanities and Social Sciences) History

Sabyasachi Rakshit (Assistant Professor, Chemistry) Nanomechanics of Macromolecules

Rajesh Ramachandran (Assistant Professor, Biology) Cellular Basis of Tissue Regeneration

Ramesh Ramachandran (Assistant Professor, Chemistry) Solid-State NMR Methods, Quantum Mechanics

Pranaw Rungta (Assistant Professor, Physics) Quantum Information and Computation

Anu Sabhlok (Assistant Professor, Humanities and Social Sciences) Postcolonial Studies, Feminist Geography, Political-Economy of Contemporary India, Globalization, Identity (Gender and Nation), Participatory Action Research, Ethnography

Lingaraj Sahu (Assistant Professor, Mathematics) Operator Theory, Operator Algebras

Kuljeet Singh Sandhu (Assistant Professor, Biology) Systems Biology of Gene Regulation

Sudipta Sarkar (Assistant Professor, Physics) Gravitation or Blackhole Thermodynamics

N. Sathyamurthy (Professor, Chemistry) Molecular Reaction Dynamics and Potential Energy Surfaces

Sharvan Sehrawat (Assistant Professor, Biology) Immunology and Immunopathology

K. R. Shamasundar (Assistant Professor, Chemistry) Quantum Chemistry

Mahak Sharma (Assistant Professor, Biology) Cell Biology

Goutam Sheet (Assistant Professor, Physics) Condensed Matter and Scanning Probe Microscopy

Kamal P. Singh (Assistant Professor, Physics) Ultrafast Quantum Dynamics, Stochastic Nonlinear Dynamics

Mahender Singh (Assistant Professor, Mathematics) Topology and Groups

Mandip Singh (Assistant Professor, Physics) Quantum Optics and Bose Einstein Condensation

Sanjay Singh (Assistant Professor, Chemistry) Synthetic Inorganic and Organometallic Chemistry

Yogesh Singh (Assistant Professor, Physics) Experimental Condensed Matter Physics

Baerbel Sinha (Assistant Professor, Earth and Environmental Sciences) Environmental Science

Somdatta Sinha (Professor, Biology) Mathematical and Computational Biology

Sudeshna Sinha (Professor, Physics) Nonlinear Dynamics, Chaos, Complex Systems, Networks, Computation

Vinayak Sinha (Assistant Professor, Chemistry and Earth and Environmental Sciences) Environmental Science, Atmospheric Chemistry Field Experiments

Varadharaj R. Srinivasan (Assistant Professor, Mathematics) Differential Algebra

S. V. Rama Sastry Sripada (Assistant Professor, Chemistry) Synthetic Organic Chemistry

Sugumar Venkataramani (Assistant Professor, Chemistry) Physical Organic Chemistry

Ananth Venkatesan (Assistant Professor, Physics) Mesoscopic Electronic and Electromechanical Systems

K. S. Viswanathan (Professor, Chemistry) Spectroscopy

Ram Kishor Yadav (Assistant Professor, Biology) Plant Developmental Genetics

K. P. Yogendran (Assistant Professor, Physics) Quantum Aspects of Gravity

Honorary Faculty

Raghvendra Gadagkar (Professor, Biology) Animal Behaviour and Ecology and evolution

Anil Kumar (Professor, Physics) NMR Spectroscopy

I. B. S. Passi (Professor, Mathematics) Algebra

Visiting Faculty

Michael Baer (Professor, Chemistry)

Parth R. Chauhan (Assistant Professor, Humanities and Social Sciences)

Mangla Sunder Krishnan (Professor, Chemistry)

Meera Nanda (Professor, History and Philosophy of Science)

T. R. Rao (Professor, Biology)

H. L. Vasudeva (Professor, Mathematics)

Adjunct Faculty

Charanjit Singh Aulakh (Professor, Physics)

Rajendra Bhatia (Professor, Mathematics)

Amitabha Chattopadhyay (Professor, Biology)

Ashok K. Ganguli (Professor, Chemistry)

Amitabh Joshi (Professor, Biology)

Ashok Sahni (Professor, Earth Sciences)

Girish Sahni (Professor, Biology)

Jayant Udgaonkar (Professor, Biology)

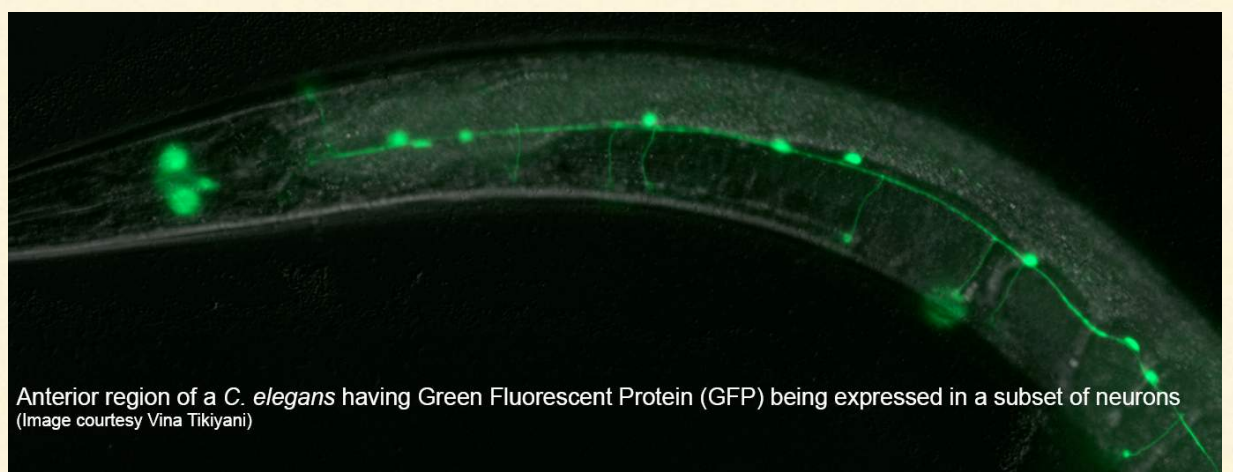
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Research

Faculty and Research at the Department of Biological Sciences

Kavita Babu: Cell Adhesion Molecules (CAMs) are known to play important roles at synapses, which are the sites of communication between neurons and their targets. They are required for various aspects of synapse function including maintaining the integrity and promoting the stability of the synapse as well as linking the pre-synaptic and post-synaptic membranes. CAMs have also been shown to be required for target recognition and the differentiation of pre- and post-synaptic structures (Yamagata M. et al., *Current Opinion in Cell Biol.* 2003, 15:621-632).

Kavita Babu's Laboratory aims to study the function of Cell Adhesion Molecules on synapse development and activity at the *C. elegans* neuromuscular junction (NMJ). Her group is performing experiments that will allow for identifying CAMs that regulate the body wall NMJ and interneuron synapses in *C. elegans*. Kavita had previously done an RNAi screen for changes in aldicarb sensitivity on a set of cell adhesion molecules picked out from the *C. elegans* genome (Babu K. et al., *Neuron* 2011, 71(1):103-116). Aldicarb is an acetylcholine esterase inhibitor that causes hypercontraction of muscles in wild type animals. Mutants with defects in synaptic transmission could have altered responses to aldicarb (Miller K.G. et al., *PNAS* 1996, 93(22): 12593-8). Kavita's Laboratory is currently characterizing some of the Cell Adhesion Molecules that she had found in her earlier screen, that show either enhanced sensitivity or resistance to aldicarb. They use techniques including cell biological assays like imaging, behavioral assays and genetics to understand how these Cell Adhesion molecules affect the *C. elegans* nervous system.



Anand Bachhawat's laboratory continues to focus on different aspects of glutathione homeostasis. His laboratory had recently shown that ChaC1, which is a mammalian pro-apoptotic factor of unknown function induced during Endoplasmic Reticulum stress functions as a γ -glutamyl cyclotransferases that degrades glutathione. The plant *Arabidopsis* was also examined for the presence of these pro-

teins and attempts were also made to identify two of the missing enzymes of the gamma-glutamyl cycle in plants. It was shown that the plant AtLAP1, a known leucine aminopeptidase functions as the missing cys-gly peptidase. The other missing enzyme, gamma-glutamyl cyclotransferase acting on gamma-glutamyl amino acids however appears to be absent. Based on these results a modified gamma-glutamyl cycle for plants has been proposed. The lab has continued their work on the glutathione transporters and has succeeded in mutating all the transmembrane residues to alanine in the glutathione transporter, Hgt1p. The analysis of these mutants is underway. Using a combined mutational and bioinformatic approach new insights have been obtained into the cysteine-binding pocket of the key biosynthetic enzyme of glutathione, γ -glutamyl cysteine synthase.

Samarjit Bhattacharyya: The appropriate delivery of G-protein coupled receptors (GPCRs) to the cell surface to permit receptor/ligand interactions and their subsequent retrieval from the plasma membrane, are of fundamental importance for the regulation of GPCR activity. Samarjit Bhattacharyya's group is currently engaged in studying the trafficking mechanisms of one family of GPCR called group I metabotropic glutamate receptors (mGluRs). These receptors play crucial role in circuit formation in the brain as well as in various forms of synaptic plasticity including learning and memory. These family of receptors have also been implicated in various neuropsychiatric disorders like fragile X syndrome, autism etc. Currently, Samarjit Bhattacharyya's lab is studying the cellular and molecular mechanisms of the trafficking of these receptors using various cell biological, biochemical and imaging techniques in non-neuronal and neuronal cells.

Data from Bhattacharyya lab suggest that group I mGluRs undergo internalization on ligand application and this internalization of the receptor is monoubiquitination dependent. Following endocytosis, most of the receptors enter the recycling compartment and the receptors recycle to the cell surface subsequent to ligand-mediated internalization. In addition, the lab also investigates the role of various post synaptic density proteins in the trafficking of mGluRs using virus mediated "molecular replacement" approach. This method includes the acute knockdown of the protein of interest in the neuron and subsequent replacement with various mutated/deleted form of the protein. Thus, using various sophisticated approaches the lab hopes to shed light in the understanding of the behaviour of various neurotransmitter receptors in the brain which in turn in the long run would help in understanding the role of these receptors in various brain related processes and disorders.

Rachna Chaba's research group is interested in the systems-level analysis and mechanistic dissection of metabolic pathways in bacteria. Metabolism provides energy, creates building blocks, and regulates macromolecular processes. Integrating metabolism with other cellular responses provides the robustness enabling bacterial survival in diverse nutrient and toxic environments, key to their success as commensals, pathogens and industrial workhorses. Metabolic processes have often been probed by qualitative, non-saturating genetic techniques that may miss players and connections, thereby leading to a focus on the identification/characterization of individual components rather than considering metabolism as a cellular system. Thus despite decades of active research, the knowledge of metabolism even in the well-studied microbe, *E. coli*, is far from complete. A major obstacle impeding systems-level analysis of metabolism has been the lack of a comprehensive, quantitative, functional-genomics approach that provides an entire parts list and hints of connections.

The Chaba lab utilizes high-throughput quantitative genetic screening methodology (response of every gene deletion/overexpression strain to chemical perturbations), to identify novel players and networks in metabolism. The information extracted from these genomic approaches is integrated with knowledge from other high-throughput datasets to generate testable hypotheses about the function of novel genes, the process they participate in, and interconnections between pathways. As a complement, Chaba lab also performs detailed molecular studies of important targets to establish their functional roles. The research in Chaba lab is mainly focused on the metabolic processes that govern utilization of carbon sources implicated in pathogenesis and those providing tolerance to toxic agents important in biofuel production. Overall, these studies intend to identify novel transporters, metabolic enzymes and regulators required for the degradation of carbon sources and toxic agents; cross-talk between metabolic pathways; and stress response pathways important for survival in toxic conditions. The combined use of a functional-genomics approach and mechanistic analysis will help expand knowledge of metabolism beyond a mere description of parts and will provide new metabolic information that can be harnessed to design novel antibacterials and create strains with superior toxicity tolerance.

Kausik Chattopadhyay: Pore-forming toxins (PFTs) represent a unique class of membrane-damaging protein toxins that are documented in wide array of organisms starting from bacteria to human. These PFTs act by punching holes into the membrane of their target host cells. Mechanism of membrane pore-formation involves complex cross-talk between the toxin molecules and the membrane components. The research in Kausik Chattopadhyay's lab is focused to

ward elucidating the structure-function mechanisms of some of the prominent bacterial PFT proteins. Kausik Chattopadhyay's group investigates the structural mechanism(s) of membrane pore formation by the bacterial PFTs, and also explores the functional consequences of their toxin activity. Such study would enrich insights regarding the implications of such protein toxins for the bacterial virulence mechanisms.

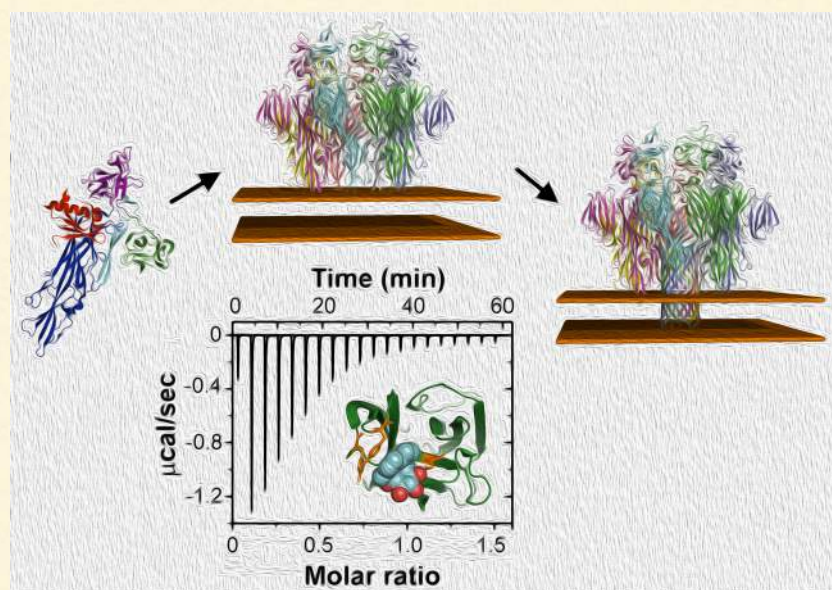


Figure: Membrane pore-formation mechanism of *Vibrio cholerae* cytolysin

Purnananda Guptasarma's main interests lies in understanding and engineering the manner in which globular proteins fold; in why (and how) they misfold; in what these misfolded forms do (to cause human disease) or can be made to do (e.g., conduct electricity); in what determines the thermodynamic and kinetic stabilities of the folded, native forms of globular proteins (especially those evolved to function in extremophile microbes); and in developing protein engineering approaches through which the activities and functions of globular proteins and enzymes can be altered through rational and/or combinatorial mutagenesis. He commonly employs (and also occasionally develops) preparative and analytical methods/approaches deriving from different forms of electronic and vibrational spectroscopy, mass spectrometry, biomolecular chromatography, electrophoresis, computation, calorimetry, microscopy, and recombinant DNA-based experimentation, and also certain other tools/techniques of organic and physical biochemistry. In addition, he also loves to dwell upon (and occasionally contribute to) current understanding of the mechanistic basis of regulation of gene expression, and the cellular and molecular basis of development.

During the last academic year, work has been continuing in his laboratory on structural and functional studies, and engineering, of hyperthermophile and mesophile aminopeptidases, glycosyl hydrolases, triose phosphate isomerases,

beta-2-microglobulin, histone-like bacterial HU proteins, and certain neuronal proteins. From amongst these, they have published the following pieces of work: two papers demonstrating the molecular basis of the kinetic hyperthermal stability of *Pyrococcus furiosus* rubredoxin; one paper reporting the aggregation and precipitation of beta-2-microglobulin by calcium (and the mechanism thereof), as well as the significance of this to the disease known as dialysis related amyloidosis; and one paper each describing the engineering of the kinetic stability and function of *Pyrococcus furiosus* derived alpha lytic protease, and of *Methanococcus burtonii*-derived triosephosphate isomerase.

Manjari Jain: The work in Manjari Jain's laboratory focuses on acoustic communication in animals. The broad research objectives are to understand how animals communicate using sound, the constraints on communication and the evolutionary forces driving the communication system. To address these objectives a combination of lab and field-based work is carried out. The ultimate goal is to understand the evolution of signal design.

A recent paper by Manjari Jain, published in the journal *Evolutionary Ecology* in 2014, received media attention and the paper was covered by *India-Bioscience*: www.indiabioscience.org/news/chorusing-cricket-kudremukh Ref.: Jain M, Diwakar S, Bahuleyan J, Deb R, Balakrishnan R (2014) A rain forest dusk chorus: cacophony or sounds of silence? *Evolutionary Ecology* 28: 1-22.

Lolitika Mandal's group is interested in unraveling the specification, maintenance and regulation of stem cell niches. Using *Drosophila* hematopoietic stem cell niche as the model, an unbiased genome wide RNAi- screen was conducted to reveal the key regulators of niche maintenance. Their efforts have yielded a variety of molecules like transcription factors, signaling molecules, chromatin remodeling factors, and mitochondrial components whose interplay maintains the hematopoietic niche in *Drosophila*. The group is also interested in the dynamicity of these factors and the temporal requirement for their functionality in maintenance of the microenvironment.

In addition to the above project, studies from this laboratory have revealed several novel findings. One of which is a hitherto unknown cell type in the hematopoietic organ of *Drosophila* that seems to qualify as stem cell. Currently the characterization of this cell type is underway.

Sudip Mandal: Mitochondria, generally considered as the powerhouses of a cell, also function as a metabolic hub that integrates diverse metabolic processes in modulating the function of a cell. Sudip Mandal's group is interested to identify how mitochondrial activity of a cell is involved in regu-

lating cell growth. For that purpose they have launched a genome wide in vivo RNAi screen using the genetically traceable organism *Drosophila melanogaster*. So far they have identified a group of nuclear genes encoding mitochondrial proteins, which when mutated, modulates the size of a cell. Analyses of one of those mutants reveal that higher levels of reactive oxygen species present within the cell actually retards cell growth. Currently his group is engaged in finding the molecular mechanism by which this retardation in cell growth is achieved. Apart from studying mitochondrial control of cell growth, they are also investigating how altered mitochondrial function affects the process of differentiation, in terms of cardiogenesis and hematopoiesis. They are keen to understand the signaling pathway involved in this process.

Another interest of Sudip Mandal's laboratory is to identify the role of developmental signal molecules in maintaining cellular plasticity. In this direction they have been successful in unraveling the role of one such molecules that not only provides instructive signal to a cell undergoing change in cell fate but also provides necessary permissive signals to create a condition that facilitates alteration in cell fate. This finding provides an otherwise unknown in vivo role of any signaling molecule during development.

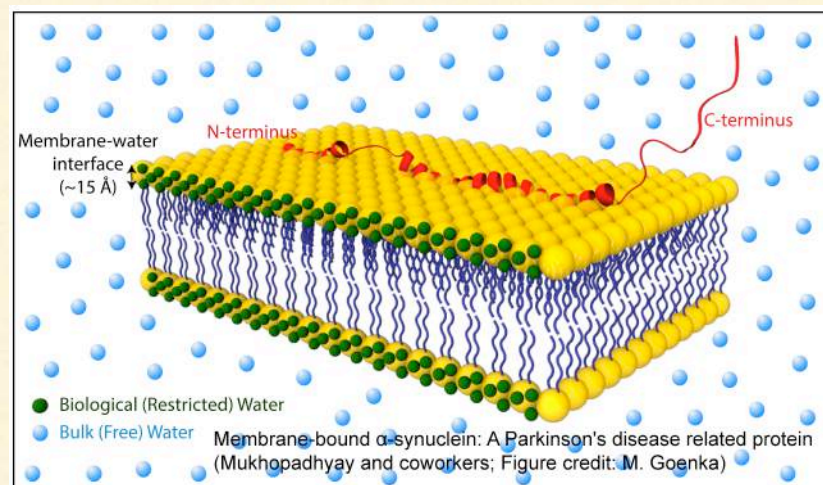
Shravan Kumar Mishra's research group is interested in studying function of ubiquitin and ubiquitin-like modifiers (referred together as UBL) with respect to regulation of various cellular processes. Proteins of this family are key regulators of a large number of processes in the cell. They not only determine fates of their targets through proteasomal destruction but also confer functional diversity to their substrates in non-proteolytic ways, for example, in DNA repair, ribosome biogenesis etc. Recent reports hint towards UBL activities at the spliceosome, the catalyst that removes introns from pre-mRNAs. Several splicing factors appear to be targets of UBLs, but their precise roles are not clear. In metazoans, the spliceosome also performs alternative RNA splicing to increase the cellular repertoire of mRNAs, thus to fulfill the demand of a larger proteome from a lower gene number. Although, spliceosomes' composition is known, its regulation that ensures constitutive and alternative splicing of almost every gene in humans is not understood. Intriguingly, as regulators of numerous processes in the cell, UBLs are also suited for the control of RNA splicing. Shravan Kumar Mishra's group at IISER Mohali is interested in finding new mechanisms of RNA splicing regulation that are controlled by the UBLs.

Arunika Mukhopadhyaya: During host-pathogen interaction pathogen triggers several host cellular responses. Several structural and secretory molecules of the pathogen are im-

portant in modulation of host-immune responses. Study of modulations of cellular/immune responses and understanding the molecular mechanisms is important to generate better therapeutics or vaccines against the disease.

Porin is one of the major outer membrane proteins present in gram-negative bacteria. Bacterial porins can modulate host cellular responses. These modulations can range from pro-inflammatory to down-regulatory, cell death induction to cellular protection. It seems porin doesn't have any conserved function regarding triggering of cellular functions. Therefore, each porin needs a separate evaluation. One of the major focus of Arunika Mukhopadhyaya's lab is to study immunomodulation of host cell by one such porin OmpU which is present across the *Vibrio* species.

Samrat Mukhopadhyay: The Mukhopadhyay lab aims at understanding the structural and molecular basis of amyloids. Amyloids are ordered protein aggregates that are implicated in a variety of debilitating human disorders such as Alzheimer's, Parkinson's and prion diseases. The transition from a normal functional protein to an altered (misfolded) form involves a profound conformational change that triggers the aberrant protein assembly resulting in a wide variety of nanostructures including amyloid oligomers, pores and fibrils. In the lab, various aspects of amyloidogenesis in a variety of folded as well as intrinsically disordered proteins are being extensively studied utilizing chemical, biochemical, molecular and cellular biology approaches and a diverse array of biophysical techniques such as CD and fluorescence spectroscopy, atomic force microscopy and Raman spectroscopy. Some of the interesting proteins that are being studied and have pathological relevance include human prion protein, tau protein, α -synuclein and B2- microglobulin. Another line of interest has been the nanoscale optical imaging of amyloid fibrils using near-field scanning optical microscopy (NSOM). Using Raman spectroscopy, an important progress has been made towards delineating in-depth molecular details of the secondary structural changes during amyloid pore formation that is implicated in cellular degeneration by cell membrane permeabilization. One of the



emerging areas in the lab is to understand the significance of biological water in protein folding and misfolding by probing hydration dynamics at the protein-membrane interface, within the disordered proteins and amyloids. Recently, the group has also embarked upon studying a number of functional amyloids that are known to play biologically beneficial roles in several organisms including humans.

Shashi Bhushan Pandit's research group is interested in understanding the structural and/or sequence basis of enzyme promiscuity, ligand-protein interactions and domain interactions in multi-domain proteins with an aim to develop robust computational prediction methodologies. Microorganisms show remarkable resilience towards deletion of genes involved in metabolic pathways. Usually, this is attributed to enzyme's capability to catalyze alternate substrate/reaction (promiscuous activity). The metabolic pathway reconstructions including these promiscuous reactions can provide comprehensive metabolic capability of an organism. Recently, using chemoinformatics approach they developed a method to predict putative promiscuous reactions using molecular reaction signatures. In this approach, they assumed that enzymes would accommodate any substrate and catalyze the same. To evaluate this assumption, his group is engaged in systematic investigation of structural and sequence properties of enzymes or substrates binding sites, which could confer them promiscuity. Furthermore, they are interested in studying the mechanistic aspect of enzyme promiscuity and their evolution. In this regard, they are evaluating the role of protein dynamics in ligand-protein interactions. Many enzymes are multi-domain proteins. Hence, to investigate structural roles domain-domain interactions in enzyme promiscuity, his group is developing tools for tertiary structure prediction of multi-domain proteins employing our recently developed method TASSER (Threading ASSEMBly and Refinement).

N.G. Prasad's Evolutionary Biology Laboratory (EBL) is interested in understanding antagonistic co-evolution between males and females (intersexual conflict), evolution of immunity and life-history evolution. The lab uses *Drosophila melanogaster* as a model system. Results from EBL clearly show that antagonistic co-evolution between the sexes can affect a large number of traits. Individuals from populations with high degree of conflict age faster and have shorter mean life-spans. Antagonistic interactions can drive the evolution of reproductive behavior including sperm competition.

Their studies on immunity clearly show that immunity is affected by mating status of an organism. Interestingly, they find that reproductive activity can have beneficial effects on male immunity in a pathogen specific manner. Mating increases resistance of males to bacterial infection. This is

quite contrary to the current understanding. This forces a rethink on the current models of the evolution of immunity.

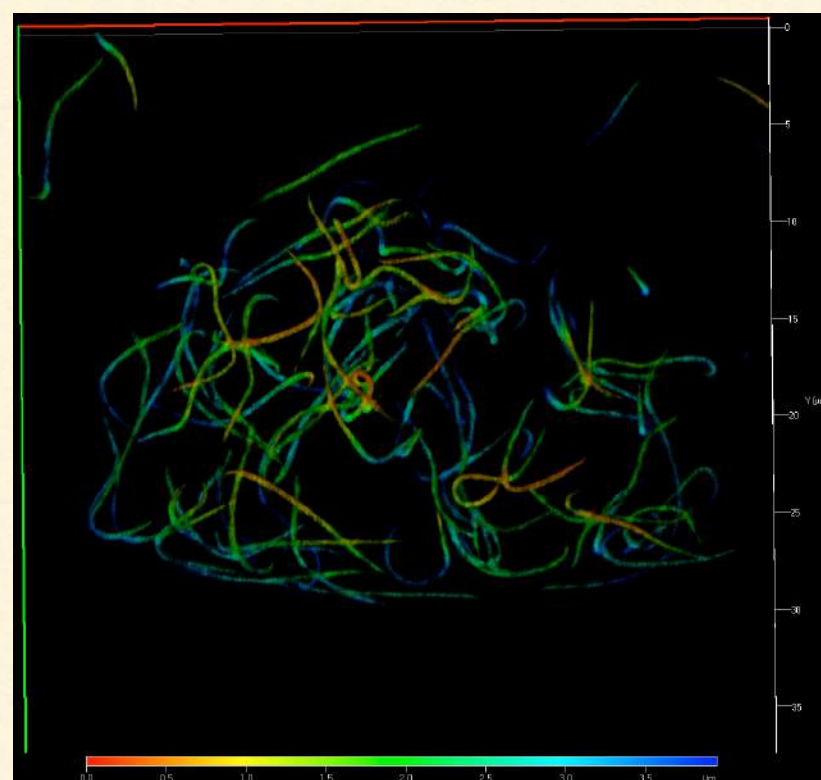


Figure: High resolution image of *Drosophila melanogaster* sperms stored in seminal receptacle of female flies. The sperms have been tagged with GFP for better visualization. These were developed by Pitnick and Belote and are used in EBL to understand sperm competition. Regions coded in red are closer to the surface while those in blue are away from the surface.

Rajesh Ramachandran's group is interested in understanding retinal regeneration after acute injury using model organisms like zebrafish. Retinal damage is one of the most common causes of blindness in the modern world. The obvious solution to this problem is to harness the regenerative potential of the retinal stem cells. The piscine model zebrafish offers the maximum potential in unraveling the mystery of retinal regeneration compared to mammalian and avian counterparts. Understanding the various molecular mechanisms on signaling pathways like wnt, notch and hedgehog would enable one to assess their impact on fish retina regeneration. A few selected genes like pluripotency inducing factors like sox2, oct4, nanog, klf4, cMyc and lin28 would be addressed to elucidate their role in retina regeneration. Currently the major research projects carried out by the group are (1) An investigation on the role of transcription factors Ascl1a, FoxN4, Zic2b and tumor suppressor Pten in retina regeneration and functional analysis of pluripotency factors in retinal stem cells, funded by Wellcome Trust-DBT India Alliance and (2) Understanding the molecular mechanisms of epigenetically regulated genes during Muller glia dedifferentiation and retina regeneration in zebrafish, funded by IISER Mohali.

Rhitoban Ray Choudhury's laboratory is generally interested in evolutionary genetics but with a strong emphasis

on genomics and symbiosis. The model organism is the tiny parasitoid wasp genera called *Nasonia* which feed mostly on pupa of different flies. This is a group of four species and have their genomes sequenced and also has many different molecular tools available for genetic research. One of the two broad areas of study in the lab is to identify gene(s) responsible for specific phenotypes using *Nasonia* as a model system. The other broad area of research involves working with a bacteria called *Wolbachia*. These bacteria are extremely wide-spread in nature and infects every two out of three insects. *Wolbachia* causes several unique reproductive alterations in their insect hosts such as feminization of males, induction of parthenogenesis, male killing and cytoplasmic incompatibility. The lab is interested in trying to find the genetic and genomic basis of these phenotypes.

Rhitoban Ray Choudhury joined IISER Mohali in December 2013 and right now is in the process of building up the first *Nasonia* laboratory in India.

Kuljeet Sandhu's group is interested in addressing some of the fundamental questions pertaining to eukaryotic genome organization. In particular, they want to understand the evolutionary and functional constraints shaping the landscape of long range gene-to-gene interactions in the nuclear space. Co-expression of engaged genes has been proposed to be the major determinant of chromatin ties in the nucleus, however some of their recent observations challenges the present view. His group is delineating the genomic associates of gene to gene interactions through comprehensive multivariate analyses of large scale datasets. Besides genome organization, he is also interested in other questions like; what explains the global disconnect between chromatin factor location and effect? What is the origin and mechanistic basis of transcriptional ripples? What constrains the biallelic and random monoallelic expression of genes? How do intrinsically disordered proteins achieve their functions?

Sharvan Sehrawat: In a quest to clear infections of various kinds, the host responds to the insults and induces activation of cells of innate and adaptive immune system that eradicate invading pathogens. At the same time regulatory mechanisms also operate to curtail excessive inflammatory responses. The timely induction of an adaptive immune response and its maintenance in the memory phase forms the basis of lasting protective immunity against infectious diseases and provides clue for successful vaccination. After receiving help from CD4 T cells, pathogen-specific CD8 T cells are appropriately activated to control the spread of intracellular pathogens such as viruses. In order to investigate host-pathogen interaction and to delineate the function and differentiation pathways of adaptive immune cells, animal models that can provide sufficient number of antigen-

specific cells in naïve state are used. In Sharvan Sehrawat's laboratory efforts are directed to develop novel animal models to understand the function and differentiation of CD8 T cells during intracellular infections. Efforts are also put to investigate immunopathological response to viral infections.

Mahak Sharma's research group is interested in understanding how endocytic trafficking towards lysosomes is regulated in mammalian cells. Lysosomes are membrane-bound organelles that degrade internalized cargo received from the endocytic and phagocytic routes and intracellular cargo from autophagic pathway. Given the critical role of lysosomes in maintaining cellular homeostasis, it is not surprising to note that mutations in almost half of the lysosomal proteins form the molecular basis of several human diseases. Mahak's laboratory is studying the role of Arl8, member of Arl (Arf-like) family of small GTPases in regulating membrane trafficking towards lysosomes. Upon GTP-binding, small GTPases recruit tethering factors to intracellular membranes which permit vesicle docking and fusion with the target membranes.

