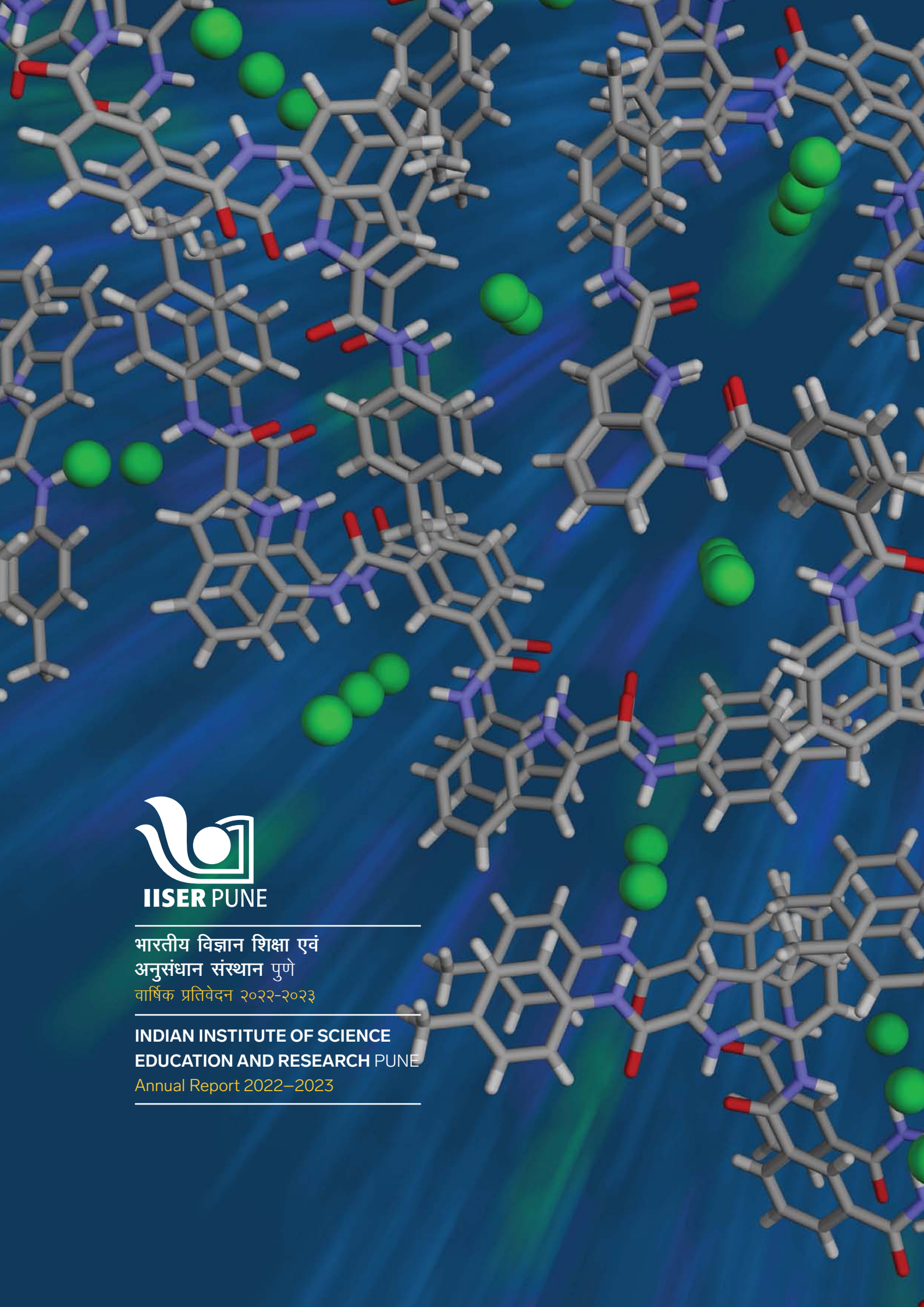

IISER PUNE

भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान पुणे

वार्षिक प्रतिवेदन २०२२-२०२३

INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH PUNE

Annual Report 2022–2023

On the Cover

This schematic represents the top view of the solid-state nanochannel formed by the self-assembly of a small organic molecule in the presence of chloride ions (shown as green balls). Prof. Pinaki Talukdar's group demonstrated that a bis(indole)-based molecule forms a double helix that, upon coordination with chloride ions, forms a supramolecular polymer. The polymer displays selective chloride transport across lipid bilayer membranes. This work demonstrates structural transformation of artificial double-helix systems in the presence of a stimulus. Materials such as this and a way to control their function through structure could have potential biological applications (Mondal et al., *Nature Communications* (2022) 13:6507).