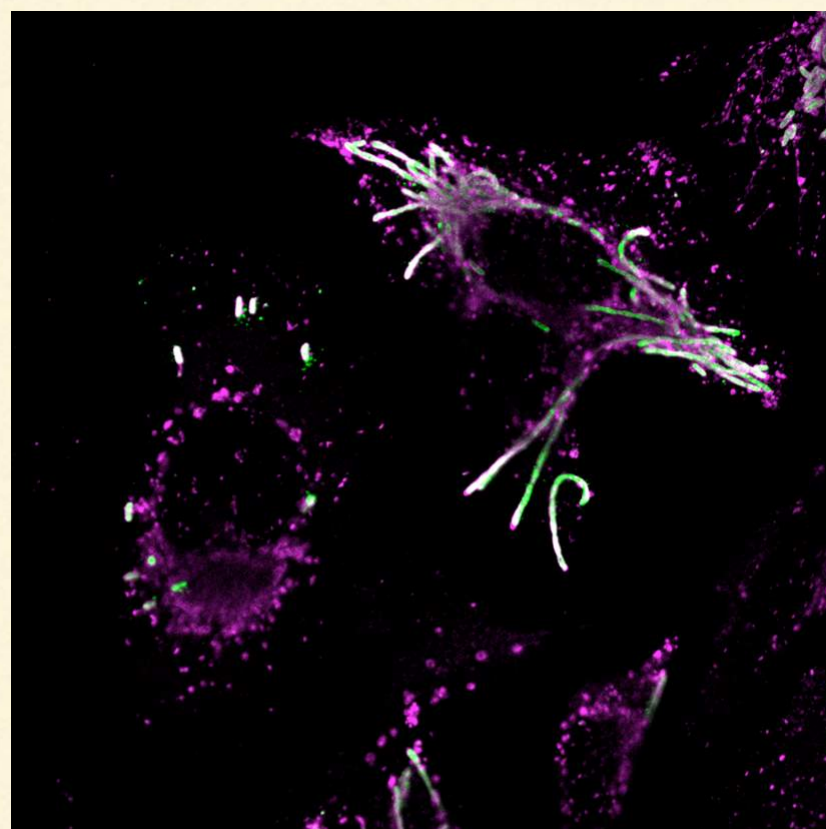


Image of lysosomes (LAMP1 staining, pseudo color in magenta) in HeLa cells infected with *Salmonella Typhimurium* (green). *Salmonella enterica* serovar Typhimurium has the fascinating ability to form tubular structures known as *Salmonella*-induced filaments (Sifs) in host cells. The Sifs form by fusion of *Salmonella*-containing vacuole with late endocytic compartment. *Salmonella* inhabit and replicate within this compartment and also undergoes cell to cell transfer from the SCV.

In her previous studies, she had identified one such Arl8 effector known as the HOPS (HOMotypic fusion and vacuole Protein Sorting) complex. HOPS complex subunits are targeted by pathogens such as *Mycobacterium tuberculosis* to evade killing by the host lysosome. Mahak's laboratory is currently studying how intracellular pathogen *Salmonella*

interacts with the HOPS complex and manipulate its role as a tethering factor to create its niche in the cell. Moreover, mutations in the HOPS complex result in arthrogryposis-renal dysfunction-cholestasis (ARC) syndrome, wherein patients suffer from recurrent bacterial infections. Mahak's research is aimed at understanding the function of the human HOPS complex as a tethering factor in regulating trafficking of endocytic and phagocytic cargo/microbes towards lysosomes. Her laboratory is also studying the molecular mechanisms by which mutations in the HOPS complex cause ARC syndrome.

Somdatta Sinha's group works in the area of Theoretical and Computational Biology focussing on understanding the logic and design of biological processes at multiple spatiotemporal scales and organizational levels - from genetic to ecological - using concepts from Physics, Nonlinear Dynamics and Complex Systems. Along with mathematical modelling, the group is also interested in computational analysis of genome and protein sequences to extract structural, functional and evolutionary information. The aim is towards development and design of new properties of systems, correction of pathological states, and prediction of conditions for improved functions. During the past year, their work focused in the following areas:

1. **Protein structure-function analysis:** Their approach involves analysis of protein structures at different length scales - coarse-grained network and atomic scale molecular dynamic simulations - to understand the "small" changes that can yield new functional properties without overall structural changes in a protein.

2. **Evolution of biochemical pathways:** Unlike single gene evolutionary studies, evolution of multi-step biochemical pathways requires study of simultaneous changes in all genes coding for the enzymes of the same pathway. The group uses a combination of comparative genomics, complex network approach, and optimization of flux through the pathways, to study the evolution of the aromatic amino acid pathway in different bacteria and archaea.

3. **Infectious disease and Epidemiology:** The group developed an alignment-free classification method to quantify variations between closely related genomes, which explores the compositional complexity of whole genomes for different word lengths. It has been used to identify the Circulating Recombinant Forms (CRFs) of different subtypes of HIV-1. The group has developed mathematical models to describe Malaria incidence by including biologically realistic factors in human-mosquito interactions. The aim is to validate the mathematical model with multiple datasets from different parts of India and Africa

Ram Yadav's laboratory is studying the gene regulatory network involved in cell type specification. Unlike animals, plants make organs throughout their life. This remarkable ability depends upon the maintenance and differentiations of stem cells in the meristem summit of shoot apex. He is using *Arabidopsis thaliana* as model system to study stem cell specification and their differentiation. His current work is focused on the role of WUSCHEL (WUS), a homeodomain transcription factor, which is produced in cells of the organizing center and migrates into adjacent cells where it specifies stem cells. Microarray studies revealed that WUS represses a large number of genes, which are expressed in the differentiating cell types, including key transcription factors that are involved directly in differentiation of stem cells. In addition, he identified three key enzymes involved in local auxin biosynthesis that are repressed by WUS. At single cell level resolution auxin signalling depends directly on the concentration of this phytohormone and plays an important role in cell differentiation. Therefore it is tempting to speculate its role in stem cells differentiation. Currently, his research group is studying the role of WUS in auxin homeostasis in the stem cell niche using genetic approaches.

How does the transition of stem cells in to differentiated cell types take place in shoot apex? To identify relevant transcriptional gene regulatory network involved in cell and tissue specialization, he has developed cell type specific fluorescence marker lines for cell sorting. Using this resource he was able capture transcriptome profile of ten cell populations and identified cell type specific transcription factors. Currently his group is mapping protein-DNA and protein-protein interaction using yeast-one-hybrid and yeast-two-hybrid assays for the epidermal and subepidermal cell type enriched transcription factors to delineate the regulatory circuitry involved in cell type specification.

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Academic Visits

Kavita Babu

Fred Hutchinson Cancer Research Center, University of Washington, Seattle, USA, July 2013. Meet with Assistant Professor Jihong Bai and his Laboratory.

Kausik Chattopadhyay

Attended a discussion meeting on “Host-Pathogen Interaction and Immunity” organized by IISER Pune, October 18-19, 2013, Khandala.

Manjari Jain

Visited (1) National Physical Laboratory, New Delhi to attend a conference ACOUSTICS 2013 (November 10-15, 2013), and (2) Nagaland University to attend conference YETI 2013 (December 17-19, 2013).

Lolitika Mandal

Cytogenetics Laboratory, Banaras Hindu University (BHU), Varanasi.

Sudip Mandal

National Centre for Human Genome Studies and Research, Panjab University, Chandigarh.

Shravan Kumar Mishra

Department of Molecular Biology and Genetics, Cornell University, Ithaca, New York, USA, March 8-23, 2014.

Arunika Mukhopadhaya

Attended a discussion meeting on “Host-Pathogen Interaction and Immunity” organized by IISER Pune, October 18-19, 2013, Khandala.

Samrat Mukhopadhyay

IISc Bangalore, July 2013.

Rajesh Ramachandran

LV Prasad Eye Institute, Bhubaneswar, October 19-21, 2013.

Somdatta Sinha

Computational Biology Group, International Centre for Theoretical Physics (ICTP), Trieste, Italy, November 8-16, 2013. Invited for talk and research discussions.

Ram Yadav

Visited Professor S. Balasubramanian laboratory at School of Biological Sciences, Monash University, Clayton Campus, Melbourne, Australia, July 1-5, 2013.

Invited Talks

Kavita Babu

Indian Society for Developmental Biology (InSDB), TIFR, Mumbai, India, December 2013. Title: The Role of Cell adhesion molecule at the *C. elegans* Synapse.

Anand Bachhawat

National Institute of Immunology (NII), Delhi, April 29, 2013. Title: Glutathione and apoptosis: discovering a missing link.

CSIR Foundation day lecture, Indian Institute of Toxicology Research (IITR), Lucknow, September 26, 2013. Title: Researching Glutathione: The cells’ redox buffer.

“Yeast 2013: An International conference on yeast biology”, Institute of Microbial Technology (IMTECH), December 6, 2013. Title: ER stress and apoptosis: discovering a missing link.

Samarjit Bhattacharyya

Annual meeting of Indian Academy of Neurosciences, 2013, Allahabad, India. Title: Intracellular trafficking of metabotropic glutamate receptors (mGluRs).

Kausik Chattopadhyay

82nd Annual Meeting of Society of Biological Chemists (SBC) India, Hyderabad University, December 2-5, 2013.

IUBMB 10th International Symposium on "Biochemical Role of Cell Surface Macromolecules", Kolkata, January 20-24, 2014.

Purnananda Guptasarma

National Symposium on Biophysics, PGIMER, Chandigarh, May 11, 2014. Title: A novel intrinsic fluorescence in proteins from H-bonded peptide bonds, with implications for biophysics and health.

MCM DAV College, Chandigarh, August 19, 2014, Title: Engineering Protein Structure, Function and Stability.

BIOINFO-GEN 2013, PGIMER, Chandigarh, September 7, 2014. Title: A Different Kind Of Proteomics : Some Side-Uses Of Mass Spectrometry In The Biochemical Analyses Of Proteins.

Workshop on Mass Spectrometry, Sophisticated Analytical Instrumentation Facility (SAIF), Panjab University, Chandigarh, March 7, 2014. Title: Techniques in Biological Mass Spectrometry.

One Day Symposium on Recent Techniques in Biotechnology, March 24, 2014. Title: Circular Dichroic Studies of Proteins.

Manjari Jain

Workshop for the conference YETI 2013, Nagaland University, December 17-19, 2013. Title: Bioacoustics in Ecology.

Lolitika Mandal

Annual meeting of the Indian Society of Developmental Biologists (InSDB), 2013. Title: What it takes to make a hematopoietic niche.

Drosophila Meeting, 2014, Banaras Hindu University, Varanasi. Title: *Drosophila* as a model system to study hematopoiesis.

Sudip Mandal

Annual meeting of the Indian Society of Developmental Biology, TIFR, Mumbai, December 2-4, 2013. Title: Decapenta-

plegic as a new Avatar during Transdetermination in *Drosophila*.

38th Mahabaleshwar Seminar on Mitochondria, Metabolism and Energetics at Mahabaleshwar, January 27-30, 2014. Title: Control of cell growth by reactive oxygen species.

Shravan Kumar Mishra

NIT Durgapur, December 19, 2013. Title: Mechanisms of Alternative RNA Splicing.

International Conference on Yeast Biology - "Yeast 2013". IMTECH, Chandigarh, December 6, 2013. Title: Regulation of RNA Splicing by Ubiquitin-Like Protein Hub1.

Arunika Mukhopadhyaya

IUBMB 10th International Symposium on "Biochemical Role of Cell Surface Macromolecules", Kolkata, 20-24 January, 2014.

Samrat Mukhopadhyay

Bioengineering seminar at IISc, Bangalore, July 2013.

Seminar at NII, New Delhi, July 2013

International Conference on Biomolecular Simulations and Dynamics, IIT Madras, November 2013.

Indian Association for the Cultivation of Science, Kolkata, December 2013.

Saha Institute of Nuclear Physics, Kolkata, December 2013

N. G. Prasad

Kavli frontiers of Science meeting organised by Indo-US Science and Technology Forum, Agra, April 9-11, 2013.

Foundations of Evolutionary Theory meeting organised by Indian Academy of Sciences, Coorg, February 23-26, 2014.

Rajesh Ramachandran

LV Prasad Eye Institute, Bhubaneswar, October 19-21, 2013. This was part of "Think Tank" discussion forum to explore the potential areas of collaborative research programs.

Sharvan Sehrawat

Attended a workshop on Biorisk management conducted by Sandia National Laboratory, USA, Panjab University, April 3-9, 2014.

Attended BIRAC roadshow and workshop for promotion of biosciences Industry in Punjab organized by Punjab State Council for Science and Technology in association with Mohali Biotechnology Park, Indian School of Business (ISB), March 5-6, 2014.

Mahak Sharma

EMBO-India Bioscience Young Scientist Networking Meeting, Bangalore, November 2013. Title: Understanding the Mechanisms regulating Vesicular Trafficking to Lysosomes.

Indraprastha International Conference on Biotechnology, G.G.S.I.P.U, New Delhi, October 2013. Title: Regulation of mammalian HOPS complex recruitment to lysosomes by small GTPase Arl8b.

Somdatta Sinha

Workshop on “Nonlinear Dynamics in Biology” at Mathematics Department, IISc Bangalore, July 8, 2013. Title: Introduction to Nonlinearity in Biology.

Indian Women and Mathematics at IISER Pune, July 26-28, 2013. Title: Mathematics IN/AND Biology.

Applied Physics seminar, ICTP, Trieste, Italy, November 13, 2013. Title: Regulation of Cellular Processes: From Pathways to Multi-Cell Systems.

“Complex Systems: From Physics to Biology”, Jawaharlal Nehru Univ, Delhi, October 15, 2013. Title: Compositional Complexity of Genomes.

Indo-Canadian Workshop on Mathematical Modeling of Infectious Diseases, IIT Roorkee, January 20-22, 2014. Title: Modelling Infectious Disease: from genomes to populations.

Mathematics Department, IIT Ropar, February 10, 2014. Title: Modelling in Biology.

DST-SERC School on Nonlinear Dynamics, Physics Department, Punjab University, Chandigarh, February 14-15, 2014. Four talks on “Modelling Biochemical Pathways”.

“International Conference on Environmental Biology and Ecological Modelling”, Visva Bharati, WB, February 24-26, 2014. Title: Understanding Population Dynamics: From generic to specific models.

National Centre for Biological Sciences, Bangalore, February 28, 2014. Title: Compositional Complexity of Genomes.

Ram Yadav

EMBO-India Bioscience: Young scientist networking meeting, 9th November 2013. Title: Deciphering gene regulatory networks underlying cell type specification in plant shoot apex.

Symposium: Genetics@Monash-2013, Monash University, Clayton Campus, Melbourne, July 4, 2013. Title: Transcriptional repression in stem cell specification - Lessons from plant shoot apex.

International Conference on *Arabidopsis* Research, Sydney, June 24-28, 2013. Title: A High Resolution Gene Expression Map of *Arabidopsis* Shoot Apex.

Young Scientist Networking Meeting 2013: Initiated by EMBO-India Bioscience, November 7-10, 2013.

Third Ramalingaswami Fellowship Conclave Organized by the NCCS Pune and DBT, Pune, September 12-14, 2013.

Posters

Kavita Babu

British Society for Developmental/Cell Biology (Join Meeting), Warwick, UK, March 2014. Title: Understanding the Function of Cell Adhesion Molecules at the *C. elegans* Nervous system.

Cold Spring Harbor Asia, Jiangsu Province, China, October 2013. Title: The Function of Cell Adhesion Molecules at the *C. elegans* Nervous system.

19th International Worm Meeting, Los Angeles, USA, June 2013. Title: Understanding the Function of Cell adhesion molecule in the *C. elegans* Nervous system

Anand Bachhawat

“Glutathione degradation and apoptotic cell death: The role of the ChaC protein family” Anand. K. Bachhawat, Amandeep kaur, Avinash Chandel in “Cell death” conference, Cold Spring Harbor Laboratory, USA, October 8-12, 2013.

“Identification of AtLAP1, a leucine aminopeptidase as Cys-gly peptidases in plants” Shailesh Kumar, Banani Chattopadhyay, Anand. K. Bachhawat in 8th international conference on Yeast biology 2013, Chandigarh, India, December 4 -7, 2013.

“Functional analysis of human lysosomal cystine transporter cystinosin (CTNS) in *S. cerevisiae*” A. A. Deshpande, A. Shukla, Anand. K. Bachhawat in 8th international conference on Yeast biology 2013, Chandigarh, India, December 4-7, 2013.

“Identification of residues important for proton translocation in the proton driven plasma membrane glutathione transporter Hgt1” M. Zulkifli, Shambhu Yadav, Anand. K. Bachhawat in 8th international confer-

ence on Yeast biology 2013, Chandigarh, India, December 4-7, 2013.

“Engineering of isoprenoid pathway of *Saccharomyces cerevisiae* for Torularhodin production” Manisha Wadhwa, Anand. K. Bachhawat in 8th international conference on Yeast biology 2013, Chandigarh, India, December 4-7 2013.

“Functional analysis of human lysosomal cystine transporter cystinosin (CTNS) in *S. cerevisiae*” A. A. Deshpande, A. Shukla, Anand. K. Bachhawat in Celebrating 20 years of CDR1 research, New Delhi, India, January 4-8, 2014.

“Identification of residues important for proton translocation in the proton driven plasma membrane glutathione transporter Hgt1” M. Zulkifli, Shambhu Yadav, Anand. K. Bachhawat in Celebrating 20 years of CDR1 research, New Delhi, India, January 4-8, 2014.

“Glutathione degradation and apoptotic cell death: The role of the ChaC protein family” Amandeep kaur, Avinash Chandel, Anand. K. Bachhawat in Mitochondria, metabolism and energetics, 38th Mahabaleshwar Seminar, India, January 27-30, 2014.

Kausik Chattopadhyay

PhD fellows Karan Paul, Anand Kumar Rai and Barkha Khilwani presented posters on their research works in the 82nd Annual Meeting of Society of Biological Chemists (SBC) India, Hyderabad University, December 2-5, 2013.

Purnananda Guptasarma

Sharma, P. and Guptasarma, P. (2014) Second-site-based endoglucanase activity in *P. furiosus* triosephosphate isomerase.

Lolitika Mandal

Biography of a stem cell niche. Shiv Kr. Sharma, Nidhi S. Dey, Satish K Tiwari, Harleen Kaur, Mayank Chugh, Parvathy Ramesh and Lolitika Mandal. 2013 Annual meeting of the Indian Society of Developmental Biologists (InSDB), TIFR, Mumbai.

What it takes to make a niche. Shiv Kr. Sharma, Nidhi S. Dey, Satish K Tiwari, Harleen Kaur, Mayank Chugh, Parvathy Ramesh and Lolitika Mandal. The XXXVII All India Cell Biology Conference on Cell Dynamics and Cell Fate, 2013. InStem, Bangalore.

Niche in action. Saikat Ghosh, Shiv Kr. Sharma and Lolitika Mandal. The XXXVII All India Cell Biology Conference on Cell Dynamics and Cell Fate, 2013. InStem, Bangalore.

Characterization of the hematopoietic niche. Saikat Ghosh and Lolitika Mandal. Vth Bangalore Microscopy course 2013, NCBS

Dissecting stem cells and niche crosstalk during *Drosophila* hematopoiesis. Nidhi Sharma and Lolitika Mandal. EMBO-IndiaBioscience Young Scientist Networking Meeting, Hyderabad, November 2013.

Sudip Mandal

Poonam Aggarwal, Swati Sharma, Sakshi Gupta, Sudip Mandal; A novel role, played by the morphogen Decapentaplegic (DPP) during transdetermination (Annual meeting of the Indian Society of Developmental Biology, 2013, TIFR, Mumbai).

Ashish G. Toshniwal, Sakshi Gupta, Yashpal Singh, Sudip Mandal: Molecular and genetic dissection of cell growth regulation by mitochondrial function (37th All India Cell Biology Conference on Cell Dynamics and Cell Fate, 2013, InStem Bangalore).

Ashish G. Toshniwal, Sakshi Gupta, Sudip Mandal; Molecular and Genetic Dissection of Cell Growth Regulation by Mitochondrial Function (38th Mahabaleshwar Seminar on Mitochondria, Metabolism and Energetics, 2014, Mahabaleshwar).

Swati Sharma, Lolitika Mandal, Sudip Mandal; Unraveling the retrograde signaling by mitochondria to modulate cardiogenesis and hematopoiesis in *Drosophila* embryo (38th Mahabaleshwar Seminar on Mitochondria, Metabolism and Energetics, 2014, Mahabaleshwar).

Arunika Mukhopadhyaya

Shelly Gupta presented a poster in 82nd Annual Meeting of Society of Biological Chemists (SBC) India, Hyderabad University, December 2-5, 2013.

Junaid Ali Khan presented a poster in 82nd Annual Meeting of Society of Biological Chemists (SBC) India, Hyderabad University, December 2-5, 2013.

Samrat Mukhopadhyay

Biophysical Society Meeting, San Francisco, California, USA, February 2014.

N.G. Prasad

Rapid response to selection against *Pseudomonas entomophila* in *Drosophila melanogaster* without major life-history trade-offs. Vanika Gupta and N. G. Prasad. Meeting of European Society for Evolutionary Biology, August 2013, Lisbon, Portugal.

No apparent cost of evolved immunity in *Drosophila melanogaster*. Vanika Gupta and N. G. Prasad. Young Scientists Investigators Meet, NCBS, Bangalore, November 2013.

Evolution of reproductive behavior in response to selection for resistance to environmental stress in *Drosophila melanogaster*. Karan Singh and N. G. Prasad. Meeting of European Society for Evolutionary Biology, August 2013, Lisbon, Portugal.

Mahak Sharma

Divya Khatter, Devashish Dwivedi, Surbhi Bahl, Aastha Sindhwani, and Mahak Sharma#. Regulation of mammalian HOPS complex recruitment to lysosomes by small GTPase Arl8b. Poster presentation at the American Society for Cell Biology Meeting, December 2013. #Presenting Author.

Divya Khatter#, Devashish Dwivedi, Surbhi Bahl, Aastha Sindhwani, and Mahak Sharma. Lysosomal GTPase Arl8B governs HOPS Tethering Complex-mediated Late Endosome-Lysosome Fusion in Mammals. Poster presentation at the All India Cell Biology Conference on Cell Dynamics and Cell Fate, Instem, Bengaluru December, 2013. #Presenting Author.

Divya Khatter, Devashish Dwivedi, Surbhi Bahl, Aastha Sindhwani, and Mahak Sharma#. Regulation of mammalian HOPS complex recruitment to lysosomes by small GTPase Arl8b. Poster presentation Wellcome Trust Annual Conference, October 2013. #Presenting Author.

Somdatta Sinha

“Network Analysis of Inhibition and Resistance Mechanisms in Viral Polymerases” by Ashutosh Srivastava and Somdatta Sinha at Albany 2013, The 18th Conversation, Albany, NY USA, June 2013 (presented by Ashutosh Srivastava).

“Network Based Modeling of Inhibition and Resistance Mechanisms in HIV-1 Reverse Transcriptase” by Ashutosh Srivastava and Somdatta Sinha at 20th International HIV Dynamics and Evolution Meeting at

Utrecht, The Netherlands, May 2013 (presented by Ashutosh Srivastava).

“Network Analysis of the Protein Contact Networks of HIV-1 Reverse Transcriptase and its Resistance Mutants” by Ashutosh Srivastava and Somdatta Sinha at Bioworld 2013, IIT-Delhi, December 2013 (presented by Ashutosh Srivastava).

Science and Communication Workshop (SciComm) 2013, Wellcome Trust-DBT India Alliance. Ashutosh Srivastava, September 2013.

“Genetic Variation and Evolution of Tryptophan Biosynthetic Pathway Genes in Microbial Genomes” by V K Priya and Somdatta Sinha, at The 14th International Conference on Systems Biology, Copenhagen, Denmark, August 30 - September 3, 2013 (presented by V K Priya).

Awards and Honors to Faculty and Group Members

Kavita Babu

Innovative Young Biotechnologist Award (IYBA) (2012-2015).

Wellcome Trust-DBT India Alliance Intermediate Career Fellowship (2012-2017).

Yogesh Dahiya (Postdoctoral fellow) recommended for a Wellcome Trust-DBT India Alliance Early Career Fellowship. Start Date, July 2014.

Anand Bachhawat

JC Bose Fellow (2012-2017).

Editorial Boards of *Current Science* (since January 1, 2013), *J. Biosciences* (since January 1, 2010), and *Microbial Cell* (since January 1, 2014).

Member, Task force on Basic Research in Modern Biology (DBT).

Member, PAC on Biochemistry, Biophysics, Molecular Biology and Microbiology (DST).

M. Zulkifli (PhD fellow) and Shambhu Yadav (MS student) received a best poster award for “Identification of residues important for proton translocation in the proton driven plasma membrane glutathione transporter Hgt1” M. Zulkifli, Shambhu Yadav, Anand K. Bachhawat in 8th international conference on Yeast

biology 2013, Chandigarh, India from 4-7th December 2013.

Samarjit Bhattacharyya

Continued as an expert in the DBT neurobiology task force for the year 2012-13.

TIFR alumni association patent award.

Organized a workshop for IISER Mohali's students on "Present day advanced Microscopy Techniques". Company: DSS Imagetech, India and Photometrics India. May 28-30, 2013, IISER Mohali.

Kausik Chattopadhyay

Organized a discussion meeting on "Host-Pathogen Interaction and Immunity", IISER Mohali, August 30-31, 2013.

Karan Paul (PhD fellow) received the best poster award in the 82nd Annual Meeting of Society of Biological Chemists (SBC) India, Hyderabad University, December 2-5, 2013.

Purnananda Guptasarma

Editorial Board: PRION.

DBT Task Force: Energy Biosciences.

Lolitika Mandal

Wellcome Trust-DBT India Alliance Intermediate Career Fellowship (2010-2015).

Served as the member of scientific committee for 2013 Annual meeting of the Indian Society of Developmental Biologists (InSDB).

Harleen Kaur (PhD fellow) won the Prof BR Sheshachar Memorial Award for best poster presentation in All India Cell Biology Conference on Cell Dynamics and Cell Fate, 2013. Instem, Bangalore.

Sudip Mandal

Poonam Aggarwal (PhD fellow) received the best poster award in the Annual meeting of the Indian Society of Developmental Biology, TIFR, Mumbai.

Shravan Kumar Mishra

Head, Max Planck - DST partner group at IISER Mohali (2012-2017).

Co-organizer of "8th International Conference on Yeast Biology - Yeast 2013", IMTECH Chandigarh, December 4-7, 2013.

Poonam (PhD fellow) was selected to attend an advance course titled "Genome-wide Approaches with Fission Yeast" in Hinxon UK, December 7-14, 2013. She was also awarded a scholarship to attend the course.

Samrat Mukhopadhyay

Professor B.K. Bachhawat International Travel Award.

N.G. Prasad

Member of editorial board of *Journal of Genetics*.

Syed Zeeshan Ali (PhD fellow) won SSE Travel Award.

Vinesh Shenoj (PhD fellow) won ESEM Travel Award.

Vanika Gupta (PhD fellow) won the ESEB Travel Award.

Karan Singh (PhD fellow) won DBT Travel Award.

Rajesh Ramachandran

Wellcome Trust-DBT India Alliance Intermediate Career Fellowship (2013-2017).

Mahak Sharma

Wellcome Trust-DBT India Alliance Intermediate Career Fellowship (2012-2017).

Nominated and selected for EMBO-India Bioscience Young Scientist Networking Meeting, Bangalore, November 2013.

Divya Khatter (PhD fellow) won "Excellent Poster award" for her poster "Lysosomal GTPase Arl8B governs HOPS Tethering Complex-mediated Late Endosome-Lysosome Fusion in Mammals", All India Cell Biology Conference on Cell Dynamics and Cell Fate, Instem, Bangalore, December 2013.

Somdatta Sinha

J C Bose Fellow (2012-2017).

External member, Academic Council of University of Hyderabad, Hyderabad (AP).

Member of Scientific Advisory Committee, National Institute of Biomedical Genomics (NIBMG), Kalyani (WB).

Member, INSA-INSPIRE Faculty Award Committee on Biomedical Sciences.

Coordinator of Mohali Node of National Network for Mathematical and Computational Biology (NNMCB).

Organized a "Discussion workshop on Computational Biology", June 10-13, Chail, HP.

Organized a workshop on “Nonlinear Dynamics in Biology” at Mathematics Department, IISc Bangalore, July 8-13, 2013.

Organized a discussion workshop on Computational Biology at Raichak, WB, October 25-27, 2013.

Ashutosh Srivastava (SRF, CCMB, working at IISER Mohali):

Selected for “Young Scientist Speaker” program at International Conference “Albany 2013, The 18th conversation”, Albany, NY USA.

Best poster award at “Bioworld 2013” at IIT-Delhi, for poster titled “Network Analysis of the Protein Contact Networks of HIV-1 Reverse Transcriptase and its Resistance Mutants”.

Awarded Foreign Travel Grant from DBT and ICMR for Oral Presentation at “Albany 2013, The 18th Conversation” Albany, NY USA.

Awarded Full Scholarship by School of Medicine, University of California San Diego, to present a poster at the 20th HIV Dynamics and Evolution Meeting, Utrecht University, The Netherlands.

V K Priya (SRF, CCMB, working at IISER Mohali) was awarded Foreign Travel Grant from DBT to attend The 14th International Conference on Systems Biology, Copenhagen, Denmark, August 30 - September 3, 2013.

Ram Yadav

Invited by the EMBO-India Bioscience initiative to participate in Young Scientist Networking Meeting, Bangalore, November 7-10, 2013.

Recipient of Ramalingaswami fellowship from the Department of Biotechnology Government of India (2012-2017).

Recipient of Innovative Young Biotechnologist Award from Department of Biotechnology Government of India (2012-2015).

PhD Theses

Ms Neha Jain was awarded PhD degree for her research on “Chain Collapse, Aggregation and Membrane- induced Folding of Amyloidogenic Proteins” in the laboratory and guidance of **Samrat Mukhopadhyay**.

Mr Bodhisatta Nandy was awarded PhD degree for his research on “Of War and Love: A study of sexual conflict and sexual selection using *Drosophila melanogaster* laboratory system” in the laboratory and guidance of **N. G. Prasad**.

Faculty and Research at the Department of Chemical Sciences

S. Arulananda Babu's research involves the design and synthesis of new synthetic mimics for Malaria / Cancer. They are also working on the metal-mediated construction of unnatural amino acid derivatives. The other main research topic in which his group currently working is on the development of transition metal-catalyzed enantioselective/stereoselective C-H activation and Carbon-Carbon forming reactions. In this line, they have recently published the direct C-H arylation of cyclopropane and cyclobutane frameworks. Further, his group is working on the synthesis of new crown- and aza crown ether-type macrocycles which are expected to be used for the extraction of metal cations and in catalysis. Apart from these works, his group is also focusing on the development of green organic reactions, especially, magnetically separable transition metal catalysts and organo catalysts.

P. Balanarayan and his research has its focus on computational and theoretical chemistry. In particular he works on problems involving atoms and molecules in very intense and high frequency laser fields. The highlight of his research lies in understanding new chemistry induced in atoms and molecules by the laser. More of his research involves looking at properties of atoms and molecules, and calculating life times of metastable electronic states using complex scaling methodologies.

Angshuman R. Choudhury works on various aspects of structural chemistry of small organic compounds using both single crystal and powder X-ray diffraction methods in association with other common characterization techniques such as NMR, FTIR, TGA, DSC and UV-VIS spectroscopy. He is particularly interested in the study of weak interactions involving weak donors (C—H groups) and weak acceptors (C—X, organic halogen groups) in both model molecules and real molecules of potential futuristic drugs. All common methods of crystallization including solvent evaporation, vapor diffusion, co-precipitation, solvent-antisolvent evaporation etc. are used in his laboratory. In situ crystallization technique is a unique feature of this group for crystallization of materials having low (<20 oC), very low (<-20 C) and ultra-low (<-40 oC) melting points. His other interests include analysis of experimental charge density analyses to understand the nature and role of weak and very weak intermolecular interactions that may be responsible for holding the molecules together in a crystal lattice thereby altering its melting point compared to that of the similar molecules.

They are also interested in studying cocrystallization and salt formation of pharmaceutically active compounds in order to improve their solubility and bioavailability. A number of different classes of drugs and pharmaceuticals are being screened in search of their polymorphs and salts/cocrystals for improved biological properties.

Samrat Ghosh's research interest is in the area of solution synthesis of functional inorganic materials especially oxides both in the form of bulk and thin films and exploring their application as heterogeneous catalysts in biodiesel synthesis, components of solid oxide fuel cells, visible light activated photocatalysts for hydrogen generation by splitting of water, ceramic pigments and magneto-resistant materials. The synthetic techniques of interest to me are Hydrothermal, Regenerative Sol-Gel, Matrix Trapping and Decomposition Process. Emphasis is on the development of synthetic techniques which are environment/eco-friendly and have the potential for being scaled up for large scale industrial production.

Ramesh Kapoor For the past few years, he has been interested in the development of new polydentate ligands particularly those containing carboxamidopyridine. This group $[-C(O)NH-]$ present in the primary structure of proteins, in an important ligand construction unit. These ligands coordinate with transition metals to yield complexes of varying nuclearities, structures and interesting magnetic properties. Our research interests also involve the synthesis and structural characterization of organotin compounds containing anions of highly strong acids such as SO_3F , CF_3SO_3 , AsF_6 , SbF_6 etc.

Samrat Mukhopadhyay Refer to the section in biology for details of his research.

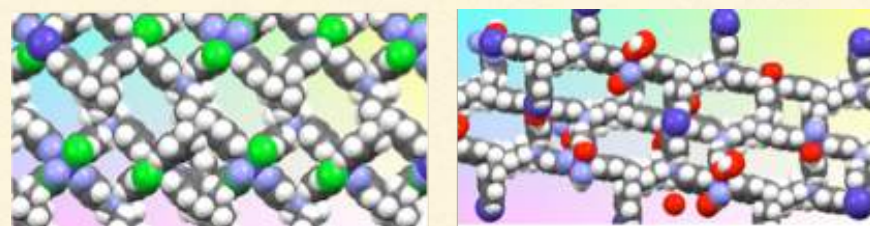
Sanjay Mandal's group is engaged in developing diversified chemistry of elements across the periodic table through a variety of interdisciplinary projects that involve multi-step organic synthesis, coordination chemistry, catalysis, materials chemistry, spectroscopy, thermal analysis, electrochemistry and X-ray crystallography. His research efforts target alternate solutions to some current issues in the fields of mesh-adjustable molecular sieves, adsorbent coolant (green air-conditioning), selective gas adsorption studies - storage of hydrogen and methane (next generation fuels), and sequestering of carbon dioxide (lowering greenhouse effect), chiral catalysis, and organosilicon polymers.

Recent important discoveries include:

(1) the encapsulation and structural characterization of a cyclic quasiplanar hexamer of water (which is considered by others as the smallest drop of water, JACS 2012,

134, 11116) as shown below. Its importance comes from the similarity to the structure of ice (Science 1997, 275, 814).

(2) molecular rectangles with tunable pore sizes showing mesh-adjustable molecular sieves properties.



(3) producing nano-sized crystalline ZnO or CdO, at 400 °C and 250 °C, respectively, via the direct thermal decomposition technique from the water soluble coordination polymer precursors. Thus application of these precursors that require no solvent like oleic acid or any surfactant makes this route a cost-effective one. Additionally, these materials in large quantities are easily prepared within few hours.

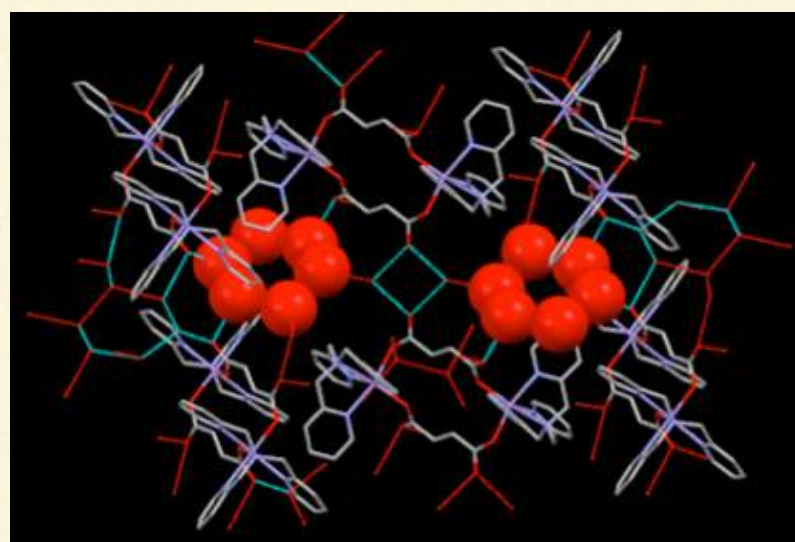
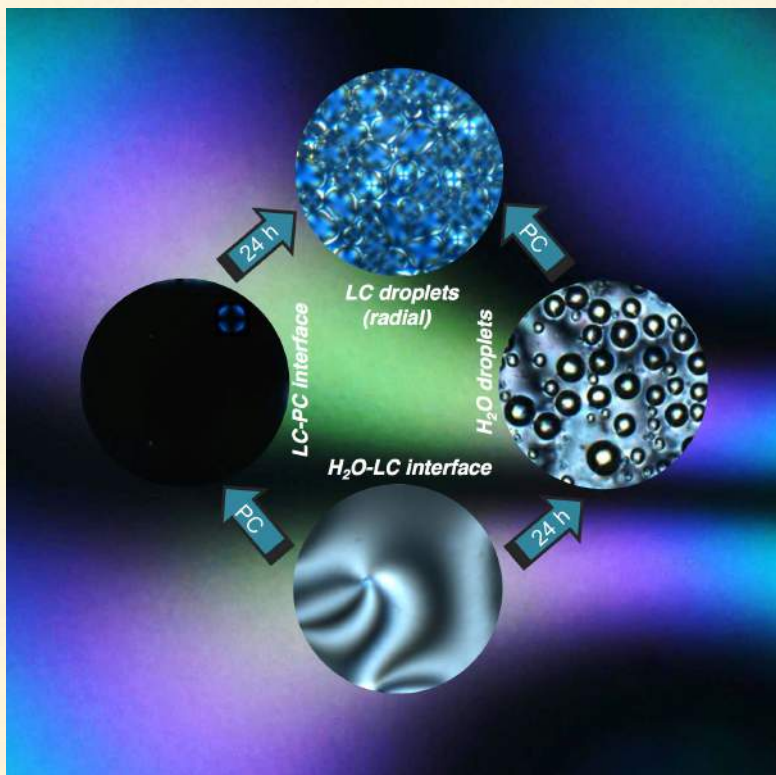


Figure: Perspective view of the encapsulated cyclic hexamer of water.

Santanu K. Pal: Interfacial phenomena and complex fluids such as liquid crystals (LCs) have important applications in. A particular focus is directed to dynamic phenomena at functional organic interfaces, including the development of new principles which offer the basis of general and facile approaches to the building of new sensing platforms that can report on the presence/organization of chemical and biological agents. For example, we have recently found that smart LC gels are sensitive to bacterial endotoxin. A second broad approach in our laboratory towards functionalized soft nanomaterials involves design, synthesis, characterization of new LCs (rod-, disc- and bent-shaped).

Incorporation of nanomaterials in the supramolecular order of discotic LCs is likely to lead novel materials for many device applications. The ultimate aim is to provide a new resource of functional soft materials for applications in nano-



sciences. We are also interested to develop principles based on surface-driven ordering transitions in LCs that will enable design of chemically responsive soft materials. The ultimate goal will focus on development of science and technology, that may, in the long term, enable the design of materials capable of responding to their chemical environment.

S. V. Ramasastry Sripada Major objective of his research is the development of new C-C, C-O bond forming reactions with relevance to both medicinal and natural products chemistry with a particular emphasis on catalysis and application of these strategies to the total synthesis of architecturally complex heterocycles of biological significance. Research also includes the development of atom economic, green and sustainable synthetic processes. The philosophy of research includes that methods developed should be user-friendly, experimentally trivial, environmentally friendly and economically sound, while providing access to otherwise difficult targets.

His group has developed (references mentioned above) new modes of Lewis/Bronsted acid activation of a variety of functional groups, typically alcohols, carbonyls, olefins etc., and their transformation to privileged structures and novel scaffolds. These methods find significant applications in both academia as well as industry.

Ramesh Ramachandran Solid-state nuclear magnetic resonance (SSNMR) is the application of NMR spectroscopy to systems that are solids, nearly solids, or strongly anisotropic. Recent advancements in this field have established solid-state NMR as a viable alternative for determining the structure of biological systems (membrane proteins and peptide aggregates) that are less amenable to characterization by other high-resolution techniques. In spite of the tremen-

dous progress made in the last decade or so, SSNMR is still a developing field and methods towards structural characterization are just emerging.

The primary objectives of our research group are to invoke the principles of physics and try to apply them in solving problems in chemistry and structural biology. In this regard we plan to use Solid-state Nuclear Magnetic Resonance (SSNMR) spectroscopy as a tool to understand the biological implications of structural transformations taking place in proteins and their role in protein related diseases.

Besides its implications in chemistry and structural biology, SSNMR can also be used as a test-bed to investigate/understand some of the founding principles of quantum physics.

Sabyasachi Rakshit's group is an interdisciplinary research group whose primary interests are to explore and understand science that is happening at the nanometer regime and within picoNewton to nanoNewton force range. They use both experimental techniques like Force Spectroscopy, Forster Resonance Energy Transfer (FRET), Time-Resolved Emission Spectroscopy etc. for single molecule and ensemble measurements as well as computational approaches like Molecular Dynamics and Steered Molecular Dynamics.

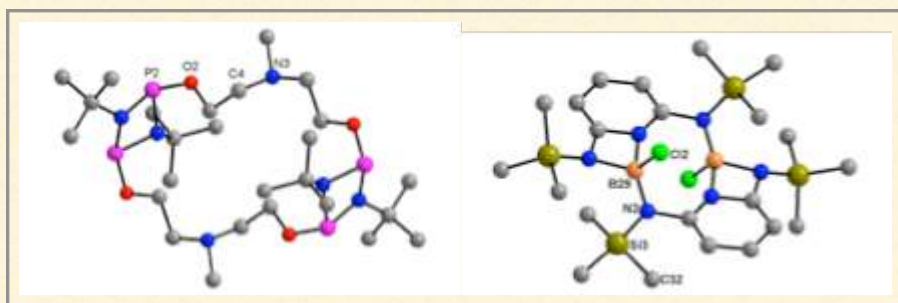
They are interested in understanding the biophysical properties of mechano-responsive proteins in hearing. Develop mechanically activated smart polymers: It has been often found that biology has mastered and engineered the non-covalent interactions to convert polymers into smart materials. In order to develop such smart mechano-active materials, quantitative understandings of non-covalent weak interactions are essential. Our research goal here is to quantitatively estimate the magnitude and kinetics of pi-pi, pi-cation and pi-anion interactions and at the single molecule level and design a rule of thumb. The better understanding of such pi-interactions would help us in rational drug design and lead optimization in medicinal chemistry.

N. Sathyamurthy: The work of Dr. Sathyamurthy and his students has centered around non-covalent interactions, particularly on CH-pi and pi-pi interaction in benzene-acetylene. They studied the structure and stability of ozone-water complexes. They investigated the host-guest interaction in gas hydrates and evaluated the effectiveness of different functionals available for computing accurately the long range interactions. In addition, his group has investigated the ground and the excited electronic states of XH- (X = H, C, N and O) systems including spin-orbit coupling. They were able to compute the ab initio potential energy curves to the complete basis set limit and predict the electron affinity of the neutral molecule and the autoionization thresh-

old and photodetachment threshold for the anions and compare them with the available experimental results.

K.R. Shamasundar In collaboration with experimental groups, he has contributed to understand the large differ. Currently, he has been exploring the photochemistry of Crotonaldehyde and ethylene. In collaboration with Baer who spent a semester at IISER Mohali, he has performed several calculations of non-adiabatic coupling effects in ethylene. These calculations have uncovered new results on the nature and influence of seam of conical intersections in ethylene.

Sanjay Singh The chemistry of highly reactive organo-main group ionic compounds and late transition metals supported by bulky iminophosphonamide ligands with N-P-N skeleton and formation of four-membered metallacycles is the focus of research work here. In addition to this we are also looking at C-H activation in aromatic compounds by Au(III) salts supported by bulky N-arylimidoamidines and synthesis of pincer type/tripodal N-heterocyclic carbenes and their palladium complexes for C-H activation and for catalysis.



Sugumar Venkataramani One of his major areas of interest is to understand the structure, stability and reactivity of radicals and highly reactive species. In this regard, he utilizes an experimental technique called matrix isolation infrared/UV spectroscopy. At very low temperatures (4 K), gases like argon, neon and nitrogen form transparent matrices in the UV and IR regions. By controlling the dilution in such gases, molecules can indeed be isolated and trapped. If the molecules of interest are prepared with photo-labile groups, transient and unstable species can be generated through photolysis and isolated in matrices.

Alternatively, Flash Vacuum Pyrolysis (FVP) can also be adopted, in which a precursor molecule with thermo-labile group can be sublimed through a hot quartz tube at very high temperature and high vacuum so as to generate transient species. The kinetically stable products can consequently be trapped in argon or nitrogen matrices at low temperature. Further photochemistry of such transient products can also be followed to get information about their reactivity. A detailed infrared/UV spectroscopic investigation will be performed along with computational studies in order to understand the structural information and mechanistic path-

ways. Studies on heterocyclic transient species, photosensitized transients and developing model systems for radical damage are the immediate goals.

R. Vijaya Anand 's research interest is inclined towards development of new functional group transformations under organo-catalytic conditions. His research group is currently engaged in the following sub-areas of organocatalysis.

Enantioselective transformations using chiral N-heterocyclic carbenes (NHCs). Synthesis of unnatural small peptides and their utility in enantio-selective transformations. Asymmetric synthesis using chiral phase transfer catalysts (PTCs). Development of transition metal free photo-redox reactions.

K. S. Viswanathan Using the matrix isolation infrared facility, the hydrogen bonding interactions of phenylacetylene with a number of precursors such as water, methanol, methyllamine, chloroform were studied. We have also studied the conformations of propargyl alcohol and its complexes with water. These are weak complexes and can be observed only by high resolution techniques, as the perturbations in the infrared features as a result of complex formation are quite small. The small linewidths in our experiments allows for the observation of such features. In addition, the matrix isolation technique also allows one to sample local minima, which is not possible in gas phase molecular beam techniques. For example, in the systems studied above, we have been able to clearly identify n- σ hydrogen bonded structures, which correspond to local minima and which were not observed in gas phase studies.

Publications

Construction of Functionalized Carbocycles Having Contiguous Tertiary Carbinol and All-Carbon Stereogenic Centers, C. Reddy, **S. Arulananda Babu**, N. A. Aslam, and V. Rajkumar Eur. J. Org. Chem. 2013, 2362-2380.

RCM strategy-based entry into new crown ether/polyether macrocyclic systems derived from hydroxy benzaldehydes-Naveen, R. Parella, and **S. Arulananda Babu**, Tetrahedron Lett. 2013, 54, 2255-2260

Auxiliary-enabled Pd-catalyzed direct arylation of methylene C(sp³)-H bond of cyclopropanes: Highly diastereoselective assembling of Di- and trisubstituted cyclopropanecarboxamides, R. Parella, B. Gopalakrishnan, and **S. Arulananda Babu**, Org. Lett. 2013, 15, 3238-3241

Direct Bis-Arylation of Cyclobutanecarboxamide via Double C-H Activation: An Auxiliary-Aided Diastereoselective Pd-

Catalyzed Access to Trisubstituted Cyclobutane Scaffolds Having Three Contiguous Stereocenters and an All-cis Stereochemistry, R. Parella, B. Gopalakrishnan, and **S. Arulananda Babu**, *J. Org. Chem.* 2013, 78, 11911-11934

Diastereoselective construction of a new class of nicotine analogues having contiguous stereocenters via 1,3-dipolar cycloaddition of azomethine ylides, V. Rajkumar, and **S. Arulananda Babu**, *Indian J. Chem. Sec. A.* 2013, 52A, 1113-1127 (Invited Article for the Special Issue: 'Complex Chemical Systems')

Chelation-controlled diastereoselective construction of N-aryl-, N-acyl/tosylhydrazono β -substituted aspartate derivatives via Barbier-type reaction, N. A. Aslam, **S. Arulananda Babu**, A. J. Sudha, M. Yasuda, and A. Baba, *Tetrahedron* 2013, 69, 6598-6611

Magnetic Nano Fe₃O₄ Catalyzed Solvent-Free Stereo- and Regioselective β -Aminolysis of Epoxides by Amines; a Green Method for the Synthesis of β -Amino Alcohols, A. Kumar, R. Parella, and **S. Arulananda Babu**, *Synlett* 2014, 25, 835-842.

Cinchona Alkaloid-Catalyzed Stereoselective Carbon-Carbon

Bond Forming Reactions, **Babu, S. A.**; Anand, R. V.; Ramasastri, S. S. V. *Recent Patents on Catalysis*, 2013, 47. [Invited review article]

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Karnam, M.; **Choudhury, A. R.** *Cryst. Growth Des.* 2013, 13, 4803-4814.

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Microwave-assisted synthesis of novel mixed tail rufigallol derivatives, Setia, S.; Soni, A.; Gupta, M.; Sidiq, S.; Pal, S. K. *Liq. Cryst.*, 2013, 40, 1364-1372.

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Cinchona Alkaloid-Catalyzed Stereoselective Carbon-Carbon Bond Forming Reactions, Babu, S. A.; Anand, R. V.; Ramasastry, S. S. V. *Recent Patents on Catalysis*, 2013, 47. [Invited review article]

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M. K. Bharty, Pooja Bharati, A. Bharti, A. Singh, Sanjay Singh, N.K. Singh, *J. Mol. Str.*, 2014, 156-157, 326-332. Syntheses, spectral and structural characterization of Ni(II) complexes of 4-amino-5-phenyl/3-pyridyl/thiophen-2H-1,2,4-triazole-3-thione.

"Base mediated 5-endo-dig cyclization of N-propargyl proline derivatives: A facile entry to pyrrolizidine scaffolds" by Sriram Mahesh, Manish Pareek, B T Ramanjaneyulu, Gurpreet Kaur and R Vijaya Anand, *Indian J. Chem.* 2013, 52A, 1086 (Invited article).

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K. Sundararajan, N. Ramanathan, K. S. Viswanathan, K. Vidya and E. D. Jemmis, *J. Mol. Struct.* **1049**, 69 (2013).

Bishnu Prasad Kar, N. Ramanathan, K. Sundararajan, K. S. Viswanathan, *J. Mol. Struct.* (in press).

Patents Filed

Inventors: Srinivasarao Arulananda Babu and Nayyar Ahmad Aslam, Patent Application No. 3400/DEL/2013, Date: 20th November 2013 Title: Process for the Preparation of Homoserine Lactones Derivatives

Patent Application No. 3400/DEL/2013, Date: 20th November 2013 Title: Process for the Preparation of Homoserine Lactones Derivatives

Inventors: Srinivasarao Arulananda Babu and Naveen, Patent Application No. 2152/DEL/2013, Date: 18th July 2013

Title: Novel Class of Crown Ether/Polyether Macrocyclic Compounds and the Process of Preparation Thereof

Inventors: **Srinivasarao Arulananda Babu**, Ramarao Parella and Bojan Gopalakrishnan, Patent Application No. 1240/DEL/2013, Date: 26th April 2013, Title: Novel Di- and Trisubstituted Cyclopropanecarboxamide compounds and the Process of Preparation Thereof

Inventors: **Srinivasarao Arulananda Babu** and Vadla Rajkumar, Patent Application No. 1102/DEL/2013, Date: 12th April 2013, Title: Novel Nicotine Analogues/2-Pyridylpyrrolidine: Derivatives and the Process of Preparation Thereof.

A novel technique for preparation of liquid crystal droplets **Pal, S.K.**; Sidiq, S. Indian patent Application No.102/DEL/2014.

Academic Visits

S. Arulananda Babu

On invitation, visited the following Universities of UK and attended Gregynog Workshop during 11-22 Sep 2013 and delivered seminars at the following Universities of UK and attended Gregynog Workshop (Sponsored by Organic Chemistry Division, RSC).

Monday 16th September 2013, University of Bath Chemistry Department, Title of the talk: Efforts toward stereoselective carbon-carbon bond formation: Construction of small to macrocyclic rings.

Tuesday 17th September 2013, University of Cardiff Department of Chemistry, Title of the talk: Stereoselective C-C bond formation, construction of small and complex molecules and synthetic building blocks.

Wednesday 18th September 2013, University of Birmingham Chemistry Department, Title of the talk: Construction of carbocyclic rings having contiguous stereocenters.

Thursday 19th September 2013, University of Reading Chemistry Department, Title of the talk: Efforts toward Pd- and In-based stereoselective carbon-carbon bond forming reactions.

Sanjay Mandal

was a visiting faculty at the IACS Kolkata between December 23, 2014 and Jan 1, 2014.

S. V. Ramasastry Sripada

Participated in the conference held at the School of Chemistry, University of Hyderabad on the occasion of 60th birthday of Professor Periasamy.

R. Vijaya Anand

Participated in the Nature Inspired Initiatives in Chemical Trends (NICT) conference organized by ICT Hyderabad during March 2-5, 2014.

Invited Talks

S. Arulananda Babu

Delivered an invited talk at 50th Annual Convention of Chemists (Indian Chemical Society), held at the Department of Chemistry & Centre of Advanced Studies in Chemistry, Punjab University, Chandigarh, December 04-07, 2013.

Title of the talk: Stereoselective C-C bond formation: Construction of small- and medium-sized ring molecules having contiguous stereocenters

Angshuman Roy Choudhury

Delivered an invited talk entitled "Organic Fluorine" and its Importance in Crystal Engineering" in 42nd National Seminar on Crystallography, held in JNU Convension Centre, New Delhi between 21st and 23rd November, 2013.

Sanjay Mandal

talk at at the Annual Convention of Chemists 2013, 04-07 December, 2013, Punjab University. Title: Metal Organic Coordination Networks: Encapsulated Water Clusters and Water Adsorption Properties

at IACS Kolkata on December 30, 2013. Title: Metal Organic Coordination Networks: Encapsulated Water Clusters and Water Adsorption Properties

at the National Symposium on Recent Advances in Physics organized by Department of Physics, GNDU, Amritsar on February 14, 2014. Title: Metal Organic Coordination Networks: Adsorbent of Gases/Liquids and Precursors to Crystalline Metal Oxides

at the IVth National Symposium on Advances in Chemical Sciences organized by Department of Chemistry, GNDU, Amritsar on February 28, 2014. Title: Metal Organic Coordination Networks: Encapsulated Water Clusters and Molecular Sieves with Tunable Pore Sizes

S. V. Ramasastry Sripada

Delivered a research talk at the School of Chemistry, University of Hyderabad on 22nd April, 2013

Delivered an invited talk on 19th Dec, 2013 during the National Seminar on Recent Trends in Organic Chemistry (NRTOC) held at S. V. University, Tirupati.

Delivered an invited talk on 20th Jan, 2014 as part of Professor A. Srikrishna memorial lecture series held at the Indian Institute of Science, Bangalore

N. Sathyamurthy

Bowls, balls and sheets: five and six-fold symmetry, Symposium on Theoretical and Computational Chemistry Frontiers & Challenges, Bharathidasan University, Tiruchirapalli, June 14-15, 2013

From molecules to materials: challenges and opportunities in computational chemistry, International conference on "Computational and data intensive science", CSIR Fourth Paradigm Institute, Bangalore, August 26-28, 2013

From atomic and molecular clusters to floral symmetry: the role of pentagons and hexagons, CF-2013: Chemical Frontiers, Goa, August 28-30, 2013

Indian Institutes of Science Education and Research (IISERs): An Indian Experiment in Science Education and Research, 2nd Summit of the South Asian Academy of Sciences, Indian National Science Academy, New Delhi, Sep. 25, 2013

Floral Symmetry, Complex Systems: From Physics to Biology, Jawaharlal Nehru University, New Delhi, Oct. 15-16, 2013

Symmetry and beauty of the floral world around us, Foundation Day Lecture, CSIO, Chandigarh, Oct. 30, 2013

Stacking and spreading interaction in molecular materials, International Conference on Interdisciplinary Areas with Chemical Sciences (ICIACS2013), Panjab University, November 1, 2013

Back to the Basics: the Case of Diatomic Anions, 50th Annual Convention of Chemists, Department of Chemistry, Panjab University, Chandigarh, December 5, 2013

IISERs: An Indian Experiment in Science Education and Research, NIAS-DST training programme on "Policy for Science and Science for Policies", Bangalore, December 19, 2013

IISERs: An Indian Experiment in Science Education and Research, SPSTI meeting on higher education in 21st century, Chandigarh, February 19, 2014

Structural motifs in chemistry and chemical biology, NISER, Bhubaneswar, Feb. 20, 2014

Symmetry in chemistry and the floral world, Spectroscopy and dynamics of molecules and clusters, Puri, Feb. 20-23, 2014

Structural motifs in chemistry and chemical biology, IV National Symposium on Advances in Chemical Sciences, GNDU, Amritsar, Feb. 27-28, 2014

Symmetry in chemistry and chemical biology, Academy Workshop on Recent Advances in Materials Science, Bharathidasan Institute of Technology, Anna University, Tiruchirapalli, March 8, 2014

Symmetry in chemistry and chemical biology, National Symposium on Chemistry, Aligarh Muslim University, Aligarh, March 22, 2014

Sanjay Singh

Modern Trends in Inorganic Chemistry-XV, December 13-16, 2013 organized by Department of Chemistry, Indian Institute of Technology Roorkee. Title: Bulky iminophosphonamines for N-P-N coordination: synthesis and structural characterization of lithium iminophosphonamides and homoleptic bis-chelates of Co(II), Ni(II) and Cu(II). Sanjay Singh, Billa Prashanth

K. S. Viswanathan

"IR spectroscopy - Recent advances" invited talk at the workshop on Recent Advances in Spectroscopic Techniques, held at Calicut University, Calicut, Nov 24-25, 2013.

"Chemistry in inert matrixes - the cage effect", Invited Talk delivered at the 6th National Seminar on New Paradigm in Chemical Sciences - 2014, on February 13, 2014 at the Department of Chemistry, Punjabi University, Patiala - 147 002 (Punjab)

Awards and Honours for faculty and students

Angshuman Roy Choudhury

Ms. Gurpreet Kaur won one of the student oral presentation awards in 42nd National Seminar on Crystallography, held in JNU Convension Centre, New Delhi between 21st and 23rd November, 2013.

Mr. Sudip Maheswari won one of the best poster awards in 43rd National Seminar on Crystallography, held in IISER Mohali, between 28th and 30th March, 2014.

Posters

Angshuman Roy Choudhury

Mr. Shiv Charan Dudi made an oral presentation entitled Study of “C–H···F Hydrogen Bond in a Series of Fluorine Substituted Phenylacetanilides” in 42nd National Seminar on Crystallography, held in JNU Convention Centre, New Delhi between 21st and 23rd November, 2013.

Mr. Gulshan Kumar made an oral presentation entitled “The Nature of C–H···F–C Hydrogen Bond in Aromatic Systems: A Systematic Study Using Cambridge Structural Database and Computational Methods” in 42nd National Seminar on Crystallography, held in JNU Convention Centre, New Delhi between 21st and 23rd November, 2013.

Ms. Gurpreet Kaur made an oral presentation entitled “Study of the Robustness of the Synthons Observed in the Crystal Packing of the System of Tetra Fluoro N-benzylideneanilines” in 42nd National Seminar on Crystallography, held in JNU Convention Centre, New Delhi between 21st and 23rd November, 2013.

Mr. Hareram Yadav made an oral presentation entitled “How Important are Fluorine Mediated Interactions in Crystal Packing in the Presence of Strong Hydrogen Bond(s)?” in 42nd National Seminar on Crystallography, held in JNU Convention Centre, New Delhi between 21st and 23rd November, 2013.

Ms. Indu Verma made an oral presentation entitled “Cocrystallization of Active Pharmaceutical Ingredients for Enhanced Properties” in 42nd National Seminar on Crystallography, held in JNU Convention Centre, New Delhi between 21st and 23rd November, 2013.

Ms. Sandhya made an oral presentation entitled “Can C–H···F Interactions Alter Crystal Packing in the Presence of Strong Hydrogen Bond?” in 42nd National Seminar on Crystallography, held in JNU Convention Centre, New Delhi between 21st and 23rd November, 2013.

Mr. Sudeep Maheswari made an oral presentation entitled “Structure, Stability, and Energetics of Complexes Involving C–H···F Hydrogen Bond” in 42nd National Seminar on Crystallography, held in JNU Convention Centre, New Delhi between 21st and 23rd November, 2013.

Sanjay Mandal

Diversifying the formation of encapsulated water clusters in Metal Organic Coordination Networks via chemical modification routes, Sandeep Kumar, Vijay Gupta, Sadhika Khullar and Sanjay Mandal. Presented at the National Seminar on Crystallography (43A), 28-30 March, 2014, IISER Mohali.

Use of a chemical modification route in diversifying the formation of Metal Organic Coordination Networks, Sandeep Kumar, Sadhika Khullar and Sanjay Mandal. Presented at the Modern Trends in Inorganic Chemistry (MTIC-XV) symposium 13-16 December, 2013, IIT Roorkee.

New chiral Metal Organic Coordination Networks comprised of Cu(II) and tyrosine based ligands, Navnita Kumar, Sadhika Khullar and Sanjay Mandal. Presented at the Modern Trends in Inorganic Chemistry (MTIC-XV) symposium 13-16 December, 2013, IIT Roorkee.

Metal Organic Frameworks Comprised of Dinuclear Manganese-oxo Subunits, Biswajit Laha, Sadhika Khullar and Sanjay Mandal. Presented at the Annual Convention of Chemists 2013, 04-07 December, 2013, Punjab University.

Metal Organic Coordination Networks based on New Hexadentate Ligands, Gaurav Verma, Sandeep Kumar, Sadhika Khullar and Sanjay Mandal. Presented at the Annual Convention of Chemists 2013, 04-07 December, 2013, Punjab University.

R. Vijaya Anand

Mr. B. T. Ramanjaneyulu (PhD Student) has presented a poster entitled “NHC catalysed intermolecular cross benzoin condensation of aldehydes with trifluoroacetaldehyde ethyl hemiacetal” in the Nature Inspired Initiatives in Chemical Trends (NIICT) conference organized by IICT Hyderabad during March 2-5, 2014.

Sanjay Singh

Synthesis and characterisation of a novel CNHCSeCNHC pincer ligand and its palladium and silver complexes. Rishu and Sanjay Singh, Poster presented in IVth National Symposium on Advances in Chemical Sciences, February 27-28, 2013, Department of Chemistry, Guru Nanak Dev University, Amritsar.

Synthesis and molecular structure of lithiumiminophosphonamide and heteroleptic complexes of group 13 elements. Billa Prashanth and Sanjay Singh, Poster Presented in National Seminar on Crystallography (43A), March 20-30, 2014 at IISER Mohali.

Selenoether bridged N-heterocyclic carbene precursor as novel CNHCSeCNHC pincer ligands and aromatic C-H activation by Pd(II) complex. Rishu and Sanjay Singh, Poster Presented in National Seminar on Crystallography (43A), March 20-30, 2014 at IISER Mohali.

Synthesis of phospho(III)zane and boron-amide based organic-inorganic hybrid macrocycles and cryptands. Deependra Bawari, Kuldeep and Sanjay Singh, Poster Presented in National Seminar on Crystallography (43A), March 20-30, 2014 at IISER Mohali.

K. S. Viswanathan

“Phenylacetylene-water heterodimer - $n-\sigma$ versus $H-\pi$ Hydrogen bond”, Ginny Karir, Kanupriya Verma, K. S. Viswanathan

“Phenyl acetylene-acetylene complexes - who is the proton donor?”, Kanupriya Verma, Ginny Karir, K. S. Viswanathan.

Faculty and Research at the Department of Earth and Environmental Sciences

Baerbel Sinha : Sulphate aerosol plays an important but uncertain role in cloud formation, precipitation and the radiative forcing of the climate. The oxidation of SO_2 to sulphate is a key reaction in determining the impact of sulphate aerosol in the environment. Most importantly this process modifies the surface properties of particles and changes the ability of particles to seed cloud droplets and control precipitation.

In 2013 and 2014 a series of papers, one of them in the prestigious journal “Science” presented results obtained in an international field experiment, the Hill Cap Cloud Thuringia 2010 (HCCT-2010) study. The results showed that SO_2 oxidation catalysed by natural transition metal ions is the dominant SO_2 oxidation pathway in clouds, even in mid-latitudes where mineral dust loadings are moderate to low. This reaction occurs only on coarse mineral dust, and is currently not included in global climate models. Before this discovery O_3 and H_2O_2 were considered to produce >64-83% of the global sulphate burden. Adding this reaction to climate models will lead to large changes in estimates of regional aerosol cooling and the magnitude of climate change in high dust regions especially over India and China.

Vinayak Sinha (also a part of the department of chemical sciences): His research group focuses on understanding at-

mospheric composition and chemistry over the Indian region and its regional to global chemistry-air quality-climate implications. They undertake in-situ chemical characterization of emission sources and ultra trace reactive (ppt-ppb) ambient air constituents in the Indo Gangetic Plain to elucidate the photochemistry of surface ozone and secondary organic aerosol formation and their potential mitigation. For this purpose they develop new atmospheric analytical instrumentation in the laboratory, perform real time measurements of ambient air at a time resolution better than 1 minute by deploying state of the art techniques and undertake field studies for source profiling and establishing temporal and spatial heterogeneities in regional atmospheric composition and chemistry.

Two key findings from the group’s research in the last one year are: 1) The release of massive amounts of carcinogenic benzenoids due to regional paddy and wheat residue burning in North India in April-May and Oct-Nov every year and its debilitating effect on ambient air quality and the atmosphere’s cleansing capacity (Sarkar et al., 2013, Current Science; Kumar et al., Eos Trans. AGU, Fall Meet. Suppl., 94, Abstract: A21K-05, 2013)

2) The occurrence of high natural emissions of reactive terpenes (isoprene and monoterpenes), due to changed land use practises in the IGP, favouring poplar and eucalyptus plantations in agricultural areas of North India (Sinha et al., 2013, Atmos. Chem. Phys. Discuss). The plant emitted terpenes can combine with nitrogen oxides released from automobile exhaust and urban sources making a potent precursor mixture for high regional surface ozone formation that reduces crop yields and can cause lung diseases.