Image Credit

Debashis Mondal and Pinaki Talukdar

Correct Citation

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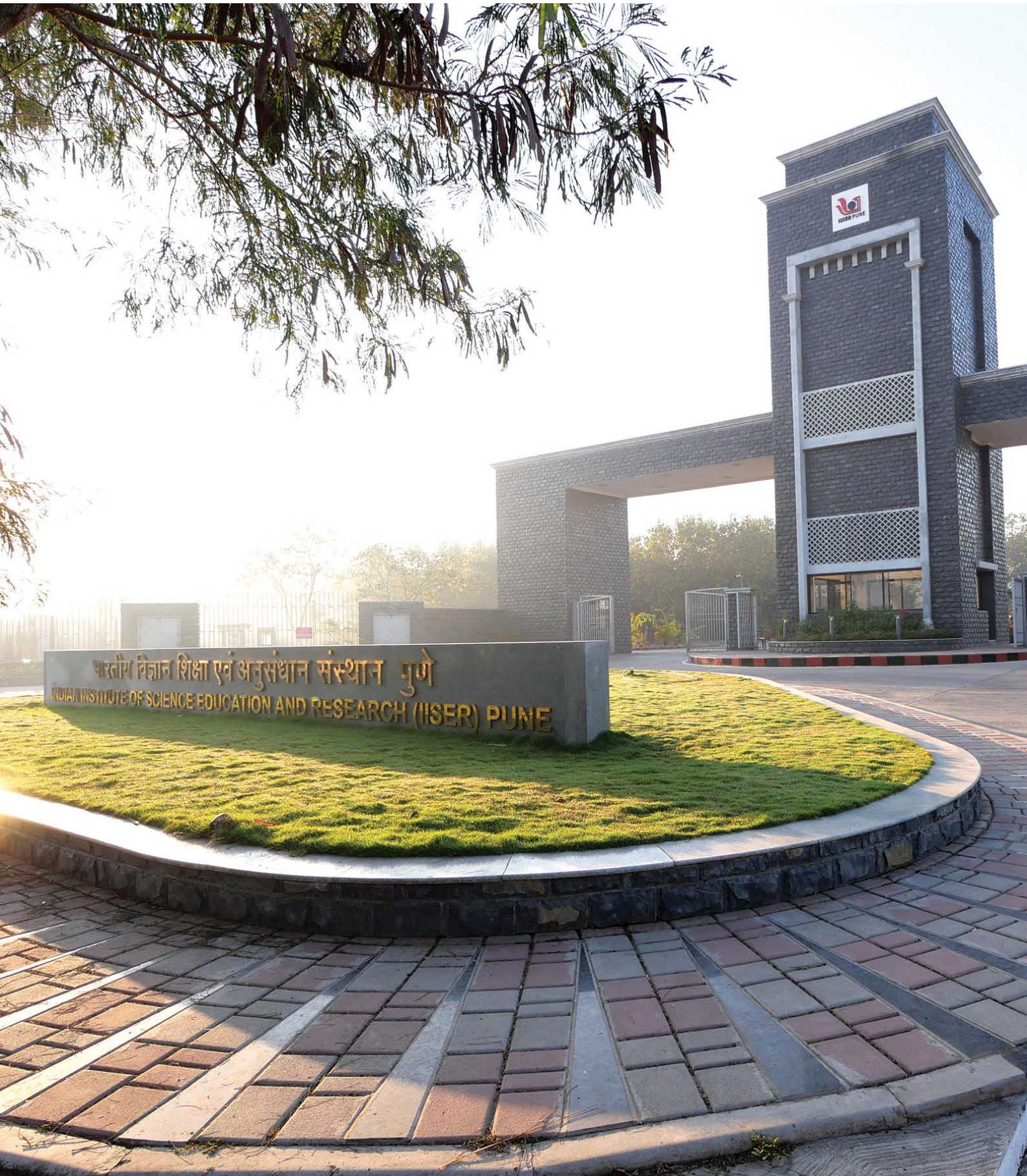
IISER PUNE

भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान पुणे

वार्षिक प्रतिवेदन २०२२-२०२३

INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH PUNE

Annual Report 2022–2023



CONTENTS

IISER PUNE

Fostering a culture of excellence and expanding the frontiers of knowledge, IISER Pune is at the forefront of training the next generation of scientists and informed citizens.

IISER Pune is an autonomous teaching and research organisation of the Ministry of Education, Government of India.

IISER Pune offers undergraduate and graduate programmes in Biology, Chemistry, Data Science, Earth and Climate Science, Humanities and Social Sciences, Mathematics, and Physics. A new department of Science Education has been initiated. Researchers at the Institute investigate a wide spectrum of topics in the basic sciences as well as in applied areas of research.

The Institute is ranked 26 in the Overall Category and 17 in the Research Category in the 2022 India Rankings of the National Institutional Ranking Framework (NIRF); 1001-1200 in the 2023 Times Higher Education (THE) World University Rankings; and is listed 7th in India, 123rd in Asia-Pacific and 369th globally for research output by the 2022 Nature Index Tables.

HIGHLIGHTS 2022-23

554 Publications in 2022

Patents
18 filed
12 published
6 granted

44 New Extramural Grants Garnered

39 crores (in ₹) Extramural Funds received / assigned

18 MoU and Agreements with industries and academic organisations

144 crores (in ₹) Funds Received from the Ministry of Education

1814 Students
471 PhD, 189 Integrated PhD, 28 MSc and 1126 BS-MS

137 Faculty Members
+ 18 visiting, emeritus, and guest faculty

134 Non-Teaching Staff Members

60 Fellows, Project Scientists, and Post-doctoral Research Associates

Over **1.47 lakh** teachers, students, and science enthusiasts reached out to by the Science Activity Centre

Numbers are as of March 31, 2023
Financial data rounded off to the nearest whole number

Director's Report

It is a pleasure to present the institute's annual report for 2022-23. The world has emerged from the shadow of the pandemic and we are re-dedicating ourselves with new vigour to the cause of science. The Institute has been growing and expanding activities in several areas.

On May 27, 2022, Honourable Minister of Education and Minister of Skill Development and Entrepreneurship Shri Dharmendra Pradhan laid the Foundation Stone towards the construction of the research and office space for the Department of Data Science and formally inaugurated the National Facility for Gene Function in Health and Disease, which has been set up with funding from the Department of Biotechnology for animal model maintenance and development for research purpose.

IISER Pune has reached the status of a premier institution within the country over the last few years. In the 2022 India Rankings of the National Institutional Rankings Framework (NIRF), IISER Pune was ranked 26 in the Overall Category and 17 in the Research category. On the 2022 Nature Index Tables, IISER Pune is listed 7th in India, 123rd at the Asia-Pacific level, and 369th globally for research output.

Earlier this year, Distinguished Professor Emeritus Prof. Deepak Dhar was conferred the Padma Bhushan Award and our Founder Director and Adjunct Faculty member Prof. K.N. Ganesh was conferred the Padma Shri Award by the Government of India. We take great pride in our colleagues' achievements.

As of March 31, 2023, we have 137 regular faculty members across our eight departments. This includes two members who have joined our faculty during the year: Dr. Debangsu Sil (Chemistry) and Dr. Surabhi Jaiswal (Physics).

In addition to this, we have had three visiting faculty members and three guest faculty members join in our relatively new departments of Science Education and Data Science, respectively. Visiting faculty members in the department of Science Education, Prof. G. Nagarjuna, Prof. K. Subramaniam, and Dr. Shamin Padalkar, have been contributing to the new elective courses structured around the pedagogy of science. Guest Faculty members in the Data Science department Dr. Manasi Patwardhan, Mr. Mousum Dutta, and Dr. Tulasi Ram Reddy bring to us their diverse experience from industry as well as academia.

Prof. Srinivasan Ramakrishnan (Physics) joined during the year as Emeritus faculty member and Prof. Sunil Mukhi (Physics), Prof. Vineeta Bal (Biology), and Prof. Satyajit Rath (Biology) continue their association with the institute in their new role during the year as Emeritus faculty members. More recently, during April and May 2023, we have had Mr. Anil Zankar (Humanities and Social Sciences) join as a Guest faculty member and Prof. Nishikant Subhedar (Biology) as an Emeritus faculty member. I myself have joined the institute in April 2023 and will be a Professor in the Chemistry Department.