Publications

Harris, E.*, Sinha, B.*, van Pinxteren, D., Tilgner, A., Fomba, K. W., Schneider, J., Roth, A., Gnauk, T., Fahlbusch, B., Mertes, S., Lee, T., Collett, J., Foley, S., Borrmann, S., Hoppe, P., and Herrmann, H., Enhanced Role of Transition Metal Ion Catalysis During In-Cloud Oxidation of SO_2 . Science 340, 727-730, 2013.

Harris, E.*; Sinha, B.; Hoppe, P.; Shuhei Ono S.: High-Precision Measurements of ^{33}S and ^{34}S Fractionation during SO_2 Oxidation Reveal Causes of Seasonality in SO_2 and Sulphate Isotopic Composition. Environmental Science & Technology 47, 12174-12183, 2013.

Henning, S., Dieckmann, K., Ignatius, K., Schäfer, M., Zedler, P., Harris, E.; Sinha, B.; van Pinxteren, D.; Mertes, S.; Birmili, W.; Merkel, M.; Wu, Z.; Wiedensohler, A.; Wex, H.;

Herrmann, H.; Stratmann, F.: Influence of cloud processing on CCN activation behaviour in the Thuringian Forest, Germany during HCCT-2010. *Atmospheric Chemistry and Physics Discussions* 14 1617-1645, 2014.

Harris, E.*; **Sinha, B.**; van Pinxteren, D.; Schneider, J.; Poulain, L.; Collett, J.; D'Anna, B.; Fahlbusch, B.; Foley, S.; Fomba, K.W.; George, C.; Gnauk, T.; Henning, S.; Lee, T.; Mertes, S.; Roth, A.; Stratmann, F.; Borrmann, S.; Hoppe, P.; Herrmann, H.: In-cloud sulfate addition to single particles resolved with sulfur isotope analysis during HCCT-2010. *Atmospheric Chemistry and Physics Discussions* 14, 2935-2981, 2014.

Sarkar, C., Kumar, V., **Sinha, V.** : Massive emissions of carcinogenic benzenoids from paddy residue burning in North India, *Current Science*, Volume 104, Issue 12, 1703-1709, 2013.

Sinha, V., Kumar, V., and Sarkar, C.: Chemical composition of pre-monsoon air in the Indo-Gangetic Plain measured using a new PTR-MS and air quality facility: high surface ozone and strong influence of biomass burning, *Atmos. Chem. Phys. Discuss.*, 13, 31761-31813.

Adame, J. A., Martínez, M., Sorribas, M., Hidalgo, P. J., Harder, H., Diesch, J.-M., Drewnick, F., Song, W., Williams, J., **Sinha, V.**, Hernández-Ceballos, M. A., Vilà-Guerau de Arellano, J., Sander, R., Hosaynali-Beygi, Z., Fischer, H., Lelieveld, J., and De la Morena, B.: Meteorology during the DOMINO campaign and its connection with trace gases and aerosols, *Atmos. Chem. Phys.* 14, 2325- 2342, doi:10.5194/acp-14-2325-2014, 2014.

Hens, K., Novelli, A., Martinez, M., Auld, J., Axinte, R., Bohn, B., Fischer, H., Keronen, P., Kubistin, D., Nölscher, A. C., Oswald, R., Paasonen, P., Petäjä, T., Regelein, E., Sander, R., **Sinha, V.**, Sipilä, M., Taraborrelli, D., Tatum Ernest, C., Williams, J., Lelieveld, J., and Harder, H.: Observation and modelling of HOx radicals in a boreal forest, *Atmos. Chem. Phys. Discuss.*, 13, 28561-28629, doi:10.5194/acpd-13-28561-2013, 2013.

Academic Visits and Invited Talks

Baerbel Sinha

Presented posters at the European Geophysical Union Conference 7th-12th April 2013 in Vienna

Visit to the Max Planck Institute for Chemistry Mainz for participating in the PhD defence of Eliza Harris 10th May to

12th May 2013 as keeper of the minutes of the Oral Examination (viva).

Invited talk on the IISER Mohali Atmospheric Chemistry facility at the 'CAIPEEX-Phase III - IGP Campaign Meeting' organized by Indian Institute of Tropical Meteorology, Pune, August 30, 2013.

Vinayak Sinha

Visit to IISER Trivandrum for Bi-annual Max Planck Partner Group Leaders' Meeting from 18.04.2013-20.04.2013

Visit to International Centre for Integrated Mountain Development (ICIMOD) for SUSKAT Campaign Data workshop, Kathmandu, Nepal from 26.08.2013 -30.08.2013

Visit to the Max Planck Institute for Chemistry Mainz, Germany under bilateral IISER-DST-MPG partner group project from 28.05.2013-13.07.2013

Solicited talk at the International Workshop on "Changing Chemistry in Changing Climate: Monsoon (C4)" organized by ICACGP, IGAC and SPARC along with Earth System Science Organization (IITM, MoES, India at Indian Institute of Tropical Meteorology (IITM), Pune from 01.05.2013-03.05.2013.

Invited lecture at Physical Research Laboratory, Ahmedabad on "Chemistry of Radicals in the Atmosphere" from 06.05.2013-07.05.2013

Invited talk during the International Atmospheric Composition and the Asian Monsoon (ACAM) Workshop held in Kathmandu, Nepal on 12.06.2013

Institute seminar at Max Planck Institute for Chemistry, Mainz on 09.07.2013

Invited lecture during 50th Annual Convention of Chemists at Punjab University, Chandigarh on 06.12.2013

Invited lecture during ICON Chemistry Conference at Sri Sathya Sai Institute of Higher Learning, Prashantinilayam, Anantpur District, AP on 14.12.2013

Invited lecture on "Atmospheric chemistry relevant to climate: Global and Indian perspective" at the first Climate Science and Policy Workshop held at IIT Mumbai on 07.03.214.

Posters

Baerbel Sinha

Sachan, H., Sarkar, C., and Sinha, B.: Rapid aqueous phase SO₂ oxidation in winter fog in the Indo-Gangetic Plain. *Geophysical Research Abstracts* Vol. 15, EGU2013-603-2, 2013.

Garg, S., Sinha, V., Sinha, B.: Taking potential probability function maps to the local scale and matching them with land use maps. *Geophysical Research Abstracts* Vol. 15, EGU2013-401-4, 2013.

Panwar, H., Sachan, H., Garg, S., Arya, R., Singh, N.K., Sinha, B., and Sinha V.: Quantifying the contribution of Long-Range Transport to PM, NO_x, and SO₂ loadings at a sub-urban site in the North-Western Indo Gangetic Basin. *Geophysical Research Abstracts* Vol. 15, EGU2013-862-1, 2013

Kumar, V., Sarkar, C., Sachan, H., Kumar, D. and Sinha, B.: PM over summertime India: Sources and trends investigated using long term measurements and multi-receptor site back trajectory analysis, *Geophysical Research Abstracts*, Vol. 15, EGU2013-640-1, 2013.

Huffman, J. A.; Pöhlker, C.; Prenni, A.; DeMott, P.; Mason, R.; Robinson, N.; Fröhlich-Nowoisky, J.; Tobo, Y.; Després, V.; Garcia, E.; Gochis, D.; Sinha, B.; Day, D.; Andreae, M. O.; Jimenez, J.; Gallagher, M.; Kreidenweis, S.; Bertram, A.; Pöschl, U. and the MPIC Analysis Team: High concentrations of biological aerosol particles and ice nuclei during and after rain. *Geophysical Research Abstracts* Vol. 15, EGU2013-5514-1, 2013.

Huffman, J. A.*; Prenni, A. J.; DeMott, P. J.; Pöhlker, C.; Mason, R.; Robinson, N.; Fröhlich-Nowoisky, J.; Tobo, Y.; Després, V.; Gochis, D. J.; Harris, E. J.; Sinha, B.; Day, D. A.; Andreae, M. O.; Jimenez, J. L.; Gallagher, M. W.; Kreidenweis S. M.; Bertram, A. K.; Poeschl, U.: Biological aerosol particles and ice nuclei during rain, and other insights. *Eos Trans. AGU, Fall Meet. Suppl.*, 94, Abstract: A11B-0028, 2013.

Sinha, B.; Harris, E. J.; Pöhlker, C.; Wiedemann, K. T.; van Pinxteren, D.; Tilgner, A.; Fomba, K. W; Schneider, J.; Roth, A.; Gnauk, T.; Fahlbusch, B.; Mertes, S.; Lee, T.; Collett, J. L; Shiraiwa, M.; Gunthe, S. S.; Smith, M.; Artaxo, P. P.; Gilles, M.; Kilcoyne, A.L.; Moffet, R.; Weigand, M.; Martin, S. T.; Poeschl, U.; Andreae, M. O.; Hoppe, P.; Herrmann, H.* and Borrmann S.; Chemical Imaging and Stable Isotope Analysis of Atmospheric Particles by NanoSIMS. *Eos Trans. AGU, Fall Meet. Suppl.*, 94, Abstract: A54C-02 (Invited), 2013.

Vinayak Sinha

Sarkar, C.*; Kumar, V. and Sinha, V.: Enhanced formation of secondary air pollutants and aggravation of urban smog due to crop residue burning emissions in North India. *Geophysical Research Abstracts* Vol. 15, EGU2013-646-1, 2013 (talk).

V. Kumar*; S. Garg; P. Chandra and Sinha, V.: A large OH sink in summertime surface air of the northern Indo-Gangetic plain revealed through in-situ total OH Reactivity measurements. *Eos Trans. AGU, Fall Meet. Suppl.*, 94, Abstract: A21K-05, 2013 (talk).

Dusanter, S.*; Hansen, R.; Leonardis, T.; Schoemaeker, C.; Blocquet, M.; Fittschen, C.; Hanoune, B.; Sinha, V.; Stevens, P.; and Locoge N.: Atmospheric measurements of total OH reactivity: Intercomparison of the pump-probe technique and the comparative reactivity method. *Geophysical Research Abstracts* Vol. 15, EGU2013- 5599, 2013 (talk).

Garg, S., Sinha, V., Sinha, B.: Taking potential probability function maps to the local scale and matching them with land use maps. *Geophysical Research Abstracts* Vol. 15, EGU2013-401-4, 2013 (poster).

Panwar, H., Sachan, H., Garg, S., Arya, R., Singh, N.K., Sinha, B., and Sinha V.: Quantifying the contribution of Long-Range Transport to PM, NO_x, and SO₂ loadings at a sub-urban site in the North-Western Indo Gangetic Basin. *Geophysical Research Abstracts* Vol. 15, EGU2013-862-1, 2013 (poster).

Chinmoy Sarkar, Vinod Kumar, B. Praphulla Chandra and Vinayak Sinha, "Molecules of special relevance in ambient Indian air from the perspective of fundamental atmospheric chemistry reactions and kinetics", presented at 11th Discussion meeting on Spectroscopy and Dynamics of Molecules and Clusters held at NISER, Bhubaneswar from 20.02.2014-23.02.2014 (poster).

B Praphulla Chandra, Vinod Kumar, Chinmoy Sarkar, Saryu Garg and Vinayak Sinha, "India wide emission estimates of VOCs, SO₂, NO_x derived from in-situ measurements during Diwali-2013" presented at the 1st Climate Workshop on Science and Policy - Organized by Climate IDP at IIT-Mumbai held on 6th and 7th March, 2014 (poster).

Vinod Kumar, Chinmoy Sarkar, and Vinayak, "Volatile Organic compounds (VOCs) in summer over the N.W. Indo-Gangetic Plain (IGP)" presented at the 1st Climate Workshop on Science and Policy - Organized by Climate IDP at IIT-Mumbai held on 6th and 7th March, 2014 (poster).

Awards and Honours

Chinmoy Sarkar (PhD scholar, EES, IISER Mohali) received a Young Scientist's Travel Award (YSTA) by the European Geophysical Union and a DST International Travel Grant to present a talk at the European Geosciences Union 2013 meeting held from 7.04.2013-14.04.2013

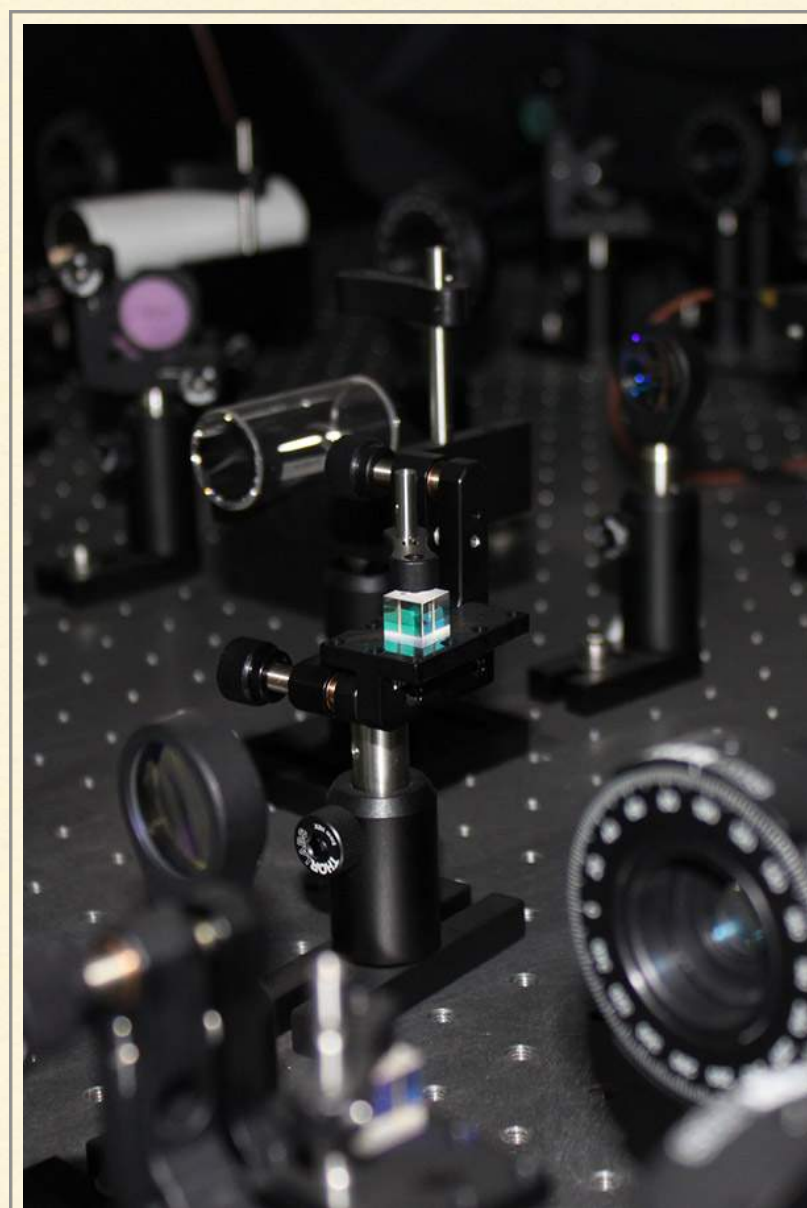
Chinmoy Sarkar (PhD scholar, EES, IISER Mohali) received a Travel Award from ICIMOD-IASS Postdam to present results of PTR-TOF-MS measurements performed by him in Kathmandu Valley in a talk at the international SUSKAT Data Workshop held in August, 2013.

Vinod Kumar (PhD scholar, EES, IISER Mohali), has been appointed member of the organising committee for the International Integrated Land Ecosystem Atmosphere Processes Study (iLEAPS) Early-Career Scientist Workshop 10-12 May 2014-Nanjing China.

Faculty and Research at the Department of Physical Sciences

Arvind is a theoretical physicist whose research interests span the areas of quantum information processing, quantum optics, foundations of quantum mechanics and research in physics education. Quantum computers when functional, are expected to qualitatively outperform their classical counterparts. Characterising quantum entanglement and tracing its exact role in quantum algorithms remains a challenging open problem. He has worked on issues related to quantum entanglement in the context of the Deutsch-Jozsa algorithm and Parity Determining algorithm, quantum dissipation and its control, optical schemes for quantum computers and NMR implementations of quantum information processors. His current research interests in quantum information include characterisation of bound state entanglement, role of entanglement in quantum computation, quantum cryptography and physical implementations of quantum computers. He has also been working on connection of Bell's inequalities with non-classicality of states of the radiation field, formulation of Bell's inequalities for multi-photon sources, geometric phases in quantum mechanics, different approaches to the quantum measurement problem and in particular understanding weak measurements.

Jasjeet Singh Bagla works on questions related to the formation of galaxies and large scale structure within the framework of the standard cosmological model. It is believed that the large scale structure forms due to gravitational collapse around over dense regions. This process am-



plifies tiny fluctuations in density and leads to formation of highly over dense regions called halos. Galaxies are believed to form when gas in halos cools and undergoes further collapse to form stars. The process of gravitational collapse in an expanding universe is fairly complex and it is required to simulate this on super computers in order to follow relevant details. His contribution in this field has been in development of highly optimized methods for doing cosmological N-Body simulations. He has used these simulations to study the process of gravitational clustering and demonstrate that this process erases differences between different types of initial fluctuations. Suites of simulations have also been used to point out deviations from certain strong assumptions made in approximate methods. Computer simulations of galaxy formation allow them to develop strategies for observations that require a large amount of time. They have used simulations to propose efficient ways to detect galaxies using emission in the hyperfine transition of neutral Hydrogen at high redshifts. Contrary to the received wisdom, they are able to demonstrate that direct detection may be easier than a statistical detection of the large scale structure. He also work on new probes of the high redshift universe. They have shown that the hyperfine transition in singly ionized Helium-3 is a potential probe of the intergalactic medium. Efforts are underway to observe certain

promising regions in the inter-galactic medium at high red-shifts.

Abhishek Chaudhuri and his group aims to understand the physical properties of biological and soft condensed matter systems that are driven out of equilibrium. He uses both analytical approaches (Equilibrium and Non-equilibrium Statistical Mechanics, Hydrodynamics) and computational methods (Molecular Dynamics, Brownian Dynamics, Monte Carlo) to investigate the dynamics of systems ranging from the cell membrane and the cell cytoskeleton to polymers and colloids in confinement. Recently, he is looking at the force induced desorption of an active polymer from a substrate. The polymer is rendered active by the action of motor proteins which walk on it. This desorption process shows interesting features with significant departure from that of a passive system. He is also exploring the translocation process of a polymer through a pore. Here, he is looking at how the translocation process is affected by the characteristics of the pore as well as pore-polymer interactions.

Dipanjan Chakraborty's broad research interest lies in the physics of soft matter systems. The realm of soft matter comprises of a multitude of systems with important technological applications, with model examples ranging from colloidal suspensions, polymer gels and solutions, granular media to more complex systems of biological matter. Soft matter systems are characterized by the large length and time scales (compared to microscopic lengths) and the thermal fluctuations governing the dynamics of the constituent macromolecules. A wide range of collective phenomena resulting in complex structure and dynamics emerge at such mesoscopic length scales. The recent advancement in experimental techniques have allowed for characterization of such collective behaviors and also provide us with remarkable control down to single particle level. Particle chemistry has succeeded in producing colloidal particle with a definite control over its shape, size and interactions, such as patchy colloids of different shapes. While theoretical formulations of such emergent phenomena rely on the formulations of statistical mechanics out of equilibrium, a more microscopic insight can be gained using computer simulations, bridging the gap between theory and experiments. They serve as an indispensable tool to validate theoretical predictions and gain access to phenomena which are otherwise difficult to observe or measure in experiments. His research activities strongly build on large-scale coarse-grained simulations of soft matter systems, with a goal to understand the rich physics at such mesoscopic length scales.

Kavita Dorai's current research interests include NMR Quantum Computing, NMR Metabolomics and Diffusion Studies of Nanoparticles in Biomaterials using Gradient NMR. Quantum

computers exploit the intrinsic quantum nature of particles and have the power to solve computational problems intractable on any classical computer. Her research in this area focuses on demonstrations of entanglement on an NMR quantum computer and reconstruction of multi-party entanglement from two-qubit tomographs, implementation of the quantum Fourier transform on qudit and hybrid qubit-qutrit systems, protection of an entangled subspace using the quantum super-Zeno effect, and construction of an ensemble witness operator on an NMR quantum information processor. Metabolomics is the new kid on the 'omics' block and metabolites can be used as biomarkers of environmental stress or change. Her research in this area focuses on plant-pathogen interactions, plant-insect interactions, human diseases such as diabetes and the impact of aging on immunity, using fruitflies, beetles and plant tissue as model systems. Diffusion NMR has wide-ranging applications in physics, biology and medicine. Her research in this area focuses on the development of novel 2D and 3D DOSY-based diffusion pulse sequences to separate individual components of a molecular mixture, to study the diffusion of gold and silver nanoparticles inside biomembranes such as lipid bilayers, and to model protein diffusion using a combination of pulsed-field gradient NMR experiments and molecular dynamics simulations.

Ramandeep Singh Johal's recent research has shown that intimate connection between thermodynamics and information is going to play a central role in our understanding of quantum phenomena. Understanding thermal properties of nano-materials also demands a thermodynamic framework appropriate for systems at small scales. He is interested in the interplay of work and heat in quantum systems and we address various issues like how fundamental notions of thermodynamics may be modified in the light of quantum theory. The study is also popularly addressed as "Quantum Thermodynamics". Heat engines using quantum working media provide a useful platform to analyze such issues. Another line of enquiry is related to developing statistical mechanical tools for treating systems with long-range interactions. Issues like emergence of long-lived quasi-stationary states, ensemble inequivalence are addressed.

Rajeev Kapri's research interests are in developing simple models of complex biological processes and study them by using tools of statistical physics like generating functions, exact transfer matrix, Monte Carlo and molecular dynamics simulations. The melting or unzipping of DNA is a crucial step in many biological processes such as DNA replication and RNA transcription. In these processes, the strands of the dsDNA, which is a bound state of two polymers or strands held together by hydrogen bonds of base pair, are separated by mechanical force exerted by enzymes like helicases and

polymerases. It is now possible to apply and measure forces in the piconewton range by using single molecule manipulation techniques, like atomic force microscopy, optical and magnetic tweezers, and study the structure and function of biomolecules. The theoretical studies on simpler models, like free jointed chain and worm like chain, help to understand the experimental results better and provide new insights to the problem. The strands of the DNA are modelled by directed self avoiding walks on the square lattice in the presence of an external force, and obtained many interesting results including phase diagrams, changing of the order of the transition due to the presence of single stranded binding proteins, and the existence of a critical end point in the presence of an attractive surface near DNA. Presently, he is exploring the surface-polymer interaction via external forcing of the polymer and the behavior of particles or fluids on a fluctuating membrane.

Materials which simultaneously exhibit a ferroelectric as well as ferromagnetic ordering are known as multiferroics. A strong coupling between the two order parameters allow for a control of magnetization with external electric fields and have a great potential in the memory storage device industry. The challenge is to find suitable materials that can exhibit the phenomena of multiferroicity at room temperatures. Using a combination of ab-initio Density Functional Theory calculations and Monte Carlo simulations, **Sanjeev Kumar** and his collaborators predicted the existence of a high-temperature multiferroic phase in cupric oxide under external pressure. If realized, this would be the first room-temperature multiferroic material with a strong magnetoelectric coupling. In another work, they studied a two-dimensional model relevant to cupric oxide for a better understanding of the unusual high-temperature ferroelectric behavior and the co-existing spiral magnetism. The model consists of Heisenberg interactions as well as higher order biquadratic couplings between magnetic moments. They

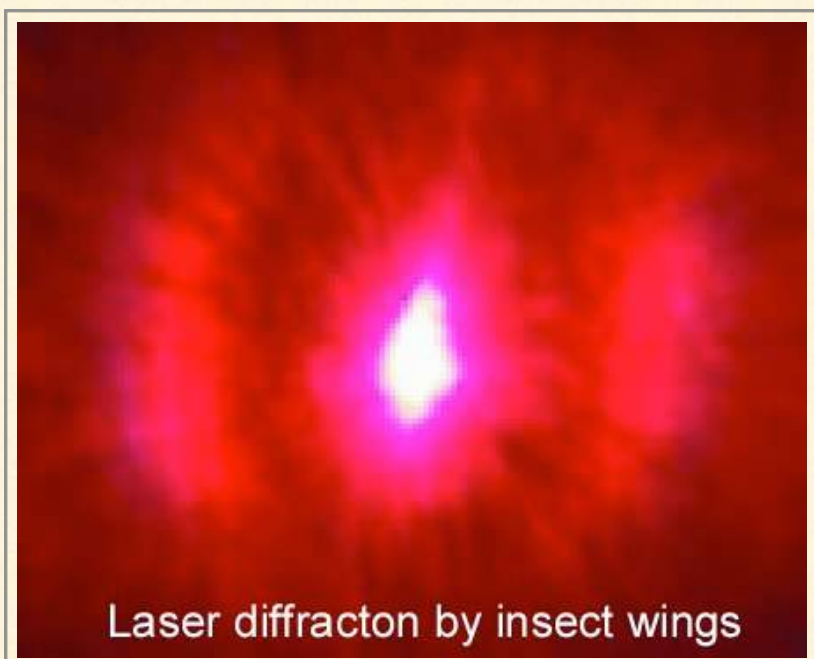
find using Monte-Carlo simulations that a high-temperature spiral phase is stabilized over a collinear magnetic phases by entropic effects.

Black holes have often provided important insights into the nature of quantum gravity and the structure of space time. A profound and puzzling fact related to the black holes is that the laws of black hole mechanics, derived in classical general relativity, seem mysteriously to anticipate the laws of thermodynamics. **Sudipta Sarkar's** research interest involves understanding of these properties of black holes in and beyond general theory of relativity.

A large amount of data is available and it is therefore possible to constrain cosmological parameters to high precision. In her work, **Harvinder K. Jassal** uses different observations to set constraints on models of the Universe, especially constraints on dark energy. In the context of dark energy as a fluid, she considers cosmologies with constant and varying equation of state. The different observations used are the supernovae data, the baryonic acoustic oscillations (BAO) data and the Cosmic Background Radiation (CMB) data. She also presents constraints on different scalar field models using the above observations. Dark energy must cluster in order to be consistent with the equivalence principle. Perturbations in dark energy have been studied extensively in the context of their effect on matter perturbations. For early dark energy scenarios, presence of radiation can affect the growth of perturbations. She studies growth of dark energy perturbations and their effect on matter perturbations in presence of radiation as a contributing component to structure formation. She has shown that in this scenarios, for fluid models, dark energy perturbations have a delayed onset due to the interplay of two different pressure components. The enhancement of matter perturbations is consistent with earlier studies. In her work she also discusses the technique used to incorporate radiation in matter and scalar field systems and studies the implications on structure formation.

Kamal P. Singh is interested in dynamics of atomic and simple molecular systems exposed to shaped intense fs/as light pulses. The basic objective of his research has been two-fold: (i) to develop an understanding of the emerging phenomena when atomic/molecular systems interact with ultrafast light pulses, and (ii) to explore new quantum control scenarios of the fundamental photo-processes such as ionization, dissociation, electron localization etc. He wants to investigate phenomenon akin to Stochastic Resonance (SR) where an addition of noise (or disorder) into a nonlinear system can indeed improve its response.

Spin-liquid (SL) states are new states of electronic matter in solids where strongly interacting spins fail to undergo long-



range magnetic order due to geometric magnetic frustration and Quantum fluctuations. Low dimensional structures are more likely to harbor such SL states because effects of quantum fluctuations are enhanced in low-dimensions. Recently, **Yogesh Singh** has shown that a 3-dimensional material $\text{Na}_4\text{Ir}_3\text{O}_8$ is a strong candidate for a SL and further that it sits on the brink of magnetic order at zero temperature. Na_2IrO_3 is a spin-orbit + correlation driven Mott insulator expected to harbor unusual magnetic exchanges (called Kitaev exchange) in addition to the usual Heisenberg exchange between effective spins sitting on a honeycomb lattice. The importance of the Kitaev term relative to the normal Heisenberg exchange is debated in this material and we have in the past pioneered experimental work demonstrating that the Kitaev term should be significant. The presence of the Kitaev term will lead to several effects which can be observed in measurements. Dr. Yogesh Singh measured the magnetic excitation spectrum of Na_2IrO_3 probed with resonant inelastic x-ray scattering. They have shown that the observed spectrum is in excellent agreement with predictions of models which include a strong Kitaev term.

Mandip Singh's research interests are focused on exploration of quantum physics at a basic level. He is establishing two research laboratories to explore basic principles of quantum physics through quantum systems made of Bose Einstein condensation, photons and superconductors. Bose Einstein condensation will be realized through a laser and evaporative cooling. Frequency locking of lasers, major optics for laser cooling and control instrumentation have been implemented. One of the main research directions of his lab is to experimentally explore quantum entanglement through Bose Einstein condensation and quantum circuits.

Gautam Sheet does scanning probe microscopy at different temperatures and magnetic fields. The temperature range is between 400 mK to 400 K. The magnetic field range is -6 T to + 6 T. He studies superconductors, topological insulators, ferromagnets, ferroelectrics and multiferroics using scanning probes. He is building a low-temperature scanning tunneling microscope (STM). The STM works well at room temperatures and can image the atomic steps in graphite.

Ananth Venkatesan is an experimentalist working on mesoscopic systems like nano-electro-mechanical systems (NEMS) and nano-scale electronic devices defined by gating 2-D electron systems. His work involves fabricating nano-scale samples and investigating them at extremely low temperatures. Apart from the state of the art nano-fabrication facility we are building we are equipped with a dilution fridge capable of reaching as low as ~ 10mK and basic low frequency and high frequency electronics. These devices

are expected to show quantum behaviour at low temperatures. One aspect of our work is we look for quantum effects in nano scale mechanical structures.

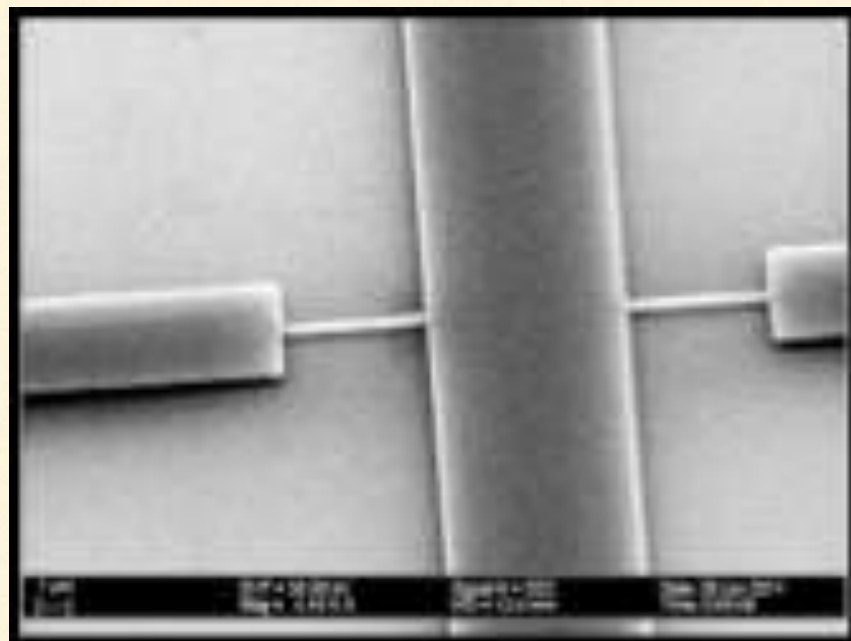


Figure: A set of Pd beams of dimensions ~5 micron length ~ 180nm width and ~ 80nm thickness.

Shown in the figure is a Pd nano-mechanical resonator we studied recently. The response of the a similar beam over a temperature range of 0.15 K to 1 K showing significant changes in Q-factors. Most materials except liquid helium freezes below 4.2K but quantum tunneling of defects give rise to mechanical dissipation in solid state nano-scale systems. Spintronics is a term referring to electronic devices like GMR hard drives that use the spin of the electron rather than the charge. Another theme in our research involves understanding spin currents in nano-structured devices. This includes a wide variety of materials like simple metals to semi-conductor hetero-structures where electrons are confined to 2-D .

K. P. Yogendran's primary research interest is in Quantum aspects of Gravity. He uses String theory to study quantum properties of black holes. These days, he is also involved in using the AdS/CFT correspondence to model systems of condensed matter.

Publications

S. Dogra and **Kavita Dorai**, Numerically optimized band-selective pulses in SOFAST-HMQC experiments for biomolecular NMR, J. Mol. Struct., 1063, 45 (2014).

A. Kumari and **Kavita Dorai**, 3DChemCorr: Using NMR chemical shift 3D correlation maps as secondary structure identifiers in proteins, J. Mol. Struct., 1041, 200 (2013).

P. Aneja and **Ramandeep S. Johal**, Prior information and inference of optimality in thermodynamic processes, *J. Phys. A: Math. Theor.* Vol. 46, 365002 (2013).

X. Rocquefelte, K. Schwarz, P. Blaha, **Sanjeev Kumar** and J. van den Brink, High-pressure cupric oxide: a room-temperature spin-spiral multiferroic, *Nature Communications* 4, 2511 (2013).

K. Pasrija and **Sanjeev Kumar**, High temperature non-collinear magnetism in a bilinear-biquadratic Heisenberg model” *Phys. Rev. B* 88, 188814 (2013).

J. S. Sekhon, L. Aggarwal and **Goutam Sheet**, Voltage induced local hysteretic phase switching in silicon, *Appl. Phys. Lett.* 104, 162908 (2014).

A. Arora, P. Kumar, J. Bhagwathi, **Kamal P. Singh** and **Goutam Sheet**, Microscopic modulation of mechanical properties of transparent insect wings, *Appl. Phys. Lett.* 104, 063702 (2014).

B. Kumar, A. Thakur, B. Panda and **Kamal P. Singh**, Optically Probing Torsional Superelasticity in spider silk, *Appl. Phys. Lett.* 103, 201910 (2013).

Kamal P. Singh, Progress in sub-fs control of electron localization in molecules, *PRAMANA*, 82, 87 (2014).

P. Kumar and **Kamal P. Singh**, Signature of spatial correlation in symmetries of natural photonic structure organization for bio-mimetic applications, as conference proceedings in *EAP Newsletter*, Vol. 15, No. 2, December, 15(30):10-11 (2013).

G. Verma, A. Gaurav, J. Nair, and **Kamal P. Singh**, Can low power laser induce dimple on air-water interface? as conference proceedings in *CLEO: 2013 Optical Society of America Technical Digest*, Paper JW2A.08.

P. Kumar, D. Shamoan and **Kamal P. Singh**, Optical functionality of natural photonic structures on the transparent insect wings for bio-mimetic applications, as conference proceedings in *Proc. SPIE* 9056 March (2014).

Yogesh Singh, Y. Tokiwa, J. Dong, and P. Gegenwart Spin liquid close to a quantum critical point in Na₄Ir₃O₈, *Phys. Rev. B* 88, 220413(R) (2014).

H. Gretarsson, J. P. Clancy, **Yogesh Singh**, P. Gegenwart, J. P. Hill, Jungho Kim, M. H. Upton, A. H. Said, D. Casa, T. Gog, and Young-June Kim Magnetic excitation spectrum of Na₂IrO₃ probed with resonant inelastic x-ray scattering, *Phys. Rev. B* 87, 220407(R) (2013).

V. Kohar and **Sudeshna Sinha**, Emergence of epidemics in rapidly varying networks, *Chaos, Solitons & Fractals* 54, 127 (2013).

E. H. Hellen, S. K. Dana, J. Kurths, E. Kehler, **Sudeshna Sinha**, Noise-aided Logic in an Electronic Analog of Synthetic Genetic Networks, *PLoS One* (2013).

A. Sharma, V. Kohar, M. Shrimali and **Sudeshna Sinha**, Realizing logic gates with time-delayed synthetic genetic networks, *Nonlinear Dynamics* 1-9 (November 2013).

V. Kohar, K. Murali and **Sudeshna Sinha**, Enhanced Logical Stochastic Resonance under Periodic Forcing, *Communications in Nonlinear Science and Numerical Simulation*, 19, 2866 (2014).

S.K. Bhowmick, P. Roy, S. K. Dana, D. Ghosh, K. Murali and **Sudeshna Sinha**, Targeting Temporal Patterns in Time-Delay Chaotic Systems, *International Journal of Bifurcation and Chaos*, 24, 1450014 (2014).

V. Agrawal, S.P. Kang and **Sudeshna Sinha**, Realization of Morphing Logic Gates in a Repressilator with Quorum Sensing Feedback, *Physics Letters A*, 378, 1099 (2014).

A. Choudhary, V. Kohar and **Sudeshna Sinha**, Taming Explosive Growth through Dynamic Random Links, *Scientific Reports (Nature)*, 4, 4308 (2014).

B. Kia, K. Murali, M.R.J. Motlagh, **Sudeshna Sinha**, W.L. Ditto, Synthetic Computation: Chaos Computing, Logical Stochastic Resonance, and Adaptive Computing, *International Conference on Theory and Application in Nonlinear Dynamics (ICAND 2012)*, pp 51-65, *Understanding Complex Systems* (2014).

W.L. Ditto, A. Miliotis, K. Murali and **Sudeshna Sinha**, Logic from Dynamics, Book Chapter in *Chaotic Signal Processing*, ed. H. Leung pp 85-107 (SIAM, 2013).

Academic Visits

Arvind

Visited the Quantum Information Group Masaryk University Czech Republic June 5-9 2013.

Visited the Physics Department of the University of British Columbia Vancouver Canada July 2-5 2013.

Visited the Physics Department of Ljubljana University Ljubljana Slovenia October 3-5 2013.

Jasjeet S. Bagla

Visited the Homi Bhabha Centre for Science Education Mumbai, May 8-17, 2013.

Visited Inter-University Centre for Astronomy and Astrophysics, Pune May 18-22, 2013.

Visited the Radio Astronomy Centre, Ooty December 26-28, 2013.

Abhishek Chaudhuri

Visited ICTS-TIFR, Bangalore for the period May 15-23, 2013.

Visited National Center for Biological Sciences, Bangalore June 17-25, 2013.

Attended the IISER Computational Biology Group Second Meeting at Raichak, Kolkata October 24-27, 2013.

Kavita Dorai

Visited the Quantum Information Group Masaryk University Czech Republic June 5-9 2013.

Visited the NMR EN-FIST Center of Excellence Ljubljana University Ljubljana Slovenia October 3-5 2013.

Harvinder K Jassal

Visited HBCSE Mumbai to give lectures in Astronomy Olympiad Camp.

Visited IUCAA Pune, May 2013.

Sanjeev Kumar

Visited ISI Chennai (India): December 12-13, 2013.

Visited the department of Physics, University of Toronto (Canada): February 26-28, 2014.

Sudipta Sarkar

Visited Institute of Physics, Bhubaneswar and presented a seminar on Black hole Thermodynamics.

Goutam Sheet

Visited the synchrotron facility DESY in Hamburg, Germany during September, 2013.

Yogesh Singh

Visited the Condensed Matter Physics and Materials Science Division of the Brookhaven National Lab, New York, USA during the period 9th -11th March 2014.

Visited the department of Physics, Stanford University, USA during the period 11th -13th March 2014.

Sudeshna Sinha

Visited University of Hawai'i, 20-28 June 2013.

K. P. Yogendran

Visited FTAG, IIT Gandhinagar Sept 07-09, 2013.

Attended the Black Hole information Workshop, HRI Allahabad, Dec 2013.

Invited Talks

Arvind

A set of 03 lectures on Quantum Information in the "Recent Advances in Physics" Refresher Course in Physics at Kurukshetra University May 13-14 2013.

DST-INSPIRE camp at Guru Nanak Dev Engineering College Ludhiana Punjab on August 09 2013.

Guru Gobind Singh Khalsa College Sector 26 Chandigarh on September 11 2013.

DST-INSPIRE camp at Chandigarh Group of Colleges Landran Punjab on September 28 2013.

Physics Department of Ljubljana University Ljubljana Slovenia October 3 2013.

Chaired the session on Theoretical and Physical Modelling at the International Conference on Interdisciplinary areas with Chemical Sciences ICIAS 2013" organized by Panjab University and INST October 30-November 01 2013.

Expert lecture on "Role of basic sciences in engineering" in the Faculty Development Program at UIET Panjab University Chandigarh November 13, 2013.

DST-INSPIRE camp at Asian Institution Patiala Punjab on November 17 2013.

DST-INSPIRE camp at Asian Institution Patiala Punjab on November 23 2013.

Meeting on ``Quantum Information Processing and Applications (QIPA-2013)" at HRI Allahabad December 02-05 2013.

"Science Academies' Refresher Course in Quantum Mechanics" at the Department of Physics IIT Roorkee December 05-12 2013.

DST-INSPIRE camp at Guru Gobind Singh Khalsa College Sector 26 Chandigarh on January 7 2014.

DST-INSPIRE camp at Chandigarh University Gharuan Punjab on January 22 2014.

``Nine Pursuits in Science: One-day meeting in celebration of Professor N Mukunda's platinum birthday" on January 25 2014 at IMSc Chennai.

BBSBEC Fatehgarh Sahib Punjab on February 13 2014.

``National Seminar on Recent Advances in Physics (NSRAP-2014)" at GNDU Amritsar February 14, 2014.

Chaired a session in the conference ``Scientific Temper and Nation" organized by Vigyan Prasar (DST) and NISCAIR New Delhi February 21-22, 2014.

``Chandigarh Science Congress (CHASSCON-2014)" at Panjab University Chandigarh February 28, 2014.

Symposium on Recent Research Trends in Physics at Kurukshetra University March 01-02 2014.

Jasjeet S. Bagla

'The tale of cometary tails' during a state level workshop on Eyes on Ison held at Science city, Kapurthala, Nov. 9, 2013.

'HI intensity mapping' during the workshop on Science with the Square Kilometre Array, March 19, 2014, IISER Mohali, India.

Abhishek Chaudhuri

Soft Matter - Young Investigator's Meeting at Pondicherry January 5-7, 2014.

Symposium at School of Physical Sciences, JNU on 10th March, 2014.

Kavita Dorai

``DST-NIPER Brainstorming on Science, Technology and Innovation Policy" Chandigarh April 16, 2013.

A set of 03 lectures on NMR and Quantum Computing in the ``Recent Advances in Physics" Refresher Course in Physics at Kurukshetra University May 13-14, 2013.

Colloquium ``NMR at the interface of physics, chemistry and biology" at Department of Physics, IIT Kanpur August 30, 2013.

``Trends in Biomolecular Structure; from Chemistry to Function" at Ljubljana University Ljubljana Slovenia October 3-5, 2013.

IAPT-NSSP2014 conference at Panjab University Chandigarh January 18, 2014.

Symposium on Recent Research Trends in Physics at Kurukshetra University March 01-02, 2014.

Harvinder K Jassal

HBSCE Mumbai in Astronomy Olympiad School.

Conference on Field Theory Aspects of gravity 2013 at IIT Gandhinagar.

Ramandeep S. Johal

"Probability and Uncertainty", at the DST Inspire Camp, 08 August 2013, Guru Nanak Engineering College, Ludhiana.

Opportunities at IISERs, to Class XII students at Punjab School Education Board, Mohali.

"Are optimal thermodynamic processes - a feature of inference?" at Inter-IISER Physics meet at IISER Pune, March 15-16, 2014.

Rajeev Kapri

Academic Session of Alumni Day Celebration at the Institute of Physics Bhubaneswar on September 03, 2014.

Soft Matter Young Investigator's Meet in Pondicherry during January 05 - 07, 2014.

Indian Statistical Physics Community Discussion Meeting in IISc Bangalore during February 01 - 03, 2014.

Symposium on Recent Research Trends in Kurukshetra University during March 01 - 02, 2014.

Sanjeev Kumar

"Non-coplanar magnetism in Kondo-lattice and Hubbard models on frustrated lattices" at IACS-APCTP conference on novel oxides, ICTS-IISC Bangalore (India) - December 2013.

“Non-coplanar magnetism in Hubbard model on frustrated geometries” at the University of Toronto, Toronto (Canada) - March 2014.

“Non-coplanar magnetism in Hubbard model on frustrated geometries” at the APS March Meeting, Denver (USA) - March 2014.

Goutam Sheet

Kurukshetra University in March, 2014 for an invited talk on “Studying (bio)physics using scanning probe microscopes”.

Mandip Singh

“Recent trends in Physics Research” symposium at the University of Kurukshetra organized jointly by IISER Mohali and the University of Kurukshetra, May 1-2, 2014.

Kamal P. Singh

“Probing matter with ultrafast intense laser pulses”, Kurukshetra University, March 2014.

“Torsional Superelasticity and Optical nanoprocessing spider silks” at Ramanujan Conclave, Pune, 12-15 Dec. 2013.

Yogesh Singh

‘Tuning a spin-liquid into a correlated metal in $\text{Na}_{4-x}\text{Ir}_{308-\delta}$ ’ on 3rd March 2014 at the APS March meeting in Denver, Colorado, USA.

‘Spin liquid close to a magnetic quantum critical point in $\text{Na}_4\text{Ir}_{308}$ ’ at Brookhaven National Lab, New York, USA on 10th March 2014.

‘Spin liquid close to a magnetic quantum critical point in $\text{Na}_4\text{Ir}_{308}$ ’ at Stanford University, USA on 12th March 2014.

Sudeshna Sinha

International Conference on Nonlinear Dynamics, Cusco, 12-17 May 2013.

Conference on Nonlinear Systems and Dynamics (CNSD 2013), IIT Indore, 11-14 December 2013.

Symposium on Complex Systems, Delhi 15-16, Oct. 2013.

DST SERC school on Nonlinear Dynamics, at Punjab University, Chandigarh 27-28, Jan 2014.

Ananth Venkatesan

“Bringing the nano-world together” a conference organized by Messrs Oxfords Instruments in IISER Mohali and IIT Bombay.

Posters

Arvind

“Structures of completely entangled subspaces”, Ritabrata Sengupta and Arvind, Presented at 17th conference on Quantum Information Processing (QIP2014), Feb 3-7, 2014 Barcelona, Spain.

“Structures of completely entangled subspaces”, Ritabrata Sengupta and Arvind, Presented at 17th conference on Quantum Information Processing (QIP2014), Feb 3-7, 2014 Barcelona, Spain.

“Positive maps and quantum filtration”, Ritabrata Sengupta and Arvind, Presented at 13th Asian Quantum Information Science Conference (AQIS 2013), Aug 25-30, 2013 IMSc Chennai, India.

“Quantum State Tomography and Entanglement Detection using Weak Measurements”, Debmalaya Das and Arvind, COST 2014 meeting on Fundamental Problems in Quantum Physics 23-27 March, 2014. Weizmann Institute of Science, Rehovot, Israel.

“Estimation of quantum states using weak and projective measurements: A comparative study”, Debmalaya Das and Arvind, Meeting on Quantum Simulations(QS2013), 2-3 September, 2013. IISc Bangalore, India.

“Estimation of quantum states using weak and projective measurements: A comparative study”, Debmalaya Das and Arvind, 13th Asian Quantum Information Science Conference (AQIS), 25-30 August, 2013. IMSc, Chennai, India.

Presented a poster in the 10th Central European Quantum Information Processing Workshop Valtice Czech Republic June 5-9 2013.

Presented a poster in the workshop on “Quantum Information and Foundations of Quantum Mechanics” at the University of British Columbia Vancouver Canada July 2-5 2013.

Jasjeet S Bagla

Optimizing observation strategies for redshifted HI detection using upgraded Ooty Radio telescope, Bharat Gehlot and J S Bagla,. Presented at the 32nd meeting of the Astronomical Society of India, March 20-22, 2014, IISER Mohali, India.

Kavita Dorai

"Tomographic reconstruction of generic three-qubit states on an NMR quantum computer using only two qubit detectors", Shruti Dogra, Kavita Dorai and Arvind, Presented at 13th Asian Quantum Information Science Conference (AQIS) 2013, Aug 25-30 2013, IMSc Chennai.

"Tomographic reconstruction of generic three-qubit states on an NMR quantum computer using only two qubit detectors", Shruti Dogra, Kavita Dorai and Arvind, Presented at Meeting on Quantum Simulations (QS) 2013, Sep. 02-03, 2013, IISc Bangalore.

"Preserving an entangled state using the Super-Zeno effect on an NMR Quantum Computer", Harpreet Singh, Kavita Dorai and Arvind, Presented at the National Magnetic Resonance Society Symposium Tezpur University, February 2-5, 2014, Tezpur Assam.

"HR-MAS NMR-based metabolomic approach to study the effect of fungicidal seed treatment on wheat seed germination", Navdeep Gogna and Kavita Dorai, Presented at EURO-MAR 2013, June 30-July 05 2013, Hersonissos, Crete, Greece.

"NMR studies of fluorinated drugs using PFG spin-echo experiments and cross-correlated spin relaxation" Aditya Jhajharia and Kavita Dorai, Presented at the National Magnetic Resonance Society Symposium Tezpur University, February 2-5, 2014, Tezpur Assam.

"Molecular dynamics stimulations and magnetic field gradient spin-echo NMR studies of antioxidants diffusing in a phospholipid bilayer", Satnam Singh and Kavita Dorai, Presented at the National Magnetic Resonance Society Symposium Tezpur University, February 2-5, 2014, Tezpur Assam.

Presented an invited poster at the "Fifth Kavli Indo-American Frontiers of Science Symposium" organized by the Indo-US Science and Technology Forum and the U.S. National Academy of Sciences, Jaypee Palace Hotel Agra April 7-10, 2013.

Ramandeep S. Johal

Coupled quantum Otto cycle and friction, G. Thomas (presenter) and R.S. Johal, Frontiers of Quantum and Mesoscopic Thermodynamics, International Conference at Prague, Czech Republic, July 29- Aug. 03, 2013.

Quantum Otto engine: Work, efficiency and friction, G. Thomas and R.S. Johal, Meeting on Quantum Information Processing and Applications, QIPA-2013, Harish Chandra Research Institute, Allahabad, Dec. 02-08, 2013.

Inference of optimal characteristics of heat engines with prior information, P. Aneja and R.S. Johal, at Inter-IISER Physics meet at IISER Pune, March 15-16, 2014.

Goutam Sheet

"Is Piezoresponse Force Microscopy a "Smoking Gun" for Ferroelectricity and Piezoelectricity?", Goutam Sheet, ICONSAT 2014.

PhDs awarded

Ms Amrita Kumari obtained a PhD from IISER Mohali for work done under the supervision of Dr. Kavita Dorai.

Awards, Honours & Grants

Jasjeet S. Bagla has been nominated as a member of the International Science Determination Team on Fundamental Physics and Cosmology for the Thirty metre telescope to be built in Hawaii.

Jasjeet S. Bagla has been appointed as an associate of the Abdus Salam International Centre for Theoretical Physics, Trieste, Italy for the period 2014-2019.

Kamal P. Singh received a Max-Planck India Mobility Grant 2014-2018.

Ananth Venkatesan has been awarded a major grant around 2.5 crores to set up a plasma etch tool and other auxiliary process tools. The equipment will be shortly installed in the central nano-fabrication facility.

Sudipta Sarkar has received a grant to visit Universidade de Santiago de Compostela, Spain for one month under PEIN Research Excellence Program USC-India.

Facilities Set Up

Goutam Sheet has installed a multi-mode scanning probe microscope. He has also recently installed the liquid helium plant.

Mandip Singh is developing research laboratories to pursue basic research on quantum physics. Major laboratory equipment which have been procured and installed: Optical tables, single frequency tunable lasers for laser cooling, optics for laser cooling, oscilloscopes, function generators, acousto-optic modulators and various research tools.

Yogesh Singh has installed an inert Gas Golve-box & a Physical Property Measurement System (PPMS).

Faculty and Research at the Department of Mathematical Sciences

Chandrakant S. Aribam: Elliptic curves are very nice mathematical objects that are ubiquitous. Associated to these curves is the L-function of the elliptic curve that captures a lot of information regarding rational points on the curve. The study of special values of L-functions is one of the central problems of arithmetic. L-functions are also associated to other objects known as modular forms. These L-functions are intimately related to one another. One way to study these special values is through the Main conjecture of Iwasawa theory.

We have studied this question by taking a family of modular forms that divisible by a prime number. We have also verified certain hypothesis that are required to carry out the program of studying the special values through the Main conjecture.

Krishnendu Gongopadhyay: The linear group $Sp(n,1)$ acts as the isometry group on the n -dimensional hyperbolic space over the division ring of real quaternions. In the joint work with Shiv Prasad, Gongopadhyay classified the quaternionic hyperbolic isometries and characterised them algebraically using conjugacy invariants in $Sp(n,1)$. This provides counterpart of the classical "trace-classification" in $SL(2,C)$ that is of interest to three dimensional real hyperbolic geometry. This generalizes earlier work of Gongopadhyay that appeared last year in Proc. Amer. Math. Soc, 141 (2013), 1017-1027.

Two elements are said to be in the same z -class if their centralizers are conjugate in G . The classification of z -classes in a group is an interesting problem in group theory. Using linear algebra of the isometries of the n -dimensional hyperbolic space, the z -classes in $Sp(n,1)$ were classified and counted. This completes the project of classifying the z -classes in those linear groups that appear as isometry groups of the rank one symmetric spaces of non-compact type.

Let G be a group with a symmetric set of generators X . A reduced word in the alphabet X is a palindrome if it reads the same forwards and backwards. The palindromic length of an element g in G is the minimum number that is needed for expressing g as a product of palindromes. The palindromic width of G with respect to X is the supremum of all possible palindromic lengths in G . In the joint work with Bardakov, Krishnendu Gongopadhyay proved that the palindromic width of a finitely generated free nilpotent group with re-



Figure: A) Part of a wet processing facility in the cleanroom. B) A state of the art scanning electron microscope that will also be used for e-beam lithography.

Ananth Venkatesan is setting up a central nano-fabrication facility. A class 10,000 clean-room with basic wet processing tools has been setup for housing state of the art nano-fabrication equipment. Major equipment like a thermal field emission scanning electron microscope and a 40 MHz e-beam lithography system has been installed. Other major equipment like a plasma etch system consisting of an Inductively Coupled and Reactive ion etch system are being installed.

spect to the free set of generators is finite; a bound for the palindromic width was obtained.

Sudesh Kaur Khanduja is mainly interested in valuations, specially in their applications to algebraic number theory and other basic problems of algebra like discovering criteria for irreducibility of polynomials. She along with her collaborators have used prolongations of valuations to simple transcendental extensions to generalize the classical Eisenstein-Dumas Irreducibility Criterion, Schanemann Irreducibility Criterion, Hensel's Lemma, Ehrenfeucht's Irreducibility Criterion and Akira Criterion. She jointly with her research student worked on the irreducibility of truncated binomial expansions over rationals using Newton polygons with respect to p-adic valuations. She also worked on the invariants associated with irreducible polynomials with coefficients in henselian valued fields using saturated distinguished chains. Currently she is exploring the possibility of applying these invariants to some other problems in algebra.

Amit Kulshrestha is exploring quadratic forms over fields of characteristic 2, aiming to understand representations of special 2-groups. He been successful in writing down the character table and rational Wedderburn decomposition of these groups. His techniques have also yielded an infinite class of strongly real groups which admit complex symplectic representations. These are only known examples of such groups.

Chanchal Kumar's research interest in algebraic geometry includes study of moduli space of vector bundles, Geometric Invariant Theory and Classical Algebraic Geometry.

For the last five years, he has been interested in some aspects of Combinatorial Commutative Algebra; namely, the study of free resolutions of monomial ideals, computation of their Betti numbers and relationship between their combinatorial and algebraic properties.

Alok Maharana's research interests are in algebraic geometry. He works on the classification of complex open algebraic surfaces.

Kapil Hari Paranjape has completed work on ongoing project with Professor D. Ramakrishnan, CalTech. The paper has been written and is in its final stages. We have investigated aspects of the study of Modular Forms beyond the theory of Motives. Specifically, the question we ask (and give answers in a small number of cases to) is whether there are special classes varieties which carry the motives of modular forms. This would be analogous to the way in which cyclotomic fields carry the Galois theory of all abelian extensions of the rational numbers.

He is continuing work on a book of lectures exemplifying the mathematics curriculum at IISER Mohali. This work is in its preliminary form. The final work will have modules with one lecture, one set of worked examples and a collection of typical problems which will build up mathematics beyond school at the level that a typical scientist of the 21st century should be able to master.

Triviality of projective modules on certain affine varieties. The recent paper by Ravi A. Rao, et al appears to imply a positive solution to question posed by M. P. Murthy many years ago. In collaboration with V. Srinivas and M. Levine he is attempting to unravel the motivic cohomology arguments to find an explicit polynomial solution to this question.

I.B.S. Passi's subject of main contributions is Group Rings. His interests include dimension subgroups, augmentation powers, homological and combinatorial methods, Schur multiplier, relation modules, algebraic structure of group rings, cyclic homology and geometric group theory. He is author of Group Rings and Their Augmentation Ideals LNM Vol. 715, Springer, 1979, and coauthor with R. Mikhailov of Lower Central and Dimension Series of Groups, LNM Vol. 1952, Springer 2009.

Lingaraj Sahu: In C^* or von Neumann algebras, completely positive (CP) maps are very important classes of linear maps. Semi-group of CP maps are often used to model evolution of a quantum dynamical system and they are called quantum dynamical semi-group. The infinitesimal generator of uniformly continuous quantum dynamical semi-group is bounded. In general, for strongly continuous semi-group, it is not well understood. In specific cases, we are trying to construct CP semi-groups from a unbounded Linblad type generator. We are also interested in understanding of the set of positive maps which are not completely positive. These non CP maps help in detecting entangled states. Understanding of the spectrums (discrete, continuous and absolutely continuous) of a self-adjoint operator A , not necessarily bounded, on a Hilbert space H are very important from mathematical as well as physical point of views. Often these operators are used to model observables in quantum mechanics. The Schrodinger operators $H = -\Delta + V$ are perturbation of Laplacian by suitable multiplication operator (the potential). We are investigating problem related to determining various spectrums of self-adjoint operators and their perturbations.

Mahender Singh: Determining the homeomorphism or homotopy type of orbit space of a given group action is a classical problem in transformation groups. This problem is often difficult, and a weaker problem is to determine the cohomology algebra of the orbit space. Lens spaces are fundamental examples of spherical space forms. Recently, we have given

a complete classification of cohomology algebra of orbit spaces of free involutions on Lens spaces.

This has extended the results known previously only for the three dimensional case to higher dimensions.

Milnor manifolds were introduced by Milnor to give generators for the unoriented cobordism algebra of all smooth manifolds. Recently, we have obtained some results on the maximal rank of elementary abelian 2-groups acting freely on products of real and complex Milnor manifolds. These results have extended the class of manifolds for which the well known Carlsson's conjecture is true.

Varhadharaj R. Srinivasan is presently studying the structure of field extensions generated by solutions of linear differential equations. This project describes in detail the nature of solutions of solvable differential equations. In a joint work with Dr. Amit Kulshrestha, he is studying central simple algebras with derivations to understand the problem of constructing crossed product algebras that are not central division algebras.

Publications

Krishnendu Gongopadhyay and Shiv Parsad, Classification of quaternionic hyperbolic isometries, *Conform. Geom. Dyn.* 17 (2013), 68-76

Krishnendu Gongopadhyay, The z-classes of quaternionic hyperbolic isometries, *J. Group Theory*, Volume 16, Issue 6 (2013), 941-964

Krishnendu Gongopadhyay and Valeriy G. Bardakov, Palindromic width of free nilpotent groups, *J. Algebra* 402 (2014), 379-391

Anuj Bishnoi and **Sudesh K. Khanduja**, On Generalized Schonnemann Polynomials, *Communication in Algebra* ,41(2013), 2417-2426.

Anuj Bishnoi, Sanjeev Kumar, **Sudesh K. Khanduja**, On liftings of powers of irreducible polynomials, *Journal of Algebra and Its Applications*, 12:5 (2013), pp. 1-10.

Ajay Kumar and **Chanchal Kumar**, Alexander duals of multipermutohedron ideals, *Proc. Indian Acad. Sci (Math Sci)* Vol 124, No 1,(2014) 1-15.

Yashonidhi Pandey, Criteria for existence of stable parahoric $\mathbb{S}O_n$, $\mathbb{S}p$ and $\mathbb{S}pin$ bundles over the projective line, in *Journal of Ramanujan mathematical society*.

Gurmeet K. Bakshi, Shalini Gupta, **I.B.S. Passi**, The structure of finite semisimple metacyclic group algebras, *J. Ramanujan Math. Soc.*, vol. 28, no. 2, (2013) 141-158

Gurmeet K. Bakshi, Ravindra S. Kulkarni, **I.B.S. Passi**, The rational group algebra of a finite group, *J. Algebra Appl.* 12, No. 3, Paper No. 1250168, 17 p. (2013).

Mahender Singh, Free 2-rank of symmetry of products of Milnor manifolds, *Homology Homotopy and Applications*, 16 (2014), 65-81.

Mahender Singh, Cohomology algebra of orbit spaces of free involutions on lens spaces, *Journal of the Mathematical Society of Japan*, 65 (2013), 1055-1078.

Academic Visits

Krishnendu Gongopadhyay

Tata Institute of Fundamental Research Mumbai during the month of May.

National University of Singapore during June 9--23, 2013.

Institute of Mathematical Sciences, Hong Kong during June 24--30, 2013.

Vivekananda Mahavidyalaya, Burdwan during December 26--31, 2013.

University of Maryland, George Washington University and Graduate Center of the City University of New York during March 12--23, 2014.

Amit Kulshrestha

Indian Institute of Science Education and Research Pune during December 11-18, 2013.

Chanchal Kumar

Reva Institute of Technology and Management, Bangalore from 27-30 June 2013.

Kerala School of Mathematics, Kozhikode from 24-28 march 2014.

Alok Maharana

Kerala School of Mathematics, Kozhikode during 17-26 February, 2014.

Yashonidhi Pandey

Instituto de Ciencias Matematicas' to discuss with Tomas L.Gomez

Chennai Mathematical Institute.

Kapil Hari Paranjape

School of Mathematics, TIFR, 12th April 2013.

IISER, Pune, 16th-17th September 2013.

Lingaraj Sahu

Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) Bangalore, December 13-15, 2013.

Mahender Singh

International Center for Theoretical Physics (ICTP), Trieste, Italy, March 07- June 06, 2013.

Harish-Chandra Research Institute, Allahabad, March 01-06, 2014.

Varadharaj R. Srinivasan

IIT Kanpur, May 06/ 2013- June 01/ 2013.

Invited talks and Posters

Krishnendu Gongopadhyay

- gave a seminar at George Washington University, Washington DC in March, 2014.

- gave a seminar at IISER Mohali as a part of faculty lecture series in February, 2014.

- gave a seminar at Sobolev Institute of Mathematics, Novosibirsk, Russia in July, 2013.

- gave a short communication at the group theory conference at Sobolev Institute of Mathematics, Novosibirsk, Russia in July, 2013.

- gave a seminar at the Institute of Mathematical Sciences, Hong Kong in June 2013.

- gave a seminar at the National University of Singapore in June 2013.

Sudesh Kaur Khanduja

- Keynote speaker in national conference on advances in Mathematics & its Applications organised by Department of Mathematics, NIT Hamirpur held during June 25-27, 2013.

- Chaired a session in the National seminar on Number Theory and Discrete Mathematics in honour of 70th birthday of Professor R.J. Hans Gill, during Nov 12-13, 2013.

- Delivered a lecture in Faculty Development Program on Role of Basic Sciences in Engineering Organized by University Institute of engineering and technology, Panjab University Chandigarh on 14th Nov 2013.

- Delivered lectures in the INSPIRE programme sponsored by DST at Asian Institution, Punjabi University, Patiala on Nov 17, 2013.

- Chaired a session in the International Conference on History and Development of Mathematics held at Department of Mathematics, JECRC University, Jaipur during Nov. 29, 30, Dec 1, 2013

- Delivered a lecture in INSPIRE programme organized by Chandigarh group of colleges, Mohali on 25th Jan, 2014

- Delivered a lecture and chaired a session in International conference in Algebra & Allied fields organized by Department of Mathematics and statistic, H.P. University, Shimla during 26, 27 March, 2014.

- Delivered a colloquium lecture in TIFR-CAM Bangalore on 19 Dec 2013.

- Delivered a colloquium lecture in IISc Bangalore on 19 Dec 2013.

Amit Kulshrestha

- Gave a lecture on 'R-equivalence in Algebraic Groups' at a conference on 'Groups and Representation' at IISER Pune (May 24, 2013)

- Gave a talk on 'Unexpected occurrence of pi' to undergraduate students at Dayalbagh Educational Institute, Agra (August 22, 2013)

- Gave a series of five lectures on 'Orthogonal Geometry' at Advanced Instructional School on Classical Groups at IISER Pune in December 2013.

- A poster on 'Strong reality and total orthogonality of groups' was presented in 'Groups, Group Rings and Related Topics' (GGRRT 2013) at United Arab Emirates University, Dubai during October 28-31 2013. (The poster was presented by Amit Kulshrestha's student Ms. Dilpreet Kaur on a joint work with him).