While engaging in active research with 471 PhD Students and 189 Integrated PhD students, our faculty members also engage in teaching 1126 BS-MS students with a strong focus on research. The institute has launched a new Master of Science Programme starting with the 2022-23 academic year and we have 28 MSc students as of March 31, 2023. Currently, the departments of Chemistry, Earth and Climate Science, and Mathematics are offering the new MSc programme.

During the 2022 calendar year, researchers from IISER Pune have published a total of 554 publications, which include journal articles, books, book chapters, and conference papers. Our faculty members have filed 18 patent applications and published 12 patents; and 6 patents have been granted during the 2022 calendar year.

The institute faculty members secured extramural funding for 44 new projects together amounting to 38.82 crore rupees, during the 2022-23 financial year. The Institute signed 18 MoU / agreements during 2022-23 financial year with industries and academic organisations.

Apart from the Padma awards our members received during the year, several of our faculty members have been recognised for their academic contributions during the 2022-23 reporting period: Prof. Richa Rikhy and Dr. Nixon Abraham received DBT-Wellcome Trust India Alliance Senior Fellowships; Dr. Bijay Kumar Agarwalla received Regular Associateship of International Center for Theoretical Physics (ICTP), Trieste, Italy; Dr. Ramana Athreya received the Sanctuary Wildlife Service Award; Dr. Srabanti Chaudhury received the SERB-POWER Fellowship; Prof. Deepak Dhar received R.D. Birla Memorial Award in Physics from the Indian Physics Association and Distinguished Alumni Award from IIT Kanpur; Dr. Siddhesh Kamat became an Elected Member of the Royal Society of Chemistry (2022); Prof. Sujit K. Ghosh was named a Fellow of the Royal Society of Chemistry, U.K. and received Bronze Medal of the Chemical Research Society of India (CRSI); Dr. Moumita Majumdar received the Humboldt Research Fellowship for Experienced Researchers (2022) and SERB-POWER Fellowship (2022); Dr. Angshuman Nag received Silver Medal from Society for Materials Chemistry (SMC) at BARC Mumbai (2022); Dr. Venketeswara Pai received Mahakavi Kalidas Sanskrit-Vrati National Award; Dr. Gayathri Pananghat received Women Involvement in Science and Engineering Research (WISER) Award by the Indo-German Science and Technology Centre (IGSTC); Dr. Kalika Prasad was elected as a Fellow of the Indian Academy of Sciences (IAS), Bengaluru; Prof. Srinivasan Ramakrishnan received Raja Ramanna Fellowship; and Prof. Jayant Udgaonkar was selected for JC Bose Fellowship.

A resource book published under the aegis of Vigyan Prasar titled "Vigyan Vidushi: Vigyan Vidushi: 75 Women Trailblazers of Science" and released on the occasion of the National Science Day February 28, 2023, acknowledges the scientific contributions of four of our colleagues: Dr. Seema Sharma (Physics) was featured as a Trailblazer and Dr. Devapriya Chattopadhyay (Earth and Climate Sciences), Dr. Srabanti Chaudhury (Chemistry) and Dr. Suhita Nadkarni (Biology) were featured in the Future Hope section of the book.

Two student teams from IISER Pune participated in the international iGEM competition in synthetic biology and both the teams won a gold medal each. One of the teams made it to the top 10 undergraduate teams - the first time an Indian team has made it to the top 10 in this competition. During the 2022-23 period, 6 PhD students and 6 Integrated PhD students were selected for the Prime Minister's Research Fellowship (PMRF).

The Institute hosts two section-8 companies on campus, the I-Hub Quantum Technology Foundation (QTF) and the AIC IISER Pune SEED Foundation. During the 2022-23 reporting period, AIC-SEED Atal Incubation Centre incubated 18 start-up companies in various domains such as biotech, pharma, healthcare, agritech, AI/ML, clean energy and environment sustainability. Five of the start-ups incubated at AIC-SEED were initiated by faculty and students of IISER Pune. The I-Hub is funded by the Department of Science and Technology and is working on developing quantum technologies and products such as gravimeter, quantum clock, quantum sensors, and spintronic devices for data storage. In September 2022, the I-Hub team successfully demonstrated India's first portable cold atoms at the Centre-State Conclave held in Ahmedabad.

The year 2022-23 saw a revival of in-person research conferences and workshops and this allowed the institute members to once again interact with visitors from other institutions from across India and outside India. The following scientific conferences and workshops were held at the institute during the year: Data Science Research Ecosystem: Opportunities and Challenges (August 17, 2022); Low-Dimensional Materials (LDM)-2022 (May 19-20, 2022); Workshop on Retreating Himalayan Glaciers (Part I during May 22-25, 2022 and Part-II during December 16 to 17, 2022); International Asian Chemical Biology Initiative (ACBI) Meeting-2022 (September 14-18, 2022); Indian Zebrafish Investigators Meeting (IZIM) 2022 (September 21-23, 2022); Conference on Nonlinear Systems and Dynamics (CNSD) 2022 (December 15-18, 2022); Indian Women and Mathematics (IWM) Annual Conference 2022-2023 (December 27-29, 2022); Workshop on Group Theory 2023 (January 13-14, 2023); fairSTREAM Stakeholder Workshop (January 17, 2023); No-Garland Neuroscience 2023 (February 2-5, 2023); 42nd Mahabaleshwar Seminars: Mitochondria and Metabolism (February 13-15 2023); Mini-symposium: Recent Advances in Main-group Chemistry (February 14, 2023); Physics of Strongly Correlated Electron Systems (PSCES) 2023 (March 15-17, 2023); and Chintan Shivir, a critical reflection session on re-imagining education (March 25-26, 2023).

We have also had training programmes and information sessions such as Hands-on Training and Workshop on High-end Instruments and Advanced Tools in Biology (July 18-26, 2022); EMBO Practical Course on CryoElectron Microscopy and 3D Image Processing (December 4-16, 2022); Molecular Biology Workshop for Underrepresented Groups in Academia (January 25-31, 2023); the HFSP Symposium on Opportunities for Frontier Research Collaborations (February 15, 2023); and Training Workshop on Scientific Project Management (February 20-24, 2023).

The Institute hosted two named lectures during the year: the 9th Annual Homi Bhabha Memorial Public Lecture was given by Prof. Umesh V. Waghmare from JNCASR Bengaluru (November 21, 2022); and KS Krishnan Memorial Lecture was delivered by Prof. Aditya Murthy from IISc Bengaluru (November 4, 2022). Institute also hosted Indian Physics Association's DAE - C V

Raman Lecture (February 11, 2023) which was given by Priyadarshini Karve (Samuchit Enviro Tech & Cleaner Cooking Coalition). Institute Colloquium series ran from February 2023 onwards with accomplished speakers.

The past year witnessed a large number of sports activities organised by the Sports Club at IISER Pune, such as the IISER Pune League in cricket, football, badminton and basketball. The Inter-IISER Sports Meet (IISM) was held after a gap of two years, at IISER Bhopal. IISER Pune students performed extremely well and were placed second overall in the meet. The Yogen Club and the Sports Club together organised a month-long International Yoga Day celebration, which included workshops and competitions.

With the campus returning back to normalcy post-COVID lockdown, a large number of cultural activities and festivities were organised by the students making the campus vibrant. The Institute hosted the Inter-IISER Cultural Meet 2022 during December 28-30, 2022, which had over 600 student participants from all the seven IISERs, NISER, IISc, and CEBS Mumbai. The Mimamsa student team conducted the annual Inter-College Science Quiz competition in partnership with Praj Industries, and Disha continued its programmes on education for the underprivileged.

During April 2022 to March 2023, the Institute received financial commitments from 20 corporates and individuals to support student-led research, student welfare activities, and research and outreach activities of the institute. The IISER Pune – IDEAS Ltd scholarships were awarded to 15 meritorious students whereas 209 students from the Economically Weaker Section category received financial assistance through various corporate-supported scholarships. Travel grants were extended to 34 students.

During the year, the institute signed an agreement with Johns Hopkins India Private Limited (JHIPL), an Indian subsidiary company of Johns Hopkins University (JHU), USA, for establishing a Clinical Research Unit in the IISER Pune campus; and renewed MoUs with University of Notre Dame du Lac, U.S.A., and Leibniz University Hannover, Germany, to develop academic and research collaborations and exchanges. The institute signed a Memorandum of Agreement with Tata Institute of Social Sciences (TISS), Mumbai to develop joint programmes in teacher education in Science and Mathematics.