Chanchal Kumar

- Participated and delivered an invited talk entitled "Elementary transformations of rank 2 vector bundles on hyperelliptic curves" in the 28th annual conference of Ramanujan Mathematical Society, held at Reva Institute of Technology and Management, Bangalore from 27-30 June 2013.

- Participated and delivered an invited talk entitled "Betti numbers of certain monomial ideals" in an International conference on Analytic and Algebraic geometry held at Kerala School of Mathematics, Kozhikode from 24-28 march 2014.

Alok Maharana

- Gave a talk on "Complements of multi-sections on Hirzebruch surfaces" in the conference "Automorphisms of algebraic varieties", at Kerala School of Mathematics on February 24, 2014.

Yashonidhi Pandey

- Talk at Institute of Mathematical Sciences, Chennai on 'Brauer group of moduli of parahoric torsors'

- Talk at Chennai Mathematical Institute on 'A properness criteria for degenerate quadratic bundles'

Kapil Paranjape

- Plenary Address on "The Topos of Finite Sets and Algebraic Geometry" at the 28th Annual Meeting of the Ramanujan Mathematical Society in Reva Institute, Bangalore on 29th June 2013.

- Invited Address in "Symposium on Mathematics and Its Applications" at Hansraj College, Delhi University, 8th March 2013.

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I.B.S. Passi

- 24 August 2013: Mathematics: Aadhar for our knowledge and human development" at a function organized by Society for Promotion of Science and Technology in India for school students at Bhavan Vidyalaya Sector 27 Chandigarh.

- 21 September 2013: Geometric Group Theory at Department of Mathematics, University of Delhi.

- Plenary Speaker at International Conference on Groups, Group Rings and Related Topics held at Al Ain, UAE, during 28 October - 01 November 2013. Title of the Talk: Lie Dimension Subrings delivered on 31 October 2013.

- 5 January 2014: Mathematics: Aadhar for our knowledge and human development at INSPIRE Camp organized by DAV College Sector 10 Chandigarh.

- 01 March 2014: A Filtration of Schur Multiplier at Workshop on Schur Multiplier organized by Harish-Chandra Research Institute, Allahabad.

- 15 March 2014: Higher Mathematics at Arya Post-Graduate College, Panipat. The programme called Panel Discussion on Options in Higher Education in Sciences and Mathematics for Undergraduate Students was organized for college students by the Society for Promotion of Science and Technology in India.

- 20 March 2014: STEM Education in the 21st Century at International Conference on Mathematics and Engineering Sciences held at Chitkara University, Himachal Pradesh.

Mahender Singh

- Gave a talk at International Center for Theoretical Physics (ICTP), Trieste, Italy, April 02, 2013.

- Gave an invited talk at the INSPIRE Science Camp in HBN Garhwal University, Srinagar, Garhwal, January 13, 2014.

- Gave a mini course of three lectures in the instructional school on "Schur Multiplier and Related Topics" at Harish-Chandra Research Institute, Allahabad, March 01-06, 2014.

- Gave an invited talk in the "National Conference on Advances in Mathematics", Hansraj College, University of Delhi, March 08, 2014.

Varadharaj R. Srinivasan

- Mini course in the Annual Foundation School on non commutative ring theory (IIT Kanpur, May 06/ 2013– June 01/ 2013)

Awards and Honors

Krishnendu Gongopadhyay: Appointed junior associate of the International Center of Theoretical Physics, Trieste, Italy.

Kapil Hari Paranjape: Paper on "The First Digit One" by Ms. Tanya Kaushal Srivastava published in Resonance, December 2013.

I.B.S. Passi:

(1) 27 May 2013: Guest of Honour at MTTTS (O Level) Programme organized by Department of Mathematics, Panjab University Chandigarh.

(2) 21 February 2014: Honoured by Panjab University Chandigarh on the occasion of birth anniversary of Shanti Swarup Bhatnagar.

(3) Chief Guest at the inaugural function of the International Conference on Mathematics and Engineering Sciences held at Chitkara University Himachal Pradesh on 20 March 2014.

(4) Convener of Symposium on Algebra and Its Interactions held on 4 February 2014 at University of Jammu, during 101st session of Indian Science Congress Association.

(5) Annual Conference of Indian Academy of Sciences held at Chandigarh/Mohali during 8 - 10 November 2013.

(6) Seminar on Number Theory and Discrete Mathematics held at Department of Mathematics, Panjab University, Chandigarh, during 12-13 November 2013.

(6) Member, Mathematics Advisory Board, Eternal University, Baru Sahib, Himachal Pradesh.

(7) Chairman Selection Committee (Mathematics) and Member, APEX Committee for INSPIRE Faculty Award Programme of DST (GOI).

(8) Secretary and Convener, Sectional Committee I, INSA. Member, Joint Science Education Panel.

(9) Member, Governing Council, Society for Promotion of Science and Technology in India.

(10) Member, Academic Senate, IISER Mohali.

PhD's Awarded

Mrs Shalini Gupta who worked under the joint supervision of Professor I.B.S. Passi and Dr. Gurmeet K. Bakshi [Panjab University Chandigarh] was awarded PhD at the second convocation of IISER Mohali held on 25 May 2013. Her thesis is entitled "The Structure of Semisimple Finite Metabelian Group Algebras".

Faculty and Research at the Department of Humanities and Social Sciences

Parth Chauhan: As a part of the ongoing Narmada Basin Paleoanthropology Project (in collaboration with Professor K. Krishnan in the Department of Archaeology and Ancient Indian History, Maharaja Sayajirao University of Baroda and with other Indian and international colleagues), I carried out paleoanthropological fieldwork in Madhya Pradesh. Resulting discoveries made this semester included new Stone Age sites dating to the Paleolithic and Mesolithic periods. We also recovered a fragment of a fossilized ostrich eggshell from a Late Quaternary sedimentary context, and which will be dated in the future using the AMS or radiocarbon methods. The specimen will also be subjected to stable isotope



studies to reconstruct its ancient environmental context. In addition, extensive excavations at an Early Pleistocene context (Dhansi Formation) along the Narmada River yielded diverse stone tools made on a variety of raw materials, some of which were not thought to be exploited until the Upper Pleistocene.

S.K. Arun Murthy wants to examine the idea of scientific realism by bringing in the notion of scientific concepts. Concepts are always tied to the school of nominalism. However, whether the idea of concepts can be used to describe or understand the world lead to the idea of realism of a different kind. He is trying to examine this in the context of scientific theories how it affects the notion of scientific progress. In Indian Philosophy he is working on comparative study of epistemology in Indian tradition as against the Western Analytic tradition. Though a lot of serious debate like that of Potter versus Mohanty has been generated on this idea of analysis of knowledge. He would like to examine the more fundamental issue in this context. What idea of analysis is

present in the Indian tradition and whether anything like justification can be thought of in this tradition.

Meera Nanda works in the general space where history and philosophy of modern science meet and often conflict with history and philosophy of Indian sciences and religions.

Her doctoral dissertation in Science and Technology Studies was a defense of objectivity and universality of modern scientific knowledge against postmodernist critics who view all knowledge as a social construct of power and ideology. This thesis was later published as a book, *Prophets Facing Backwards: Postmodern Critiques of Science and Hindu Nationalism in India* (Rutgers University Press, 2004).

She has published original historical research on the reception and reinterpretation of Darwinism by modern Hindu reformers in the 19th century India. In addition, she have examined the influence of Theosophy on modern Hindu interpretation of the Vedic worldview as scientific.

She is currently at work on a social and intellectual history of the idea of scientific temper as it is understood in the Indian context.

V. Rajesh has been compiling primary documents related to the history of progressive writers movement in South India. Many of these documents are scattered in different places in India thus preventing scholars to have a clear understanding of regional variations of this all-India literary movement that traces its origin back to late 1930s. Documents related to the history of progressive literary movement in Tamilnadu have been secured and attempts are being made to digitize them. I intend to start working on reconstructing the history of progressive literary movement in Tamilnadu once the sources are adequately secured.

Anu Sablok is a spatial social scientist and my research investigates how spaces, scales and identities are mutually produced and used. She has focused primarily on gender, national and class identity in the lives of working class populations. She does ethnographic research with participant observation, in-depth interviews and archival analysis as the primary methodological tools.

What do the construction of national identity as a cultural process; uneven development as an economic and social process; and migration as a spatial process have in common? Her current work is an attempt to understand the above processes as they come together in the lives of Seasonal/circular migrants. The particular focus is on the oral histories and narratives of the circular migrants that travel from UP, Bihar, Jharkhand, Orissa and Nepal every summer to participate in the task of constructing, maintaining and re-

building the roads for the Border Roads Organization (BRO). The idea is to expand the understanding of circular migration from a mere movement of labour/bodies in space, to a flow of ideas, meanings and identities in and through place thereby bringing together both the discursive and material construction of bodies/and places.

Publications

Parth R. Chauhan

A peer-reviewed paper entitled “Genes, stone tools and modern human dispersals in the center of the Old World” (co-authored with two faculty from University of Pune) was accepted for publication in the volume representing a conference held in Japan (2012) on modern human evolution in Asia.

Meera Nanda

“Yoga Scientized: A second look at Swami Vivekananda’s legacy.” Revised version of the plenary lecture in Vienna. Submitted for publication to *Numen*, an international peer-reviewed journal of intellectual history.

“Science and the Subaltern: Re-examining the Postcolonial case against Enlightenment Rationalism,” revised version of the plenary lecture in Chandigarh. Work in progress. To be submitted to *Economic and Political Weekly*.

V. Rajesh

(Book Review) Michael Bergunder, Heiko Frese and Ulrike Schroder (eds), *Ritual, Caste and Religion in Colonial South India*, Verlag der Franckeschen zu Halle, Halle, 2010 in *Relegere: Studies in Religion and Reception*, Volume 3, Number 2, 2013, pp. 415-419.

Frontline, April 04, 2014, pp. 98-99 ‘Seeds of Tamil Renaissance’ Review of my book *Manuscripts, Memory and History: Classical Tamil Literature in Colonial India* by Theodore S. Bhaskaran.

P. Visakhi, Librarian

P. Visakhi and Umeshareddy Kacherki. 2013. Management of eresources at IISERs : A Consortium Approach . In : *Electronic Resources Management in Libraries* by Chennupati K. Ramaiah (Ed.) Allied Publishers Pvt Ltd., New Delhi

Sushil Kumar Sen., **P. Visakhi**, P K Jain . 2013. Potentials of the Library Profession in India: Vibrant roles of Library Associations with Special reference to AALDI. Presented in 3rd International Conference of Asian Special Libraries (ICoASL 2013) on Special Libraries towards Achieving Dynamic, Strategic, and Responsible Working Environment to be held at

the Philippine International Convention Center (PICC), Pasay City, Philippines on 1012 April 2013.

Gupta, B.M., Anurag Saxena and **P. Visakhi** .2013 " Contribution and Impact of Indian Agricultural universities : A performance analysis using Scientometric Techniques, 200711 (In Press)

P. Visakhi and Rity Gupta 2013. Contribution and Impact of Faculty and Scholars of IISER Mohali : A Scientometric Study, 200812(In Press iLibrary philosophy and Practices)

Jain, A.K. and **P. Visakhi** (2013) . A Study on Strengthening of Digital Library and Information Management under NARS . In : In*: Ganguly, Shantanu, et. al. (Eds). *International Conference on Digital Libraries2013 on "Vision 2020: Looking back 10 years and forging new frontiers (ICDL2013)*: Proceedings, November 27-29, 2013, TERI, New Delhi. pp.352-366

P. Visakhi and Nabi Hassan (2013) . Union Catalogue of agricultural libraries in India: A success story of NARS(ISSN: 2249-0213)International Research :Journal of library and Information Science, Vol.3 Issue No. 4 (Dec. 2013), : 603-617 pp.

Awards and Honors

Parth Chauhan

Was awarded a High Risk research grant from the National Science Foundation (USA) as a co-Principal Investigator in collaboration with faculty (Dr. Amanuel Beyin) from the University of Southern Indiana (USA), to conduct paleoanthropological research in eastern Africa along the Red Sea. This project involves a search for the traces of early and modern hominin dispersals from eastern Africa towards the Levant through the exploitation of coastal resources during the Pleistocene.

S.K. Arun Murthy

A project by the MHRD/UGC (e-pathshala) for preparing course material for Philosophy of Science at the MA level. This will be put up in the public domain for students to access.

Meera Nanda

Was awarded a fellowship in history of science from the Indian National Academy for 2013-2104 for research for a book titled "Ancients and Moderns: The Cultural Meaning of Science in Modern India." (The original title for which the

grant was given was different. I have asked INSA for a change of the title.)

Anu Sablok

International Student program: The Dickey Center for International Understanding has identified my project on migrant labour in the upper Himalayas as one of the global projects where a competitively selected Global Health Fellow is sent for a 6 week mentorship program in field research. In Summer 2013 Hoiwan Cheung a graduate student from Dartmouth spent 6 weeks at IISER Mohali and assisted with field research. This year Janak Padhiar from Globalization Studies at Dartmouth has been selected to spend summer 2014 on this project.

Invited talks and Posters

Parth Chauhan

Was invited to participate in a seminar (March 6-7, 2014) entitled "Anthropological Perspectives of Bio-cultural Change" at the Department of Anthropology (Panjab University, Chandigarh), where I presented a paper entitled 'Differential Pleistocene technological adaptations in the Narmada Basin, Madhya Pradesh'.

Meera Nanda

"Resemblance thinking and pseudoscience in modern yoga," plenary lecture at the international conference on "Yoga in Transformation: Historical and Contemporary Perspectives on a Global Phenomenon" organized by the Department of South Asian, Tibetan and Buddhist Studies, University of Vienna, September 19-21.

"Interrogating the Science Question in Postcolonial Theory," Plenary lecture, Indian Association of Commonwealth Literature and Language Association (IACLALS) Conference on Margins, Globalization and the Postcolonial, Punjab University, Chandigarh, February 20-22, 2014.

V. Rajesh

'Classics in Modern: Literary Labour and Philology's Destiny in Colonial Madras', Invited talk presented in a symposium on 'Literary Historiography in India: Contemporary Perspectives' organized by Sahitya Akademi in association with Central University of Gujarat, Gandhinagar at Gandhinagar on 10 January 2014.

'Colonialism, Nationalism and Science in Modern India', Invited talk presented at the Department of Humanities and

Social Sciences, Indian Institute of Technology Madras on 10 March 2014.

'Historiography of Science in Modern India', Invited talk presented at the Department of Humanities and Social Sciences, Indian Institute of Technology Madras on 12 March 2014.

'Reading the Lives of Early Surveyors in British India: Anthropology, History and the Colonial State' paper presented at the national seminar on Anthropological Perspectives of Bio-Cultural Change, Department of Anthropology, Panjab University, Chandigarh, 6-7 March, 2014.

Anu Sablok

Was an invited speaker at the "Inner-Harbour roundtable on Revitalization of Macau's Vernacular Heritage", 09-12 December 2013. The roundtable was jointly organized by the University of Macau, Institute of European Studies of Macau and International Institute of Asian Studies, Leiden.

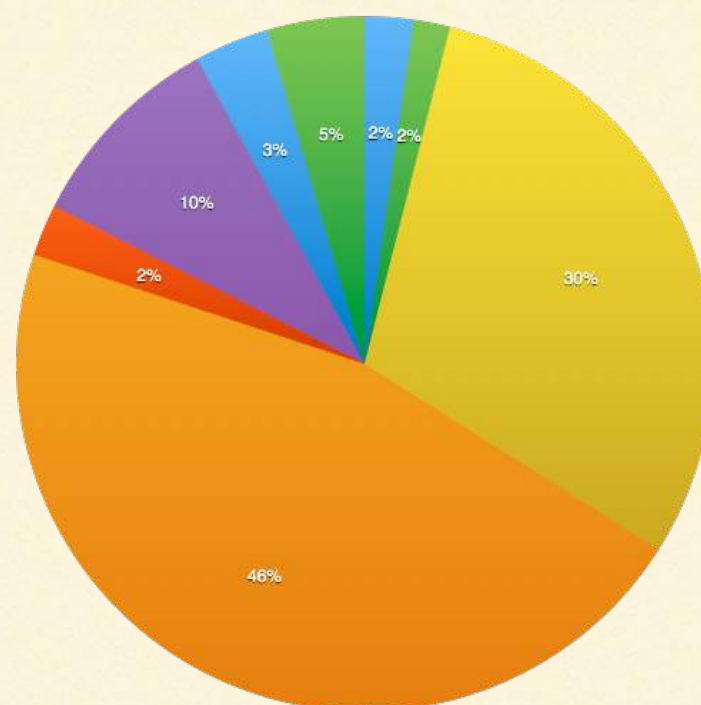
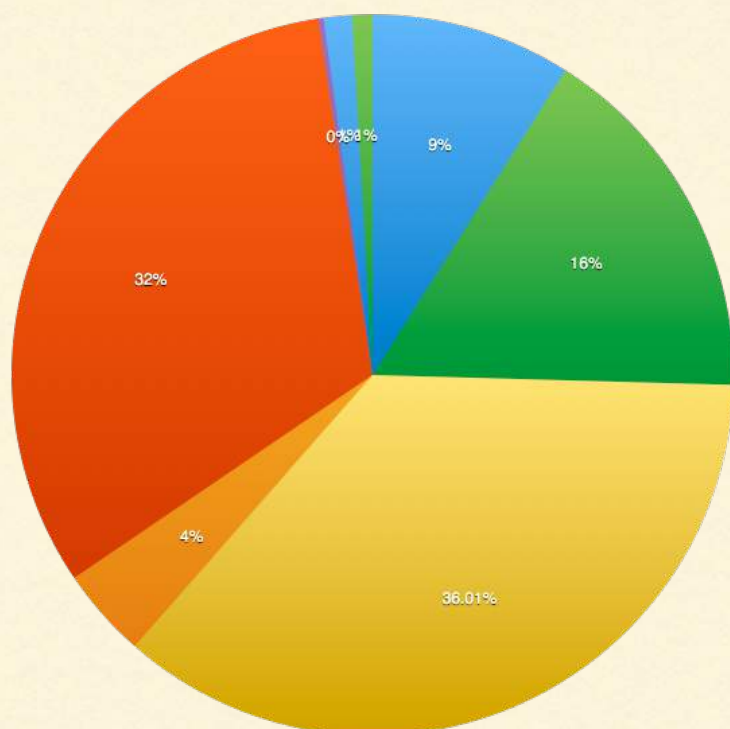
Invited talk on March 20th at Srishti School of Art, Design and Technology in Bangalore

Convened session titled "BODILY ENCOUNTERS: mobility, migrancy and movement" and presented paper entitled "Traveling Tales from the Indo Tibetan Border Roads: Bodies in national defense and development" at Annual conference of the Royal Geographic Society- Institute of British Geographers in August 2013

Presented paper titled "Walking with the Subalterns: Imagining ways of dialogic interpretations and representations" at the Indian Association for Commonwealth Literature and Language Studies Conference held at Punjab University in Feb 2014.

Plan Grant

(i) Pay & Allowances (ii) TA (iii) Scholarships (iv) Purchase of Equipment (v) Contingency (vi) Consumables (vii) Overheads (viii) Other Expenditure



R&D Projects

5

Budget and Ongoing projects

Plan Grant

The Institute has received a sum of Rs.112.82 Crore as Grant-in-Aid from MHRD in the Year 2013-14. There is an opening balance of Rs. 4.69 Crore. Thus out of the total amount of Rs. 117.51 Crore (Rs.112.82 + Rs. 4.69), the following expenditure has been made under different budget heads in 2013-14.

| Budget Head | (Rs. Crores) |
|--|--------------|
| (i) Salary Component | : 10.55 |
| (ii) Non- Salary Component | : 19.34 |
| (iii) Purchase of Equipments etc. | : 42.32 |
| (iv) Purchase of Furniture | : 4.74 |
| (v) Construction & Building(Including Deposit Money) | : 37.73 |
| (vi) Library Books | : 0.28 |
| (vii) Computers accessories & Peripherals | : 1.48 |
| (viii) Miscellaneous Fixed Assets | : 1.07 |
| Total | 117.51 |

Research & Development Projects:

In addition to the Plan Grant, the Institute also received a sum of Rs. 8.35 Crore (in 2013-14) for Research & Development projects. Opening balance of Rs. 10.78 Crore carried over from the year 2012-13. Thus out of the total amount of Rs. 19.13 Crore, the following expenditure incurred during the year 2013-14.

| Expenditure | :(Rs. in Crores) |
|----------------------------|------------------|
| (i) Pay & Allowances | : 0.32 |
| (ii) TA | : 0.24 |
| (iii) Scholarships | : 4.25 |
| (iv) Purchase of Equipment | : 6.53 |
| (v) Contingency | : 0.34 |
| (vi) Consumables | : 1.35 |
| (vii) Overheads | : 0.49 |
| (viii) Other Expenditure | : 0.64 |
| Total | 14.16 |

Leaving a closing balance of Rs. 4.97 Crore.

Endowment Fund

The balance available under this account is Rs. 9.04 Crore as on 31.03.2014.

Student Welfare Account

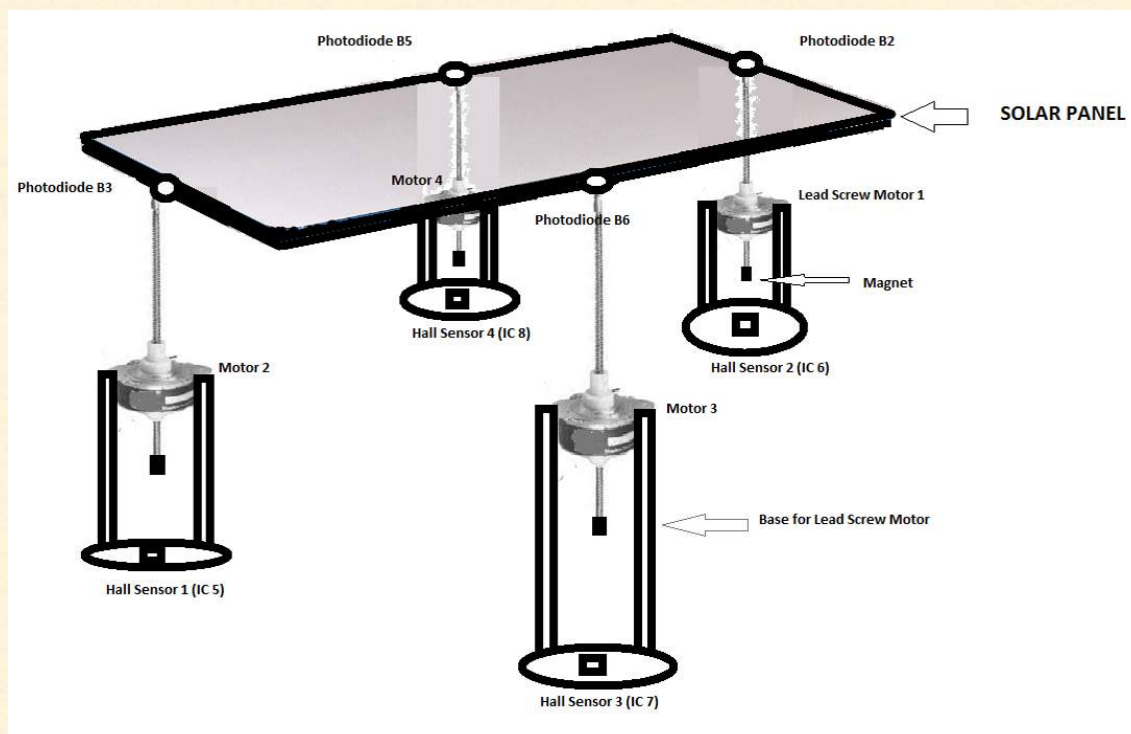
The balance available under this account is Rs. 0.63 Crore as on 31.03.2014.

| LIST OF ONGOING PROJECTS AND FELLOWSHIPS | | | | | | | |
|--|--------------|--|-------------------------|----------------|---------|----------------|----------------|
| Sr. No. | Project No. | Name of project | Principal Investigator | Funding Agency | Period | Total Sanction | Grant Received |
| 1 | CSIR-07-0002 | Studies of dissipative dynamics in quantum computers using nmr techniques | Dr. Kavita Dorai | CSIR | 3 Years | 9,45,000.0000 | 5,66,620.00 |
| 2 | DBT-07-0003 | Exploring biomolecular dynamics using cross correlated spin relaxation in nmr | Dr. Kavita Dorai | DBT | 3 Years | 53,04,400.0000 | 42,25,600.00 |
| 3 | DST-09-0009 | Biomolecular solid state nmr theory, experiments and application | Dr. Ramesh Ramachandran | DST | 3 Years | 34,80,400.0000 | 19,72,000.00 |
| 4 | DST-09-0011 | Synthesis, structures and spectroscopic studies of low valent late transition metal complexes with n-arylimidine and other neutral chelating ligands | Dr. Sanjay Singh | DST | 3 Years | 19,95,200.0000 | 14,00,000.00 |

| | | | | | | | |
|----|-----------------|--|---------------------------|----------------|---------|------------------|----------------|
| 5 | DST-10-0012 | Synthesis, characterization and aggregation studies on prion octapeptide and its covalently-linked oligomer | Dr. Milly Bhattacharya | DST Fast Track | 3 Years | 16,68,000.0000 | 15,23,000.00 |
| 6 | DST-10-0014 | Cp-crystallization of active pharmaceutical ingredients: pathways for enhanced properties | Dr. A.R. Choudhury | DST | 3 Years | 19,31,000.0000 | 18,74,000.00 |
| 7 | DST-10-0015 | Studies on organometallic - based stereoselective noncarbohydrate synthetic strategies towards stereodivergent iminosugars, iminosugar phosphonates, iminosugar c- glycosides and investigation of biological activities | Dr. S. A.Babu | DST | 3 Years | 19,75,000.0000 | 19,00,000.00 |
| 8 | 10-DST-RJN-F.1 | Ramanujan Fellowship | Dr. Kamal. P Singh | DST | 5 Years | 73,00,000.0000 | 46,70,000.00 |
| 9 | 10-DBT-ALL.-F.2 | Wellcome-DBT Alliance | Dr. Lolitika Mandal | Wellcome-DBT | 6 Years | 3,49,37,689.0000 | 2,52,53,481.00 |
| 10 | 10-DST-JCB.-F.3 | J C BOSE FELLOWSHIP | Dr. Kapil H. Paranjape | DST | 5 Years | 68,00,000.0000 | 13,60,000.00 |
| 11 | 10-DST-RJN-F.6 | Ramanujan Fellowship | Dr. Ananth Venkatesan | DST | 5 Years | 73,00,000.0000 | 46,80,000.00 |
| 12 | 11-DST-RJN-F.7 | Ramanujan Fellowship | Dr. Yogesh Singh | DST | 5 Years | 73,00,000.0000 | 36,60,000.00 |
| 13 | 11-DST-RJN-F.8 | Ramanujan Fellowship | Dr. Sanjeev Kumar | DST | 3 Years | 73,00,000.0000 | 37,60,000.00 |
| 14 | DST-11-0017 | The Z-Classes in classical groups | Dr. K. Gongopadhyay | DST | 3 Years | 3,24,000.0000 | 2,60,000.00 |
| 15 | DST-11-0018 | Exploring surface polymer interaction via external forcing of the polymer | Dr. Rajeev Kapri | DST | 3 Years | 5,04,000.0000 | 4,40,000.00 |
| 16 | CSIR-11-0019 | Conformational plasticity and amyloid aggregation of human serum albumin | Dr. S. Mukhopadhyay | CSIR | 3 Years | 18,55,335.0000 | 17,43,000.00 |
| 17 | NKN-11-0020 | Creation of additional virtual classrooms | Dr. Arvind | CIT | | 39,45,933.0000 | 39,45,933.00 |
| 18 | DBT-11-0021 | Structure - function studies on vibrio cholerae cystoisin, a membrane damaging poreforming toxin | Dr. Kaushik Chattopadhyay | DBT | 3 Years | 62,64,400.0000 | 5,34,04,610.00 |
| 19 | DBT-11-0022 | Molecular genetic analysis of mitochondrial regulation of cell growth in drosophila | Dr. Sudip Mandal | DBT | 3 Years | 67,24,000.0000 | 59,79,000.00 |
| 20 | MAX-11-0023 | Tropospheric OH Reactivity and VOC Measurements within India | Dr. Vinayak Sinha | Max Planck-DST | 3 Years | 62,45,802.0000 | 62,45,802.00 |
| 21 | DST-11-0024 | Metal organic framework (mofs) comprised of dimetal units and multi-atom organic linkers | Dr. Sanjay Mandal | DST | 3 Years | 36,36,000.0000 | 13,76,000.00 |
| 22 | DAE-11-0025 | A Study of valued fields and irreducible polynomials | Dr. S. K. Khanduja | DAE | 1 Year | 3,99,100.0000 | 3,99,100.00 |
| 23 | DST-11-0026 | Quantum heat engines: work entropy and information at the nanoscale. | Dr. R. S. Johal | DST | 3 Years | 13,56,000.0000 | 10,00,000.00 |
| 24 | DST-11-0027 | An empirical assessment of the role of inter sexual conflict in life history evolution. | Dr. N. G. Prasad | DST | 3 Years | 33,01,000.0000 | 24,50,000.00 |

| | | | | | | | |
|----|-----------------|--|---------------------------|--------------------|---------|------------------|----------------|
| 25 | DST-11-0028 | Development of novel n-heterocyclic carbenes and their application in organo and organometallic catalysis | Dr. R Vijaya Anand | DST | 3 Years | 18,05,000.0000 | 12,85,000.00 |
| 26 | DBT-11-0029 | Sys tb: a network program for resolving the interacellular dynamics of host pathogen | Dr. Sudeshna Sinha | DBT | 5 Years | 41,28,000.0000 | 12,38,098.00 |
| 27 | DBT-11-0030 | Study of vibrio cholerae porin ompu towards elucidating its role in host immunomodulation | Dr. Arunika Mukhopadhyay | DBT | 3 Years | 50,20,000.0000 | 36,08,400.00 |
| 28 | DBT-11-0031 | Investigation into the sulphur assimilatory pathways of candida albicans | Dr. Anand K. Bachhawat | DBT | 3 Years | 20,75,000.0000 | 20,91,899.00 |
| 29 | DST-12-0032 | Elucidating the role of 5-oxopolinases in <i>Saccharomyces cerevisiae</i> in the light of the truncate y-glutamyl cycle of yeasts | Dr. Anand K. Bachhawat | DST | 3 Years | 16,09,899.0000 | 16,09,899.00 |
| 30 | JCB-12-0033 | J C Bose Fellowship | Dr. Somdatta Sinha | DST | 5 Years | 68,00,000.0000 | 24,90,000.00 |
| 31 | INSPIRE-12-0034 | INSPIRE FACULTY AWARD | Dr. Mahender Singh | DST | 5 Years | | 26,07,920.00 |
| 32 | DST-12-0035 | Liquid crystal Nanocrystal - A new resource of functional soft materials for nanosciences | Dr. Santanu Kumar Pal | DST | 3 Years | 26,55,000.0000 | 25,75,000.00 |
| 33 | JCB-12-0036 | J C Bose Fellowship | Dr. Anand K. Bacchawat | DST | 5 Years | 68,00,000.0000 | 18,60,000.00 |
| 34 | DBT-12-0037 | Identification and characterization of cell type specific transcription factors from <i>Arabidopsis</i> stem cell niche to construct a gene regulatory network | Dr. Ram Kishore Yadav | DBT | 3 Years | 41,81,000.0000 | 27,50,000.00 |
| 35 | DBT-12-0038 | Deciphering the function of Claudins in the nervous system | Dr. Kavita Babu | DBT | 3 Years | 41,19,000.0000 | 28,05,000.00 |
| 36 | RJN-12-0039 | Ramanujan Fellowship | Dr. Goutam Sheet | DST | 5 Years | 73,00,000.0000 | 22,60,000.00 |
| 37 | DBT-12-0040 | Identification of transcriptional gene networks using genomic approaches | Dr. Ram Kishore Yadav | Ramalingaswami-DBT | 5 Years | 74,50,000.0000 | 29,80,000.00 |
| 38 | DBT-12-0041 | Cell type-Specific Role of Homer Proteins IN Synaptic Plasticity | Dr. Samarjit Bhattacharya | DBT | 2 Years | 54,19,800.0000 | 29,39,400.00 |
| 39 | DBT-12-0042 | Towards understanding the mechanism of antigenicity. | Dr. Kavita Babu | Wellcome-DBT | 6 Years | 3,43,26,491.0000 | 1,54,74,213.00 |
| 40 | DBT-12-0043 | Role of small GTP - binding proteins in regulating lysosomal trafficking and microbial killing | Dr. Mahak Sharma | Wellcome-DBT | 6 Years | 3,27,11,140.0000 | 1,87,82,942.00 |
| 41 | DAE-12-0044 | Passive Sensor Materials based on Crystals | Dr. Santanu Kumar Pal | DAE | 3 Years | 16,50,000.0000 | 15,12,259.00 |
| 42 | DST-12-0045 | Logical approaches to the enantioselective synthesis o biologically active compounds | Dr. S.V. Ramasastry | DST | 3 Years | 25,25,000.0000 | 15,80,000.00 |

| | | | | | | | |
|----|-------------|--|-------------------------|----------------|---------|-------------------|-------------------|
| 42 | DST-12-0045 | Logical approaches to the enantioselective synthesis of biologically active compounds | Dr. S.V. Ramasastry | DST | 3 Years | 25,25,000.0000 | 15,80,000.00 |
| 43 | DBT-12-0046 | Welcome - DBT An investigation on the role of transcription factors Ascl1a, FoxN4, Zic2b and tumor suppressor PTEN in retina regeneration and functional analysis of pluripotency factors in the retinal stem cells. | Dr. Rajesh Ramachandran | Wellcome-DBT | 5 Years | 3,23,95,132.0000 | 2,01,16,059.00 |
| 44 | DST-12-0047 | Fabrication of mesoscopic electromechanical systems for ultra low temperature studies | Dr. Ananth Venkatesan | DST | 3 Years | 2,50,11,200.0000 | 2,16,61,600.00 |
| 45 | DAE-12-0048 | A Study of polynomials over valued fields | Dr. Sudesh K. Khanduja | DAE | 3 Years | 1,89,500.0000 | 59,500.00 |
| 46 | DST-13-0049 | Regulation on RNA splicing | Dr. Shravan K. Mishra | Max Planck-DST | 3 Years | 40,50,000.0000 | 40,99,659.00 |
| 47 | DST-13-0050 | Invariants and group actions on manifolds | Dr. Mahender Singh | DST | 3 Years | 2,16,000.0000 | 1,10,000.00 |
| 48 | ICS-13-0051 | Constructing the Nation: An Ethnographic Account of Migrant Labour on the Indo-Tibetan Border Roads | Dr. Anu Sabhlok | ICSSR | | 7,00,000.0000 | 2,80,000.00 |
| 49 | DST-13-0052 | Dynamics of non-smooth model in Ecology | Dr. Soma De | DST Fast Track | 3 Years | 16,36,000.0000 | 579000 |
| 50 | DST-13-0053 | Comological parameters: Observational aspects and theoretical issues | Dr. Harvinder K Jassal | DST | 3 Years | 16,44,000.0000 | 8,80,000.00 |
| 51 | DST-13-0054 | National Network for Mathematical and Computational Biology | Dr. Somdatta Sinha | DST | 3 Years | 49,37,000.0000 | 16,00,000.00 |
| 52 | DST-13-0055 | Magnetic moments of the N^* and low lying negative parity baryons | Dr. Neetika | DST Fast Track | 3 Years | 18,12,000.0000 | 6,70,000.00 |
| 53 | DST-13-0056 | Knot, braids and automorphism groups | Dr. K. Gongopadhyay | DST | 3 Years | 30,02,450.0000 | 16,71,950.00 |
| 54 | DAE-13-0057 | Complex Hyperbolic quasi-Fuchsian group | Dr. K. Gongopadhyay | DAE | 3 Years | 6,86,900.0000 | 1,14,500.00 |
| 55 | DST-13-0058 | Evolution of galaxies and the large-scale environments | Dr. Samriti Mahajan | DST Fast Track | 3 Years | 18,72,000.0000 | 7,10,000.00 |
| | | | | | Total | 33,15,19,771.0000 | 25,65,11,444.0000 |



Schematic of the 3D solar tracking device developed by an undergraduate student Mr. Biplob Nandy

6

Undergraduate Research

An important mission of the IISERs is to get undergraduate students interested in research and creative activities early on. Almost all the students at the BS-MS level undergo summer projects. In addition, the students undertake a 1 year project along with some coursework in the fifth year.