Two multi-partner projects hosted on IISER Pune campus, iRISE and MS-DEED, are dedicated to capacity building in the education and research sectors. The Inspiring India in Research Innovation and STEM Education (iRISE) is a three-year collaborative programme between the Department of Science & Technology (DST), IISER Pune, British Council, Royal Society of Chemistry, and Tata Technologies. Maharashtra State Development of Educators and Enhancement in Delivery (MS-DEED) Programme is a close collaboration between IISER Pune and the Maharashtra State Faculty Development Academy (MSFDA) - Centre for Multi-disciplinary Curriculum & Pedagogy under the Department of Higher and Technical Education, Government of Maharashtra.

During 2022-23, the Teachers' Development Strand of the iRISE project has seen significant progress in its Phase I and Phase II programmes. Apart from reaching 1213 teachers, the programme has also trained over 3000 cascade teachers (Innovation Coaches) in 53 district-level workshops across Maharashtra and Bihar, impacting over 1 lakh students through teachers. The team conducted 7 capacity building programmes across different host institutions for PhD students. MS-DEED is involved in developing professional capacity of teachers through training faculty members of universities and colleges in Maharashtra in inquiry-based active learning. Between December 2021 to March 2023, MS-DEED programme has reached 2500+ teachers across 36 districts of Maharashtra. Teacher participants joined from across 350+ colleges across all the 36 districts of the state of Maharashtra.

Smt. Indrani Balan Science Activity Centre on campus held numerous activities during the year for school and college students and teachers. Two series the team held through the year include online live-demo sessions on Sundays and school/college visits on Wednesdays. The Centre organised several activities as part of celebrating occasions such as Teachers' Day, Children's Day, National Science Day, and International Women's Day. The Science Activity Centre engaged with a total of 1.47 lakh participants over the course of the past year. The team initiated a three-year STEM-Ready Project with a series of 5-day workshops for teachers of government and government-aided schools in and around Pune, with funding from the Tata Technologies under its CSR Initiative. A STEM Tinkering Experience Centre was inaugurated on March 27, 2023, as part of this initiative.

The Science Media Centre on campus has been hosting science communication workshops and internships as part of their newly launched student exchange programme. On the occasion of the National Science Day, on February 28, 2023, the Science Media Centre launched G.N. Ramachandran Digital Museum, which is a comprehensive online resource on the life and work of the great scientist.

On behalf of all of us at the Institute, I express our gratitude to all our statutory committees, the Senate, the Building and Works Committee, the Finance Committee, and the Board of Governors. I express my sincere thanks to the Chairperson of our Board of Governors Shri Sudhir Mehta and to the collective wisdom of all members towards smooth functioning of the institute.

Prof. Sunil S. Bhagwat
Director, IISER Pune
August 30, 2023

Governance

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List is as of March 31, 2023; changes during the year are not shown here