The past year has seen a copyright, a patent application and several publications co-authored by undergraduate students.

Biplob Nandy is a 3rd year student at IISER. As a part of his Summer Project in 2013, he built a device named as “Actinic Flux Calibration Device” with Dr. Hartwig Harder at the Max-Planck Institute for Chemistry, Mainz, Germany. This device comprised of a 3-dimensional moving robotic arm holding a photo-multiplier tube which moves in a virtual cubic array. This measures the actinic flux of a standard UV pen ray lamp in real time. The data obtained can be used in calibrating lamps for experiments in atmospheric chemistry in lesser time than needed with an actinometer. Actinometers use a chemical system to determine the number of photons per unit time which makes the process time consuming. As he was involved in designing the circuit and in VHDL programming for the same, he holds a copyright along with the Harder Group.

Biplob has also filed a single-authored patent at the Indian Patent Office on 31st December, 2013 related to an invention titled “3D Solar Tracking Using Controlled Perturbations via Sequenced Latching”.

In this patent he has described an extreme energy efficient solar tracking system/ technique whose primary objective is to provide an arrangement to install the solar tracking system on moving systems, for example, a train. This invention relates to a three dimensional solar tracking system/technique using technological applications of perturbation theory via cyclic sequenced latching using 555 timer ICs as the source for causing controlled perturbations in order to follow the sun’s trajectory up to a high degree of accuracy and self-adjusting in cases of deviations from the actual path or due to day-night cycles.

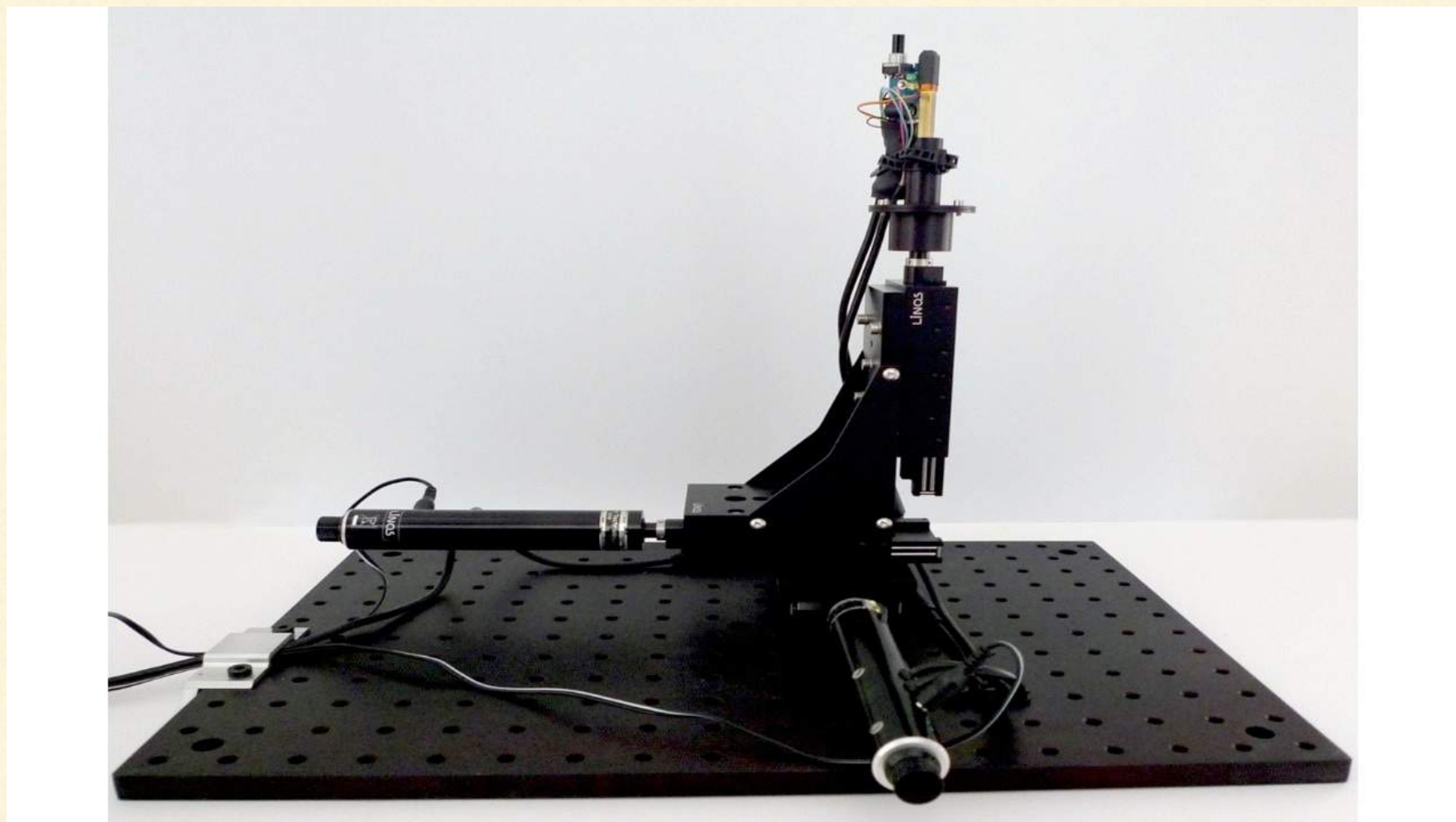


Figure: Development of instrumentation in which undergraduate students were involved.

There has been a tradition of research papers involving undergraduates. A few of them are mentioned here.

Research Papers Involving Undergraduates

Arora, P. Kumar, J. Bhagwathi, Kamal P. Singh and Goutam Sheet, Microscopic modulation of mechanical properties of transparent insect wings, Appl. Phys. Lett. 104, 063702 (2014).

Deepansh Srivastava, R. Venkata SubbaRao and Ramesh Ramachandran, Physical Chemistry Chemical Physics, 2013, 15, 6699-6713

Deepansh Srivastava and Ramesh Ramachandran, RSC Advances, 2013, 3, 25231-25236.

Tayal N, Choudhary P, Pandit SB, Sandhu KS (2014). Evolutionarily conserved and conformationally constrained short peptides might serve as DNA recognition elements in intrinsically disordered regions. Molecular BioSystems.

Jain N, Bhasne K, Hemaswasthi M, Mukhopadhyay S (2013). Structural and Dynamical Insights into the Membrane-bound α -Synuclein. PLoS One 8(12): e83752.

Nandy, B., Chakraborty, P., Vanika, G., Ali, S. Z. and Prasad, N.G. Sperm competitive ability evolves in response to altered operational sex ratio. Evolution (2013). doi:10.1111/evo.12076..

Nandy, B., Vanika, G., Udaykumar, N., Samant, M., Sen, S., Ali S.Z., Prasad, N.G. Evolution of mate-harm, longevity and behaviour in male fruitflies subjected to different levels of interlocus conflict. BMC, Evolutionary Biology 13:212.

Nandy, B., Vanika, G., Udaykumar, N., Samant, M. A., Sen, S. and Prasad, N.G. 2013. Experimental evolution of female traits under different levels of intersexual conflict in *Drosophila melanogaster*. Evolution. doi:10.1111/evo.12271.

Sarkar C., Kumar, V., Sinha, V: Massive Emissions of Carcinogenic Benzenoids from Paddy residue burning in North India, Current Science, Volume 104 (12) , pp. 1703-1709, 2013.



A painting made by the students as a part of the Science day celebrations

7

Outreach Activities

IISER Mohali remains committed to science outreach activities with a view to broaden the awareness about science and opportunities in science in various sections of society. In particular, IISER Mohali's Outreach Programme is aimed at improving the quality of science education at all levels and at inculcating the spirit of scientific enquiry among young students. The following activities were organized under the Outreach Programme:

Meet a Scientist Series with EDUSAT Punjab:

Under its Outreach activities, IISER Mohali organized a series of programmes called "Meet a Scientist" in collaboration with EDUSAT Punjab for schoolchildren. About a dozen programmes were broadcast, where students from 3000 schools from all over Punjab could interact with a scientist on Saturday mornings. The programme received a very good response and is likely to continue.

Science Teacher Training Programme:

In collaboration with the Department of Education Punjab Government, two one-day events for training of science teachers of government schools in Punjab were organized by the Outreach Centre of IISER Mohali. In the first programme on September 25, 2013, 50 teachers from the region participated and in the second programme on February 22, 2014, 100 teachers from all over the state of Punjab participated. The programme involved lectures by scientists and practical demonstrations of science experiments.

Student Group Visits



During the year 2013-14, a number of student groups at the school and college level visited IISER Mohali. These visits typically took place on Saturdays, where a few lectures, demonstrations and research laboratory visits were organized for them.

Science Day Celebration:

Science Day was celebrated this year on February 28 2014 with a program organized by our students for school students of the region. The program was coordinated under the auspices of the Outreach Centre of the institute. Around 200 school children from the region participated in the program which was advertised on the institute's website and in newspapers. The program took place in the lecture hall complex and a variety of events were organized including a science quiz. The school students were shown several demonstrations of experiments in various science laboratories and were taken to visit different research facilities in CAF. An open session of school students with scientists from IISER Mohali was organized where questions from students were answered by the faculty. A public lecture on "The Ozone Hole - History and What's Behind?" was delivered by Dr. Franz X. Meixner from Max Planck Institute for Chemistry, Mainz Germany. The Chief Guest for the programme was Professor R.N. Mukherjee, Director IISER Kolkata. The faculty coordinator for the programme was Dr Amit Kulshrestha.

Summer Research Programme:

About 40 students from different parts of the country worked at IISER Mohali with various faculty members, under the auspices of the Summer Research Programme at IISER Mohali. A fellowship of Rs 5000/- per month was awarded to these students. The programme aims at nurturing research culture in undergraduate and postgraduate students. IISER Mohali also hosted a large number of students who were selected under the Academy summer program for students and teachers.



Visitors Hostel

8

Campus Activities and Development

Library

The Library of IISER Mohali is a unique place with its rich collection of monographs and journals in Mathematics, Physics, Chemistry, Biology, Computer Science, Humanities and Social Sciences, Earth and Environmental Sciences. The collection includes textbooks for the undergraduate and postgraduate courses in the basic sciences as well as applied sciences. It also offers services like online catalogues (Web OPAC), e-journals, online full text databases, online bibliography, abstracting databases, email alerts, current awareness, document delivery, inter-library loan facilities, photocopying facilities, references, news paper clippings, science and technology news. The house keeping activities of the library are being operated through the open source library management software “Koha”. The library has added 3000+ new books, journals and databases from various publishers. The Library has organized three user oriented Hands-on Workshops on resources and services being provided by the Library. The library continues to function from a temporary building, but is expected to shift soon to the Informatics centre - a building with three centers designed for clusters of a computer centre, learning centre and informatics centre. The building is nearing completion.

A bit of statistics related to the library is as follows: 1,156 new books added, 29803 books issued and consulted, 22495 readers visited library; 12000+ users visited library website, 12482 articles supplied under document delivery, 15 books taken on Inter library loan through DELNET.

Apart from above regular services, the library has carried out additional services which include:

(1) Publication of an annotated bibliography of IISER Mohali research publications during 2007-2012. All articles, book chapters and books published by IISER Mohali since inception to Dec. 2012 were collected, verified with original sources and compiled as a publication with bibliographical details as “Author Year title subtitle-Source Volume Number pagination abstract keywords URL DOI” for the use of re-

search scholars. This was released by Professor K. K. Talwar, Chairman, Board of Governors on May 24, 2013.

(2) An analysis of research and development performance of IISER Mohali from 2007-2012 was also undertaken and published. The performance of the institute was analyzed on the broad characteristic features of publication output of IISER Mohali during 2008-2012, using quantitative and qualitative indicators by focusing on its publication growth, characteristics, format and media of communication, research impact and quality, patterns of national, international research collaborations, broad and narrow subject areas of research and contribution and citation impact of its authors etc.

(3) Institutional Repository/Archival: The library has created an Institutional Repository by using open source digital management software “Dspace” and uploaded full text of all articles published by IISER Mohali during 2007 to 2012 including all MS and PhD theses and reports of the institute. IISER Mohali’s photo album with flipping pages for 2013 and videos of institute functions are also uploaded in the repository. Professor P. Balaram, Director, IISc Bangalore, launched this repository of the institute’s knowledge during the foundation day celebration on September 27, 2013.

Several other publications have also emanated from the library and are listed under the publications section (page 50).

Health Centre

The Health centre started functioning in August 2012 in the shopping complex area of the campus. Nearly 4000 OPD registrations were done in the year 2013. All essential medicines are being dispensed at the health centre. Recently, in March 2014, two staff nurses were recruited. The furnishing of the new Health centre building is under process and will be functional soon.

Visitors Hostel

Among the buildings that were completed during this year are the Visitors Hostel, an 8-storied building for visitors that has 108 rooms and should enable us to house a large number of visiting faculty as well as conference delegates.

Hostel 8

The students Hostel 8 was also inaugurated this year. This is the third of the four hostels constructed in the current phase and with the completion of this hostel, the immediate shortage of rooms was adequately taken care of. Hostel 6 should also be completed soon. The other two hostels, the first to be constructed are Hostel No. 5 and Hostel No.7

Shopping Complex and Restaurant

The shopping complex and restaurant of Phase-I of the shopping complex were also completed earlier. It functions with a few shops, a saloon and a restaurant. The Canara Bank has opened office here, and the Health centre is also currently located at this venue, but will soon shift to a dedicated Health centre coming up on campus. An eating outlet has also opened in the Lecture Hall complex



Snapshots of the three conferences held at IISER, Mohali.

9

Conferences and Symposia

Mini-Symposium: Ubiquitin Systems and Cellular Processes (17-18 October 2013)

The department of biological sciences (DBS) organized a kick-off symposium titled “Ubiquitin Systems and Cellular Processes” from October 17-18, 2013, to initiate a Max Planck - DST partner group, headed by Shravan Kumar Mishra at IISER Mohali.

The symposium had fourteen lectures covering various cellular processes with ubiquitin systems being the central theme. The speakers were from Bose Institute Kolkata, IMTECH Chandigarh, University of Paris, TIFR Bombay, JNCASR Bangalore, NII Delhi, CDFD Hyderabad and the IISERs (Bhopal, Thiruvananthapuram, Pune and Mohali). The speakers discussed their current research work on topics related to cellular processes in lysosome and endoplasmic reticulum, in addition to functions and mechanisms of ubiquitin and ubiquitin-like proteins in cellular signaling, autophagy



etc. The number of registered participants for the symposium was more than 150, which included students and researchers from IISER Mohali and various other institutions in India.

Annual meeting of the Indian Academy of Sciences, Bangalore held in Chandigarh and Mohali from November 8-10, 2013

The 79th Annual meeting of the Indian Academy of Sciences, Bangalore was held in Chandigarh- Mohali 8-10 November. The meeting was jointly hosted by three institutions of the region- Punjab University, Chandigarh, Institute of Microbial Technology, Chandigarh, and IISER Mohali. Punjab University hosted the inaugural programme on the first day, November 8th, IMTECH hosted the second day on November 9th, and the final day was hosted at IISER Mohali.



History of Chemistry in India 15 November, 2013

A History of Science Seminar on "History of Chemistry in India" held at IISER Mohali on 15, November, 2013 under the aegis of the Indian National Science Academy. Topics included the researches of Acharya PC Ray (A Chakravorthy, D Raina), the history of natural products chemistry (K Natara-jan), the history of medicinal chemistry (Harkishan Singh), the history of physical chemistry (K Bhattacharyya) and electrochemistry (AK Shukla) and the struggles of the Indian Organic Industry (AV Rama Rao). A public lecture was also delivered on "The interplay between the Arts and Technology in Ancient Indian Metallurgical Traditions" by S. Rangana- than, Distinguished Professor, Department of Materials Engi- neering, IISc, Bangalore.

Knot theory and its application at IISER Mohali during De- cember 10-20, 2013.

An International Center for Theoretical Sciences (ICTS) Pro- gram: ADVANCED SCHOOL AND DISCUSSION MEETING ON KNOT THEORY AND ITS APPLICATIONS was held at IISER Mo- hali during December 10-20, 2013. The organizing commit-

tee consists of Krishnendu Gongopadhyay from IISER Mohali, M. Prabhakar from IIT Ropar and Rama Mishra from IISER Pune. The scientific committee includes Kapil Paranjape from IISER Mohali, Louis Kauffman from Illinois, Akio Ka- wauchi and Seiichi Kamada from Osaka City University, Ja- pan.

The program was centered around Knot theory and its appli- cations to various disciplines of mathematics and other ar- eas of science. Due to its applications in other disciplines, Knot theory has acquired an important place in terms of re- search globally. However, this area has not been so strongly studied in India. The aim of this program is to provide expo- sure of this subject to young researchers in India and en- thusiase them to work on knot theory.

The program had two components: December 10--15 there was an advanced school. The advanced school was aimed mainly at graduate students and young researchers who are either working or want to work in knot theory and related areas. It was divided into six series of three lectures (one hour each) along with two tutorials on each topic adding up to 18 lecture hours and 12 tutorial hours. The topics in- clude: Combinatorial Knot theory, Knot Quandles, Knot ho- mologies, Surface knots, Knot theory and 3-manifolds, Knot invariants.

The discussion meeting during December 16-20, 2013 was meant for connecting the lecture topics of the school to ac- tive research areas and lead to the frontiers of current re- search and trends in knot theory and its applications. The chosen topics covered the latest developments in these ar- eas. The program involved renowned researchers from around the globe as well as enthusiastic young graduate and post-doctoral students. There were total 65 participants in the program.

32nd meeting of the Astronomical Society of India, March 20-22nd, 2014, IISER Mohali, India.



The 32nd meeting of the Astronomical Society of India was held at IISER Mohali during March 20-22, 2014. A total of 300 participants attended the meeting and the two satellite workshops held on March 19: one day before the main meeting.

The two workshops were: 'Science with the Square Kilometre Array', and 'Gravity Waves', both held on March 19, 2014, IISER Mohali.

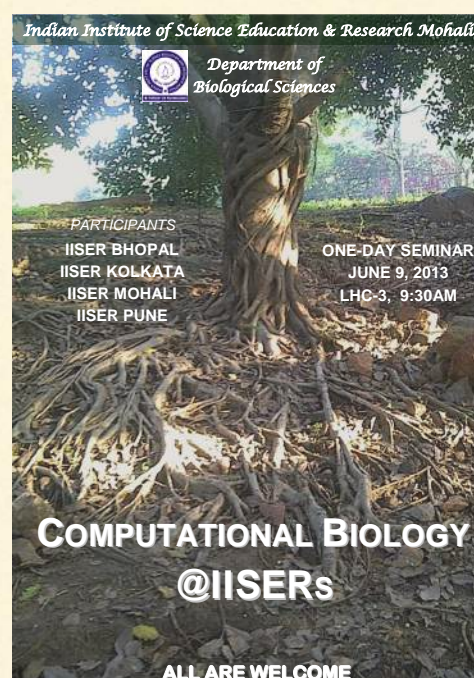
The ASI meeting had twelve (12) plenary lectures in two broad themes: mega projects in astronomy, and, polarization in astrophysical radiation. There were a total of sixty (60) presentations of contributed papers in parallel sessions and more than 150 poster paper presentations. The meeting included special sessions on history of astronomy, astronomers for tomorrow, and, gender issues. The theme of the session on astronomers for tomorrow was teaching and outreach. More than thirty student volunteers helped in the organisation of the meeting. The meeting also had presentations of PhD thesis.

Several awards including best thesis presentation award, Justice Oak best thesis medal, Young astronomer award, best poster award and the Vainu Bappu medal were announced at the meeting. The meeting was sponsored by the Astronomical Society of India with significant contributions from several research institutes: Indian Institute of Astrophysics (IIA) Bangalore, Aryabhata Institute of Observational Sciences (ARIES) Nainital, Inter-University Centre for Astronomy and Astrophysics (IUCAA) Pune, Raman Research Institute (RRI) Bangalore, Tata Institute of Fundamental Research (TIFR) Mumbai, National Centre for Radio Astrophysics (NCRA) Pune, Physical Research Laboratory (PRL) Ahmedabad, and, IISER Mohali. The local organizing committee for this meeting was chaired by Professor J S Bagla with the following members: Drs. Abhishek Chaudhuri, Harvinder Kaur Jassal, J S Bilga, Rajeev Kapri, Sanjeev Kumar and Yogesh Singh.

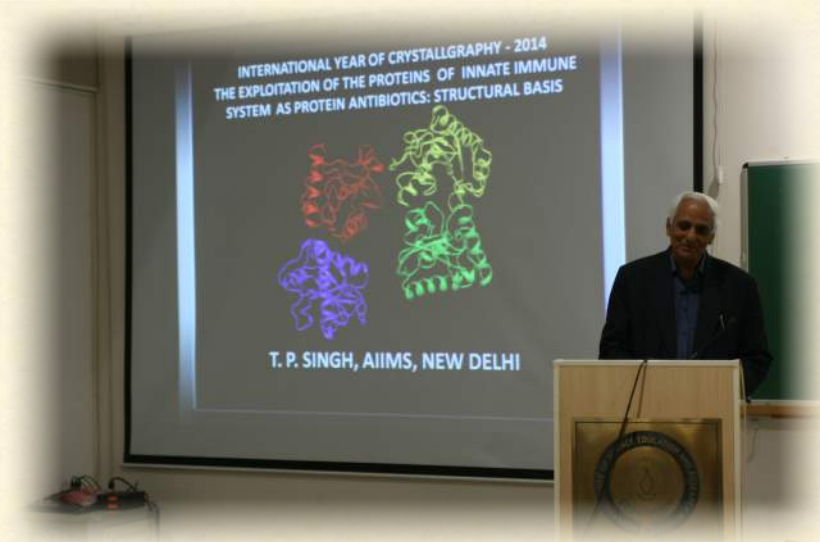
National Seminar on Crystallography

The National Seminar on Crystallography 43A was held at Indian Institute of Science Education and Research, Mohali during 28th and 30th March, 2014 by the Department of Chemical Sciences. This conference was organized as a part of the celebration of International Year of Crystallography 2014 (IYCr2014) to mark the 100th year since the award of Nobel prize in 1914 to Max von Laue for his discovery of diffraction of X-rays by crystalline materials. This conference was approved. The Local Organizing Committee (LOC) was chaired by Angshuman Roy Choudhury and included Sugumar Venkatramani and Dr Sanjay Singh and other departmental colleagues. The seminar was attended by about 100 par-

ticipants, which included three plenary speakers, 19 invited speakers and many research scholars across the country. The plenary speakers (Professors Tej P. Singh, T. N. Guru Row and Professor Roland Boese) talked on their work for the past couple of decade and highlighted the essence of their contribution towards X-ray crystallography. Professor Sekhar C. Mande from NCCS, Pune discussed the History of X-ray crystallography on the second day of the conference. The seminar had invited speakers from IIT Delhi (Professor Arunachalam Ramanan), IISc (Professor K. Suguna, Professor Parthasarathi Mukherjee, Dr. P. Thilagar), IISER Pune (Dr. R. Boomishankar and Dr. R. Vaidyanathan), IISER Thiruvananthapuram (Dr. R. Natesh), NCBS (Dr. Dipak T. Nair), Univ. of Madras (Professor D. Velmurugan), Shiv Nadar University (Dr. Parthapratim Munshi and Dr. Debdas Roy), Poornaprajna Institute of Scientific Research (Dr. Nalini G. Sundaram). In addition to the invited lectures, there were several poster presentations by PhD students in the conference. Four awards were given to PhD students for their oral and poster presentations.



A workshops on "Computational Biology@IISERs", was organized by Somdatta Sinha on June 9, 2013.



10

Seminars and Colloquia

Seminars

1. April 1st, 2013 Dr. Ruchira Sen, Purdue University, USA "The dynamics of symbiont mediated crop protection by attine ants"
2. April 1st, 2013 Dr. Swagat Mohapatra "N-Doping of Organic Electronic Materials Using Air-Stable Organometallics"
3. April 2nd, 2013 Dr. Gopala Krishna Darbha, Institute of Nuclear Waste Disposal, Karlsruhe Institute of Technology, Germany, "DETECTION OF CONTAMINANTS IN THE ENVIRONMENT AND PREDICTION OF THEIR TRANSPORT IN THE SUBSURFACE ENVIRONMENT"
4. April 2nd, 2013 Dr. Rhitoban Ray Choudhury, Purdue University, USA, "Genetics and Genomics of Insect Symbionts"
5. April 2nd, 2013 Dr. Neelam Chauhan, National Central University, Taiwan, "Star formation in the vicinity of the HII regions"
6. April 2nd, 2013 Prof. P. T. Manoharan, INSA Senior Scientist Department of Chemistry IIT Chennai, "Influence of Temperature Dependant Ligand Dynamics on Change of Spin States in Cu(II) and Fe(II) in Complex Moiety in Solid State"
7. April 2nd, 2013 Dr. S Arivazhagan, Department of Geology, Periyar University, "Reflectance spectra of analog rocks and implications for lunar exploration"
8. April 3rd, 2013 Sanjeev Sharma, Research Associate, Humanities & Social Sciences, IISER, Mohali, "Voices from high altitudes: Understanding impacts of climate change in Himachal Pradesh"
9. April 4th, 2013 Dr. Kailash C. Jena, Institute of Bioengineering École Polytechnique Fédérale de Lausanne, Switzerland, "Nonlinear light scattering spectroscopy and its relevance for probing the biological molecules at hidden soft matter and planar interfaces"

10 April 5th, 2013 Professor Mangala Narlikar, "Weird dice of Sicherman and unique factorization of polynomials"

11 April 8th, 2013 Dr. Gyan Prakash, BITS Pilani, "The Enigma of Mind and Body Relation: A Buddhist Approach to Rylean Problem"

12 April 10th, 2013 Dr. Amit Nag, Beyond diffraction limit of "Many electrons moving but strongly avoiding each other"

12a April 11th, 2013 Dr. Parth R. Chauhan, Department of Archaeology & Ancient Indian History, M.S. University of Baroda INDIA, "Pursuing human evolutionary studies in India: An inter-disciplinary perspective"

13. April 12th, 2013 Dr. Abrar Qurashi, Mount Sinai School of Medicine, New York USA, "Genetics and Genomics Non coding RNA-mediated neurodegeneration in fragile X-associated tremor/ataxia syndrome"

14. April 15th, 2013 Dr. Manvendra K. Singh, University of Pennsylvania, Philadelphia USA, "Role of Semaphorin3D in Cardiovascular development and disease"

15. April 15th, 2013 Dr. R. Vijayaraghavan, TIFR, "SUPERCONDUCTING CIRCUITS FOR QUANTUM INFORMATION PROCESSING"

16. April 15th, 2013 Dr. Sabyasachi Rakshit, Iowa State University, "Measuring force-induced kinetics of cadherin binding at the single molecule level"

17. April 15th, 2013 Dr. Bhavna Bhalla, Institute of Management Technology Ghaziabad, "Understanding Communication through Indian Knowledge Tradition"

18. April 16th, 2013 Dr. P. Morthekai, National Geophysical Research Institute, Hyderabad, "Optically Stimulated Luminescence and its Applications"

19. April 16th, 2013 Dr. Surajit Paul, IUCAA, "Blast wave formation in galaxy cluster mergers and its role in evolution of energy and structures at large scales"

20. April 16th, 2013 Dr. Viswanathan S Saji, "Electrodeposition for efficient and economic non-vacuum processed CuIn (1-x)Ga_xSe₂ (CIGS) solar cells"