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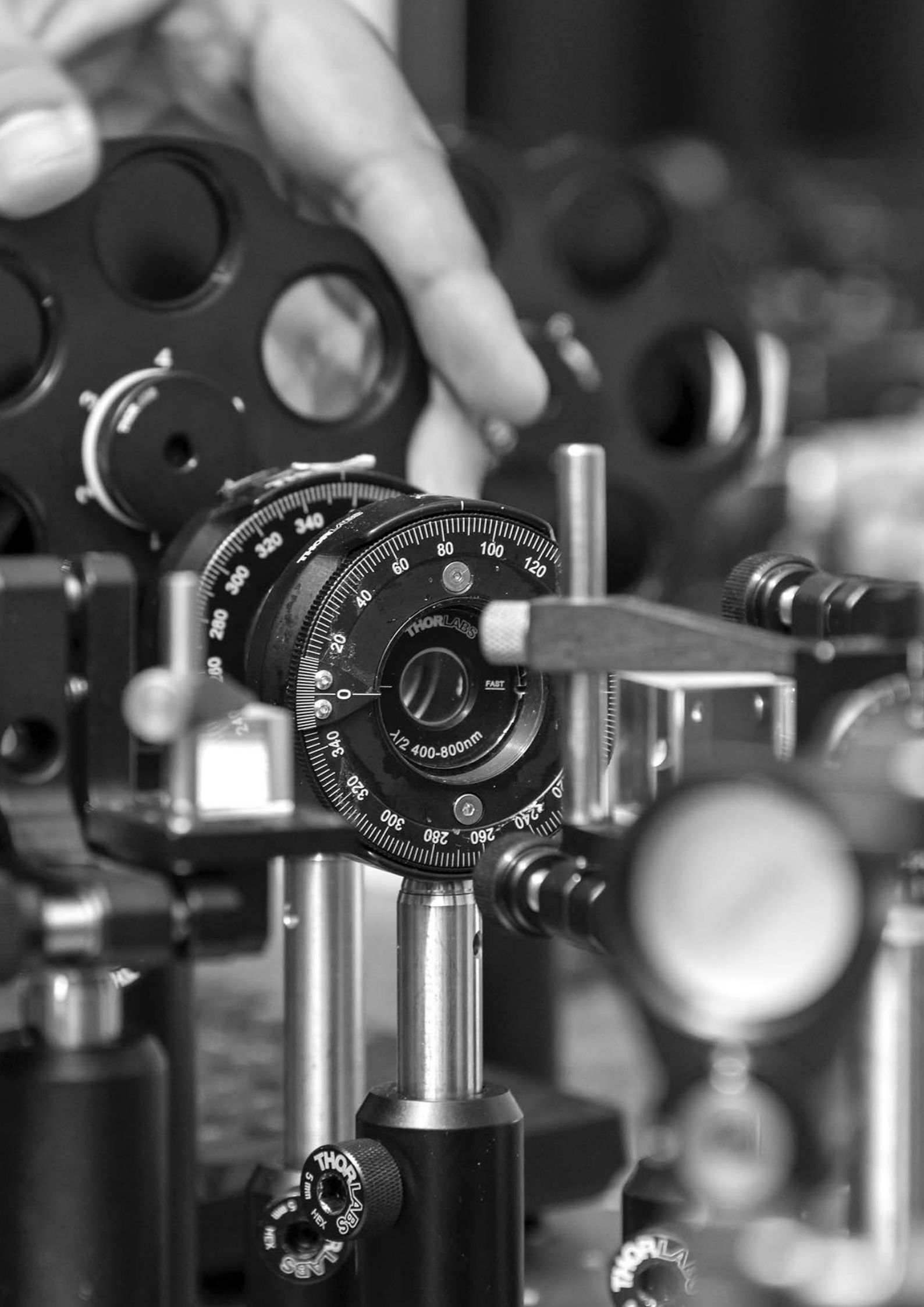
Prof. Anjan Banerjee	*Dean (Research and Development), IISER Pune*
Prof. Srinivas Hotha	*Dean (Planning and Communications), IISER Pune*
Col. G. Raja Sekhar (Retd.)	*Registrar, IISER Pune*

Secretary

Shri. Rajendra Patil	*Superintending Engineer, IISER Pune*

Research Activities and Achievements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RESEARCH REPORT

Publications in 2022

TOTAL: 554

99
BIOLOGY

150
CHEMISTRY

4
DATA SCIENCE

28
EARTH AND CLIMATE SCIENCE

16
HUMANITIES AND SOCIAL SCIENCES

49
MATHEMATICS

208
PHYSICS

Research at IISER Pune aims to reach a fundamental understanding of how the physical world works. Research is carried out through the departments of biology, chemistry, data science, earth and climate science, humanities and social sciences, mathematics, and physics. A new department of science education was initiated during the previous year (2021-22) by a coordination committee.

With 554 papers during 2022, IISER Pune has performed consistently in terms of obtaining research publications from work carried out at the Institute. During the 2022 calendar year, IISER Pune filed 18 patent applications, had 12 patents published, and 6 patents granted.

1. BIOLOGY

1.1 BIOCHEMISTRY AND BIOPHYSICS

Biological mechanisms of lipid signalling pathways

Dr. Siddhesh Kamat's group is interested in studying the biological mechanisms of lipid signalling pathways in the central nervous and immune systems. Towards this, the group integrates aspects of chemical biology, immunology, animal, and/or cellular models, in conjunction with advanced mass spectrometry-based metabolomics (lipidomics) and (chemo) proteomics techniques. The long-term goal is to identify and characterise as-of-yet uncharacterised lipid signalling pathways in vivo, annotate enzymes and/or cognate receptors that regulate their biology, and provide new insights and therapeutic paradigms for orphan and/or emerging human diseases.

Cell motility and bacterial cytoskeleton

Dr. Gayathri Pananghat's research focuses on understanding the molecular mechanism of motility and cell shape determination based on the bacterial cytoskeleton using *Myxococcus xanthus* and *Spiroplasma* as model systems.