21. April 18th, 2013 Dr. Alison Pischedda, University of California, Santa Barbara, USA, "Investigating sexual selection and sexual conflict in the *Drosophila melanogaster* model system"
22. April 18th, 2013 Dr. B. Kundu, National Geophysical Research Institute, Hyderabad, "Tectonic Geodesy revealing geodynamic complexity of the Indo-Burmese arc region, NE-India"
23. April 18th, 2013 Dr. Rampal Pandey, "Chemical Sciences"
24. April 19th, 2013 Prof. Ravi S. Kulkarni, IIT Bombay, "z-classes in p-groups"
25. April 22nd, 2013 Dr. Asif Qureshi, Department of Environmental Health, Harvard University, USA, "Global environmental cycling of mercury: using science to help inform policy"
26. April 23rd, 2013 Dr. Manjari Jain, National Institute of Advanced Studies (NIAS), Bangalore, "In pursuit of silence: communication in complex and noisy acoustic environments"
27. April 23rd, 2013 Prof. Francois Labourie, Département de Mathématique d'Orsay, "Cross ratios and surface groups"
28. April 26th, 2013 Prof. Indranil Biswas, TIFR Bombay, "A construction of universal connection"
29. April 30th, 2013 Dr. Sanjay Singh, UGC-DAE CSR Indore, "Structural and Magnetic Properties of Ni-Mn-Ga Ferromagnetic Shape Memory Alloys"
30. May 8th, 2013 Prof. Somdeb Lahiri, Pandit Deendayal Petroleum University, School of Petroleum Management, Gandhinagar, "Voluntary provision of a public good in a strategic market game"
31. May 14th, 2013 Dr. G. Gopakumar, Max-Planck-Institut für Kohlenforschung Computational Studies: From Clusters to Catalysis
32. May 16th, 2013 Prof. Utpal Nath, Department of Microbiology and Cell Biology, Indian Institute of Science, Bangalore, "Direction no bar: multiple growth polarity during leaf morphogenesis and its control by a micro RNA"
33. May 20th, 2013 Dr. P. Balanarayan, Israel Institute of Technology, Haifa 32000, Israel, "Atoms and Molecules: structure, reactivity and interactions with a laser"
34. May 28th, 2013 Dr. Bhaskar Kaviraj, NIMS Japan, "Noise Correlations in Three-Terminal Diffusive Superconductor-Normal Metal-Superconductor Nanostructures"
35. May 30th, 2013 Dr. Geetanjali Chawla, Indiana University Bloomington, IN, USA, "Regulation of *Drosophila* let-7-Complex miRNAs and their role in neurodegeneration"
36. June 4th, 2013 Dr. Sakya Sen, "Chemistry of functionalized silylenes and inter-connected bis-silylene"
37. June 11th, 2013 Dr. Suman Maji, "Implication of a tricopper centre at the active site of particulate methane monooxygenase"
38. June 12th, 2013 Dr. Shahnaz Lone, Johns Hopkins University, USA, "Circadian regulation of male driven sociosexual interactions in *Drosophila melanogaster*"
39. June 13th, 2013 Dr. Biplab Biswas, Karlsruhe Institute of Technology, Germany, "A Magneto-Structural Study on Polynuclear Metal Complexes"
40. June 17th, 2013 Dr. Somendra Nath Chakraborty, "Understanding Formation of Methane Hydrates using Molecular Simulations"
41. June 21st, 2013 B.G. Manjunath, "Recent results on Gaussian Distribution"
42. June 25th, 2013 Dr. Tarak Nath Burai, Ultrafast Photo-processes in Neat Solutions and Microheterogeneous Media
43. June 26th, 2013 Prof. Rajaram Nityananda, The global geometry of polarised light- a tale of two spheres
44. June 27th, 2013 Dr. Niraj Kumar, UCSD, Stochastic thermodynamics: Efficiency at maximum power
45. July 8th, 2013 Dr. D. V. Senthilkumar, Potsdam Germany, Synchronization in networks of time-delay systems
46. July 9th, 2013 Dr. Saroj L. Samal, Intermetallics: Complex, Metallic and Diverse Chemistry. Case Studies in Ca-Pt-Cd and R-Mn-Au Systems
47. July 17th, 2013 Dr. B. K. Mishra, Umea University, Sweden, "CH- π interaction : Substituents' influence"
48. Aug 1st, 2013 Dr. M. Shanmugam, Northwestern University, Evanston-60202, IL-USA, Modeling of Magnetic Data of Family of Tetranuclear Clusters
49. Aug 2nd, 2013 Prasenjit Guptasarma, Department of Physics, University of Wisconsin Milwaukee, WI, USA, Magnetoelectric Behavior in Complex Oxides
50. Aug 7th, 2013 Rohit Dilip Holkar, University of Goettingen, Groupoids with Haar system and their C^* -algebras
51. Aug 7th, 2013 Raghu Mahajan, Stanford, Non-Fermi liquids and the Wiedemann-Franz law
52. Aug 8th, 2013 Dr. Srikanth Hundi, IISc Bangalore, Phenomenology of extra dimensions and supersymmetry in relation with neutrinos
53. Aug 12th, 2013 Dr. Shyamal Biswas, IIT Kanpur, Unified theories on the magnetism and on the critical Casimir force
54. Aug 13th, 2013 Dr. Tamoghna Mitra, University of Liverpool, Gas Storage and Separation in Porous Material
55. Aug 14th, 2013 Prof. Praveen Chaddah, Director, UGC-DAE Consortium for Scientific Research, Indore, Metastable states avoiding first order phase transitions
56. Aug 14th, 2013 Prof. E. Arunan, Inorganic and Physical Chemistry Department Indian Institute of Science, Bengaluru, Molecular beam microwave spectroscopy: Understanding hydrogen bonding and defining carbon bonding
57. Aug 19th, 2013 Dr. Elangovan Elamparuthi, LMU Munchen, Germany, "Synthesis and studies of C-2-functionalized sugar & Neuritogenic natural products"
58. Aug 30th, 2013 Prof. Jainendra Jain, Penn State Univ, Composite Fermions: The Magical Beauty of Emergence
59. Aug 30th, 2013 Dr. Puneet Sharma, IIT Jodhpur, Chaotic Behaviour and Structural Stability for TDS and the Induced System
60. Sept 6th, 2013 Dr. Srijanani Anurag Prasad, ISI Delhi, A special fractal interpolation function
61. Sept 11th, 2013 Prof. P. Gautam, Centre for Biotechnology, Anna University, Chennai, Molecular dynamics simulations of Lipases
62. Sept 12th, 2013 Dr. Alok Kumar Pan, Nagoya University, Japan, "Aspects of weak measurement: Conceptual and metrological implications"
63. Sept 18th, 2013 Dr. Jyoti Agarwal, Sugar-based Organocatalysts and Co(III) salen complexes for Asymmetric Synthesis
64. Sept 20th, 2013 Dr. Bhaskar Kundu, CSIR National Geophysical Research Institute, Uppal Road, Hyderabad, Geodynamics of the Indo-Burmese arc region, NE-India
65. Sept 30th, 2013 Dr. Tanmoy Mondal, Structure and dynamics at threefold electronic degeneracies
66. Oct 4th, 2013 Dr. Parthasarathi R., IISER Pune, "Moduli of vector bundles"
67. Oct 4th, 2013 Dr. Nirvikar Dashora, National Atmospheric Research Laboratory, Department of Space, Govt. of India, Applications for Earth and Atmospheric Science: GNSS perspective
68. Oct 10th, 2013 Dr. Sujoy Kanti Ghosh, ETH Zurich, The role of water in the deep mantle
69. Oct 14th, 2013 Dr. Kiran Bala, IIT Indore, A renewable source of energy with sustainable solution for wastewater treatment
70. Oct 17th, 2013 Dr. C.S. Pandey, Institute of Geology, Mineralogy and Geophysics, Ruhr University Bochum, Germany, On the Elastic Properties of Minerals and Geomaterials by the aid of Resonant Ultrasound Spectroscopy
71. Oct 23rd, 2013 Prof. Deepak Mathur, TIFR Mumbai, Adventures on the interface of physics, chemistry, biology and engineering

72. Oct 24th, 2013 Prof John Ogilvie, Simon Fraser University, Vancouver Canada, Photochemistry of methane at 3 K
73. Oct 24th, 2013 Dr. Bhavin Moriya, HRI Allahabad, Some Weighted Zero Sum Problems
74. Oct 26th, 2013 Dr. Parthapratim Munshi, Shiv Nadar University, Noida, High-resolution Crystallographic Studies on Small Molecules and Protein Systems
75. Oct 28th, 2013 Dr. Harendra Negi, Snow & Avalanche Study Establishment, DRDO, Remote Sensing Applications for Cryospheric Study
76. Oct 29th, 2013 Dr. Paromita Chakraborty, Dept Of Civil Engg/ SRM Research Institute, Tamil Nadu, Measuring and Modeling of Persistent Organic Pollutants in India: Implications for Trans-boundary Movement and Human Health Risk Assessment
77. Oct 31st, 2013 Dr. Mohanakrishna Gunda, Laboratory of Environmental Biotechnology (INRA-LBE), Institut National de la Recherche Agronomique (INRA), Narbonne, France Renewable Bio-Energy Generation through Remediation of Effluents and Emissions: Process Integration Approaches to Develop Sustainable Technology
78. Nov 5th, 2013 Dr. Aditya Peketi, Physical Research Laboratory, Ahmedabad India, Sedimentary iron-sulfur-carbon systematics : Role of sediment biogeochemistry and methane hydrate
79. Nov 6th, 2013 Dr. K. Brindha, International Water Management Institute, Vientiane, Lao P.D.R. "Groundwater quality and geochemical modelling"
80. Nov 6th, 2013 Prof. K.L. Sebastian, Department of Inorganic and Physical Chemistry, IISc Bangalore, Coherences, Photosynthesis and Quantum Biology?
81. Nov 8th, 2013 Prof. G. Mugesh Department of Inorganic and Physical Chemistry Indian Institute of Science, Bengaluru, Functional Mimetics of Selenoenzymes
82. Nov 8th, 2013 Prof. R. Ramaraj, School of Chemistry, Centre for Photoelectrochemistry Madurai Kamaraj University, Madurai-625 021, Nanostructured Materials Modified Electrodes for Catalysis and Sensor
83. Nov 11th, 2013 Prof. H. Ila JNCASR, Bengaluru, "Molecular Diversity by Design: New Strategies for Heterocycle Synthesis"
84. Nov 11th, 2013 Prof. B. V. Rajarama Bhat, Indian Statistical Institute, Bangalore, Nilpotent completely positive maps
85. Nov 11th, 2013 Dr. Debabrata Maiti, Indian Institute of Technology, Bombay, AN EFFICIENT AND STEREOSELECTIVE NITRATION OF OLEFINS BY AgNO₂ AND TEMPO
86. Nov 21th, 2013 Dr. Jayanarayanan Kuttippurath, CNRS/LATMOS, University of Pierre and Marie Curie, Paris, France, Climate Change and Ozone
87. Nov 22nd, 2013 Prof. Satrajit Adhikari, Physical Chemistry Department, I.A.C.S, Jadavpur, Beyond Born - Oppenheimer Theories: Diabatic PESs for Spectroscopic & Scattering Processes
88. Nov 22nd, 2013 Dr. K. Mohan, Division of Geology and Geotechnical Engineering School of Mechanical and Building Sciences VIT Chennai, Late Neogene deep-sea benthic foraminifera from Gas Hydrate sediments of the Blake Ridge, NW Atlantic Ocean
89. Nov 22nd, 2013 Dr. Kuntal Banerjee, HRI, Arnol'd Tongues and Circle Homeomorphisms
90. Nov 25th, 2013 Dr. Chaithanya Jain, Institut de Combustion Aérothermique Réactivité et Environnement (ICARE), CNRS-Orléans, France Atmospheric chemistry studies in the laboratory and their applications
91. Nov 26th, 2013 Dr. Bibhash Nath, School of Geosciences, University of Sydney, Sydney NSW 2006, Australia, Contaminant dynamics in the hydrosphere: the role of Natural and Anthropogenic processes
92. Dec 2nd, 2013 Prof. Burkhard Koenig, Institut fuer Organische Chemie, Universitaet Regensburg D-93040 Regensburg, GERMANY, Chemistry with light
93. Dec 4th, 2013 Prof. B. M. Deb IINSA, New Delhi and Visva-Bharati University, Santiniketan, Interaction of Quantum Systems With Intense Laser Fields and Strong Magnetic Fields
94. Dec 17th, 2013 Dr. Pierluigi Belli, INFN Rome, Italy, Investigations on Dark Matter by DAMA/LIBRA and results on some other rare processes
95. Dec 20th, 2013 Dr. Gurinder Pal Singh, IBM, San Jose, Power of Innovation
96. Dec 24th, 2013 Dr. Samit Bhattacharyya, Population dynamic consequences of human response to infectious disease - Theory and Models
97. Jan 6th, 2014 Dr. Amit K. Chakraborty, Associate Professor and Head Carbon Nanotechnology Laboratory, Department of Physics, and Centre of Excellence in Advanced Materials, NIT Durgapur WB, India, Carbon Nanotube, Graphene and Beyond
98. Jan 7th, 2014 Dr. B. Ramprasad, University of Southern California, Modelling Biological functions using computer simulations: Approaches, limitations, and good practices"
99. Jan 9th, 2014 Dr. Supratim Banerjee, University of Duisburg-Essen Germany, Self-assembly of Functional Molecules: Supramolecular gels, Vesicular Chemosensors and pH-responsive Materials
100. Jan 15th, 2014 Prof. Sam P. de Visser, Manchester Institute of Biotechnology and School of Chemical Engineering and Analytical, Science, the University of Manchester, UK. Nonheme iron(IV) enzymes: Unusual mechanism and reactivity of wild-type and bioengineered systems
101. Jan 16th, 2014 Dr. Aniruddha Paul, Rice University, Houston, TX, USA. Light at Nanoscale: Localized and Propagating Surface Plasmons and Optical Waveguiding
102. Jan 20th, 2014 Dr. Samit Guha, University of Göttingen, Design of Artificial Molecular and Ion Recognition Systems
103. Jan 23rd, 2014 Dr. P. Ragupathy, Electrochemical Energy Storage and Conversion: Great Challenges and Opportunities
104. Jan 24th, 2014 Dr. Ashwin S. Pande, KK-Monopoles: A study using Topological T-duality
105. Jan 27th, 2014 Dr. Sounak Roy, Environmental Catalysis: From Mechanism and Materials Properties to Catalytic Performance
106. Jan 27th, 2014 Dr. Prabhat Arya, Prof. and Head Department of Organic and Medicinal Chemistry, Dr. Reddy's Institute of Life
- "Chemical Biology: Exploring Novel Chemical Space to Search for Modulators of Signaling Pathways
107. Jan 30th, 2014 Dr. Umaprasana Ojha, Polyisobutylene based biomaterials
108. Feb 12th, 2014 Dr. E. S. Shibu, Graduate School of Optics, University of Bordeaux 1, Talence 33405, Bordeaux, France, Nanomaterials in biology: New tools for sensing, delivery, imaging and therapy
109. Feb 13th, 2014 Dr. N. Subramanian, Indira Gandhi Centre for Atomic Research Kalpakkam 603102, Nanomaterials in biology: New tools for sensing, delivery, imaging and therapy
110. Feb 14th, 2014 Dr. Jaswant Yadav, NAOC Beijing, Environmental dependence of galaxy properties
111. Feb 14th, 2014 Dr. Gopinath Meenakshi Sundaram, Biopolis, Singapore "Non-coding and coding function of a single mRNA dictates skin homeostasis in wound healing and cancer"
112. Feb 14th, 2014 Dr. M. Anji Reddy, Metal Fluorides for Advanced Energy Storage
113. Feb 17th, 2014 Prof. William L Hase, Department of Chemistry & Biochemistry, Texas Tech University, USA, Direct Dynamics Simulations of Gas-Phase SN₂ Nucleophilic Substitution Reactions
114. Feb 17th, 2014 Dr. Jeyakumar Kandasamy, Max-Planck Institute of Colloids and interfaces, Berlin, Germany, AUTOMATED SYNTHESIS OF OLIGOSACCHARIDES: A RAPID ACCESS TO GLYCANS
115. Feb 14th, 2014 Dr. Gopinath Meenakshi Sundaram, Biopolis, Singapore, Classical Reciprocity Laws : a Recreation
116. Feb 20th, 2014 Dr. Manik Mandal, Department of Chemistry, Lehigh University, Bethlehem, PA 18015, USA, DESIGNED SYNTHESIS OF LARGE-PORE PERIODIC MESOPOROUS ORGANOSILICAS MATERIALS"
117. Feb 24th, 2014 Dr. Alok D. Bokare, School of Environmental Sci. and Engg., Pohang University of Science and Technology, South Korea, Activation of Reactive Radical Species for Advanced Water Treatment

118. Feb 25th, 2014 Dr. Mohan Ravichandran, Bilgi University, Diagonals of operators and convexity in operator algebras
119. Feb 26th, 2014 Dr. Pallavi Chattopadhyay, National Geophysical Research Institute, Hyderabad India
120. Feb 26th, 2014 Prof. Ravi Mahalingam, Department of Neurology, Anshutz Medical Campus, University of Colorado, Denver, USA, Herpes viruses: the guests that come home but never leave"
121. Feb 26th, 2014 Professor Sujatha Ramdorai, University of British Columbia, Milnor's conjecture
122. Feb 27th, 2014 Dr. Sanjayan Gangadhar, Division of Organic Chemistry, NCL Pune, Unlocking the function and properties of ORGANICS: Non-covalent forces hold the key
123. Feb 28th, 2014 Professor Chandan Singh Dalawat, Classical Reciprocity Laws : a Recreation
124. March 4th, 2014 Dr. Rupashree Balia Singh, National Institute of Advanced Industrial Science and Technology, Tsukuba Japan, An Insight into the Realm of Photoinduced Processes: Attempt at Understanding the Concept, the Types and their Applications
125. March 4th, 2014 Dr. Sutapa Rai, IISER Kolkatta, Spatial and Temporal Variation of Natural and Anthropogenic Contaminates: Source, Sink and Management
126. March 5th, 2014 Prof. Samir Kumar Pal, S.N.Bose National Centre for Basic Sciences, Kolkata, Focusing on Research in Cross-disciplinary Areas for Clean Water, Green Energy and Affordable Healthcare: A Spectroscopic Survey
127. March 6th, 2014 Prof. Sandeep Kumar, Raman Research Institute, C.V. Raman Avenue, Bangalore, Nanoparticles in Discotic Liquid Crystals
128. March 6th, 2014 Dr. Ramesh R. Kale, Application of carbohydrates for the specific detection of pathogens"
129. March 26th, 2014 Dr. Sarita Azad, School of Basic Science Mathematics, IIT Mandi India , Analyzing Indian Monsoon Rainfall: A Time Series Statistical Approach
130. March 27th, 2014 Dr. Moumita Majumdar, Universität des Saarlandes, Germany, Fraternal Relationship between Silicon and Carbon"
131. March 31st, 2014 Elango Munusamy Department of Chemistry & Biochemistry, University of Arizona, USA, "Temperature Dependence of Chemical and Biophysical Rate Processes: Phenomenological approach to deviations from Arrhenius law"

Colloquia

1. April 11th, 2013 Prof. T. V. Ramakrishnan, BHU & IISc, "Many electrons moving but strongly avoiding each other"
2. April 19th, 2013 Prof. G Rajasekran, CMI, "Neutrinos and INO"
3. Nov 6th, 2013 Prof. Madan Rao, RRI, NCBS, Mechanics of information processing and computation in cells
4. Nov 11th, 2013 Prof. N. Mukunda, CHEP, IISc, Pancharatnam, Bargmann and Berry Phases - a retrospective" "LH3, Lecture Hall Complex
5. Nov 27th, 2013 Prof. Michael Baer, The Fritz Haber Research Center for Molecular Dynamics, The Hebrew University of Jerusalem, Israel, The Born-Oppenheimer Approach and Molecular Fields
6. Feb 26th, 2014 Prof. R. Rajaraman, JNU, The Prospects and Problems of Nuclear Energy in India
7. March 5th, 2014 Franz X. Meixner, Max Planck Institute for Chemistry, Mainz, Atmospheric reactive nitrogen and the role of surface-exchange of nitric-oxide between plants, soils and the atmosphere
8. March 26th, 2014 Prof. G. Date, IMSc Chennai, Why a Quantum theory of Gravity

Opportunity Cell Talks

1. Talk by Shell Technology Centre Bangalore, August 6, 2013. The talk was about the Shell Sponsored PhD Program in Computational Sciences and internship programs at Shell Technology Centre, Bangalore. Two of our Students Sudeep Maheshwari and Nishtha Agarwal were selected for a 9 months internship at Shell Bangalore.
2. Talk by Campus France. A representative from Campus France visited IISER Mohali and talked about research and educational opportunities for our students in France. Title: Higher Studies in France/ Scholarship opportunities in France. September 25, 2013.
3. Mr. K. P. Madhu of IISER Pune visited IISER Mohali and gave two talks on science media education and science communication. Talk 1: Science Communication - besides learning, teaching and doing science? March 8, 2014. Talk 2 Perspectives on Research in Communication Theory and Practice. March 9, 2014.
4. Talk by Azim Premji Foundation. The AP foundation gave a talk via NKN facility, April 11, 2014 regarding job opportunities at their teaching facility.
5. An Interactive session with the graduating MS09 batch was organised by Opportunity Cell on April 17, 2014. The graduating batch shared their experiences on applying to MS/PhD programs in India and abroad.



11

Events, Occasions, Special lectures

INSA Oration Lecture

Professor Rajesh Kochhar, Honorary Professor, IISER Mohali, and Panjab University, and, former Director NISTADS (CSIR), Delhi) delivered the Indira Gandhi Prize for Popularization of Science Oration (2013) on February 18, 2014. The award is given by the Indian National Science Academy. Director IISER Mohali, Professor N. Sathya-murthy chaired the event.



Republic Day and 66th Independence day celebrations 2014

Republic Day and the Independence day were celebrated at IISER Mohali sector 81 campus. On the occasion of the republic day, the "CNR Rao foundation award" was



given to four students - Ms. Saloni Rose, Mr. Shreyan Ganguly, and the "Certificate of Merit" was also awarded to 16 students by the Director on this occasion. On the Independence day, sports prizes were also distributed.

IISER Mohali Foundation Day

IISER Mohali Foundation Day 2013 celebrated on September 27th, 2013. Professor P. Balaram, Director of the Indian Institute of Science Bangalore, delivered a Lecture on "Chemical Diversity in Biology " on this occasion. D-space, an open-source library software was inaugurated at IISER Mohali by Professor P. Balaram, Director of the Indian Institute of Science Bangalore, on the occasion of Founday Day 2013.

Second Convocation at IISER Mohali

Second Convocation at IISER Mohali held on May 25, 2013. Chief Guest: Professor P. Rama Rao (Former Secretary, DST Government of India and Former Chairman Board of Gover-

nors, IISER Mohali). Professor K. K. Talwar, Chairman, Board of Governors IISER Mohali presided over the function.

Release of Volume of Abstracts on IISER Mohali Publications

A volume of abstracts of "IISER Mohali Publications" was released by Professor K.K. Talwar Chairman BOG IISER Mohali on May 24, 2013 in the Board of Governors meeting.

Release of Film on IISER Mohali

A film on the inception, vision and setting up of IISER Mohali, was commissioned by the institute. The film includes footage of interviews with faculty and students and also records the progress in construction of the campus. The film, titled "IISER Mohali: The Dream of Science" has been produced by Chrysalis Films, and several cuts of the footage, targeted at different audiences, have been prepared, including a 10 minute, a 30 minute and a 60 minute version. The film was released on April 12, 2013 by Professor K. K. Talwar, Chairman Board of Governors of IISER Mohali. The film has also been broadcast by Vigyan Prasar, and has been much appreciated by viewers.

Public Lecture on "The Dance Language of the Bees"

Professor Raghavendra Gadagkar, President, INSA, CCS and CES, IISc Bangalore, Honorary Professor IISER Mohali delivered a public lecture entitled "The Dance Language of the Bees" on March 27, 2014. In this talk the speaker discussed one of the most intriguing aspects of the biology of the Honey Bees, Honey Bee Dancing, which is also one of the most fascinating behaviors in animal life. Performed by a worker bee that has returned to the honey comb with pollen or nectar, the dances, in essence, constitute a language that "tells" other workers where the food is. By signaling both distance and direction with particular movements, the worker bee uses the dance language to recruit and direct other workers in gathering pollen and nectar. Professor Gadagkar also discussed how these discoveries were made by researchers over the years.

National Technology Day Celebrations

On the occasion of the National Technology day, Professor Sanjay G. Dhande, Former Director, IIT Kanpur delivered a

lecture on the “Role of Creativity in Technology Forecasting and Development” on May 13, 2013.

The presentation focussed on how an element of creativity can be fostered in the present education and research environment of universities. The talk outlined how development of technologies based on new ideas is pursued in a society. He also discussed how emerging areas which are likely to become potentially strong technologies in the years to come. In particular, the five areas of sensors, Massive On-line Open Courses (MOOC), social media, 3D printing and cloud computing were presented and discussed.

Session on Nobel Prizes 2013

To discuss the Nobel Prizes of 2013, a session was organized with experts speaking on the different prizes.

Professor C. S. Aulakh (Panjab University) spoke on the Physics Nobel Prize which was awarded to François Englert and Peter W. Higgs.

Professor N. Sathyamurthy (IISER Mohali) spoke on the Chemistry Nobel Prize which was awarded to Martin Karplus, Michael Levitt and Arieh Warshel.

Dr. Mahak Sharma (IISER Mohali) spoke on the prize for Physiology and Medicine which was awarded to James E. Rothman, Randy W. Schekman and Thomas C. Südhof.

Session on Abel Prize 2013

Professor Kapil Hari Paranjape spoke on the Abel Prize 2013 which was awarded to Pierre Deligne of the Institute for Advanced Studies. Professor Paranjape spoke on the work of Deligne in particular describing his famous proofs of Weil conjectures and Ramanujan’s tau conjecture as a consequence.



Teachers Day Celebration and Best Teacher Award

On September 5, 2013, the students organized a Teachers day celebration, and the best teacher award (for those teachers under 40) was awarded to Dr. Ramesh Ramachandran, Department of Chemical Sciences, IISER Mohali.



Mathematics Weekend

Mathematics weekend was organized in the Institute on October 25-26 2013 to celebrate the birth anniversary of legendary mathematician Evariste Galois. The celebration started with a popular talk “The Tau of Ramanujan” by Professor Ek-nath Ghate from the Tata Institute of Fundamental Research-Mumbai.



Mathematical treasure hunt event that saw an overwhelming response from the students was organized soon after the popular lecture. Other events that kept students engaged for the whole weekend were Mathematics Olympiad, Dumb Charade, Crossword and Quiz. Mathematical stalls demonstrating fun part of the subject were put up in the foyer of Lecture Hall Complex.

Mathematics major students of the Institute along with Mathematical Sciences Faculty had put joint efforts to make the event successful.



12

Cultural Activities

IISER conducts two major cultural events in an academic year: the IISER Mohali Fest (INSOMNIA) which is conducted in March/April and a Cultural Evening organized in September/October. The institute fest is generously supported by the institute both logistically and financially and typically the students also get funds from external sponsors. Apart from these two major events the 16 registered clubs of IISER Mohali conduct various extracurricular events and celebrate various festivals all year round. Typically these events are organized solely by students and the funds for the festival celebrations came from voluntary contributions from students and the faculty. Outlined below are the highlights of the cultural activities of students in the academic year 2013-2014:



Cultural Evening: Cultural activities in the year 2013-2014 started with the organization of a cultural evening in September 2013. The evening was marked with lively performances coordinated by the dance, music and drama clubs of IISERM.

SPIC-MACAY Concert: SPIC-MACAY volunteers of IISERM (both students and faculty) organized an evening with renowned Veena artiste, Dr. Jayanthi Kumaresh and Indian classical violinist, Smt Kala Ramnath.

Onam: The month of September was also marked by the celebration of the harvest festival of Kerala, Onam. The students made traditional flower rangolis and performed a classical dance to mark the occasion which was followed by and many fun-games.

Diwali: The festival of lights was celebrated with much fanfare. The student representative council and Rang (Arts club) decorated the campus with diyas and lights.

This was followed by a firework show and the event concluded with the students dancing to the tunes of a DJ.

Lohri: The cultural activity of the year 2014 began with the celebration of Lohri in the month of January. The students built a bonfire and performed Bhangra dance to mark the occasion. The Director and Dean (students) also gave out the prizes for the winner of a photography competition, CAPTUREIT, conducted by Photography and Videography Club of IISERM.

Basant Panchami: The festival marks the onset of spring and is celebrated as Saraswati Puja in West Bengal. Students organized a small cultural evening to celebrate the spring festival. The evening began with an invocation and was followed by traditional Bengali songs and dance. Dinner in the mess was made more interesting with Khichdi served to all along with sweets.

Insomnia 2014: The science and cultural festival of IISER Mohali, INSOMNIA2014, marked the end of the cultural activities of 2013-2014. It was an inter-college festival in which 18 colleges from outside IISER Mohali participated. The main organizers of the fest were Ms. Priyanka Jamadagni (cultural secretary) Mr. Promit Moitra and Mr. Deepanshu Sisodia. As part of the opening ceremony of the fest, the students performed a shadow-dance depicting the cultural, geographic and religious diversity of India. The two and half day long fest was packed with music, dance, drama, arts events along with literary events such as quizzes and debates. The fest concluded with a rock concert, CRESCENDO, in which rock-bands from different colleges participated, marking the grand-finale of a fantastic and successful fest.

Competitions: The students of IISER Mohali participated and won several inter-college competitions at the national level. These include Inter-IISER Sports Meet, TATA Crucible quiz, IIM Ahmedabad quiz, PECFEST etc. The director of IISER Mohali distributed prizes to the winners of various



sports events on Independence Day 2013 and Republic Day 2014. The students also organized and participated in other events at IISER Mohali including the Math week, CHEM week and Teacher's day celebration. The members of the Photography and Videography Club of IISER Mohali actively covered events all year round.



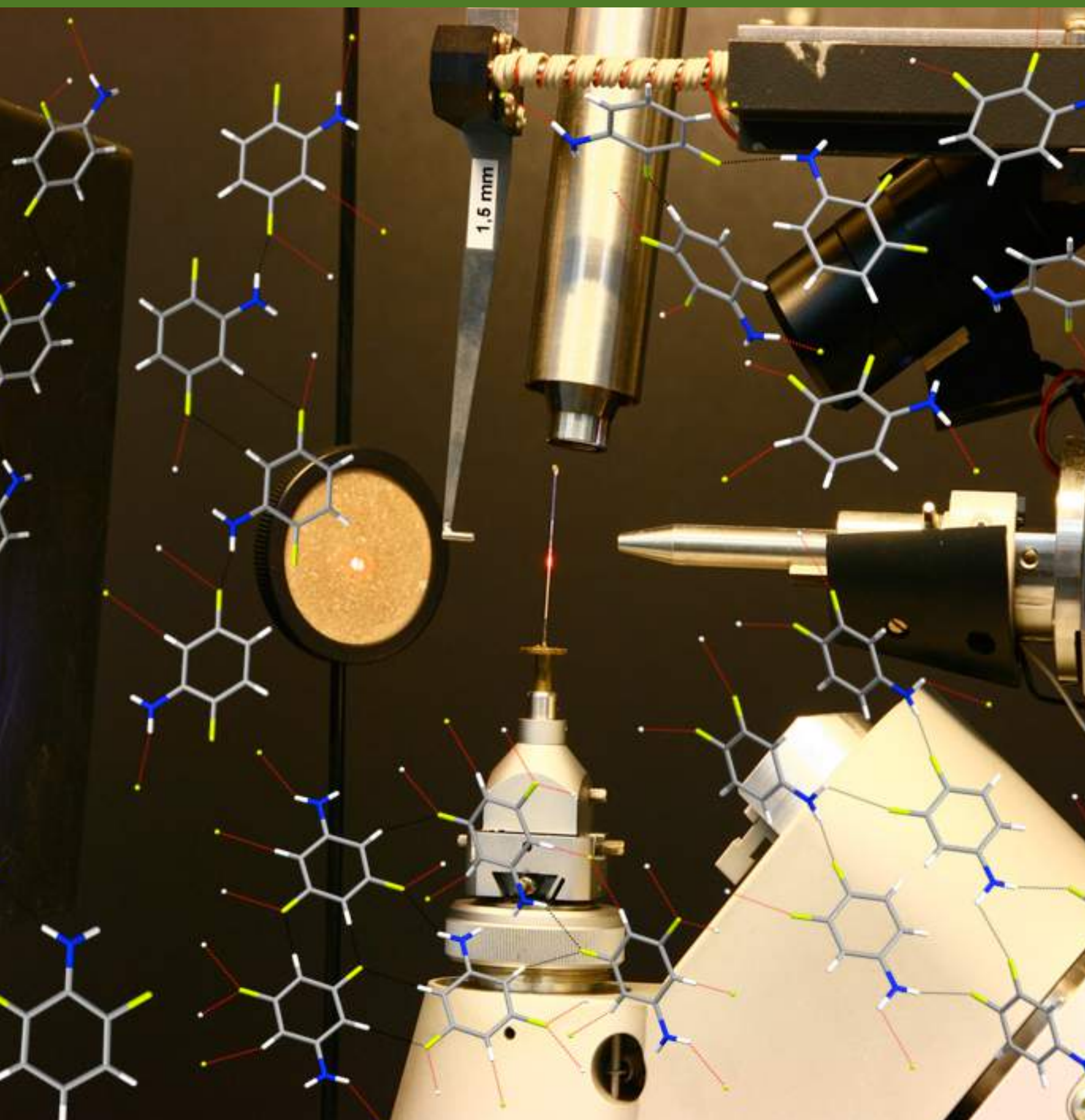


Figure: In situ crystallization of liquids.

Address: IISER Mohali, Knowledge city, Sector 81, SAS Nagar, Manauli PO 140306