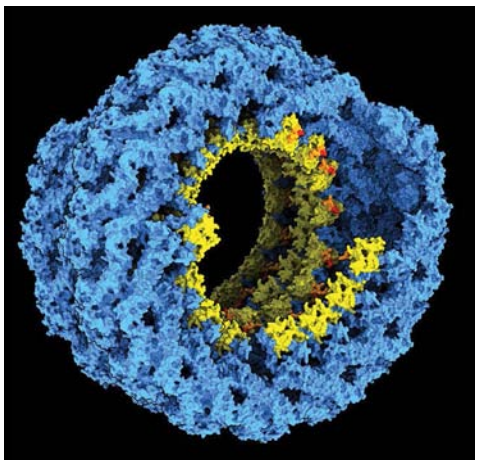
A few highlights of this year's achievements are listed below:

- Studies are underway to characterise the enzymatic activity of FrzE and interaction with other partners such as FrzCD, FrzA and FrzB.
- Characterisation of interaction between RomRX, RomY and MglAB components of *Myxococcus* polarity determinants is in progress. Structure determination of RomY has helped in identifying its fold.
- Ongoing work on the characterisation of FtsZ from the cell-wall-less organism *Spiroplasma* is progressing. Characterisation of filament dynamics of MreB of *Spiroplasma* has led to the identification of its modulation by nucleotide dependent membrane binding. Further experiments with respect to visualisation of MreB on the membrane are in progress.
- Following the sequence analysis of FtsZs from cell-wall-less bacteria, which identified that FtsZs are capable of direct membrane binding in certain mycoplasmas, they have demonstrated this experimentally.
- Analysis of small Ras-like GTpase structures and P-loop NTPases has led to a unified structural framework for describing P-loop NTPases, and the basis of evolution of catalytic residues, and nucleotide specificity.
- Standardisation of purification of MreB1, MreB2 of *Spiroplasma* and MreB of *Myxococcus xanthus* is in progress.

Understanding protein machines that catalyse membrane fission

Cell membranes are formed by the spontaneous self-assembly of amphipathic lipids into a 5 nanometer-thin bilayer. Membranes are highly resilient to bending, fission, fusion and rupture and this is perhaps the reason for evolution choosing lipids as the material to contain life inside cells. But cells are filled with numerous membrane-bound compartments or organelles, which implies that cells have evolved mechanisms to remodel membranes. Membrane remodelling requires specialised protein machines that tether and bend membranes for fusion and fission. These functions contribute to organelle biogenesis and naturally have a tremendous impact on cellular physiology. Prof. Thomas Pucadyil's group's focus is to understand regulatory mechanisms of some of the well-known membrane remodelling protein machines. They also focus on discovering novel membrane remodelling protein machines and understand their functions in cellular physiology.

Figure 1:
Gears of the constrictor: Structural model of the dynamin constrictor ring (blue) showing a novel membrane inserting loop VL4 (orange) located within the lipid binding pleckstrin homology domain (yellow). Mutation of the M580 (red) residue located in VL4 is linked to Charcot Marie Tooth neuropathy. The VL4 facilitates membrane fission by inserting into the membrane, thus acting as a gear for the dynamin constrictor ring.
(Prof. Thomas Pucadyil's Group)



Emergence of information-containing polymers in prebiotic Earth

Characterising events that led to life's origins on Earth continues to be an enduring and exciting challenge. Specifically, discerning the processes and niches relevant to the emergence of the earliest cells (protocells), has been the continued focus in Dr. Sudha Rajamani's group. This year, a big thrust was on characterising the putative amphiphilic landscape of the early Earth. Particularly, the group reported a tuneable membrane system made of phosphate containing lipids, whose physicochemical properties made them very pH responsive. This also makes them an exciting candidate for formation of robust protocells under wide-ranging prebiotoically relevant conditions. Additionally, they also described a new protoamphiphile; a hybrid moiety comprising of an amino acid and a lipid in the same molecule, which was hitherto unknown in the origins of life context. Importantly, the aforementioned studies underscore the need to characterise the prebiotic amphiphilic landscape and how environmental constraints would have shaped its evolution.

The group was invited to contribute a review based on a recently initiated project, wherein they postulated a plausible evolutionary pathway to provide a framework for discerning the emergence of metalloproteins. Lastly, based on the work done in the group over the last decade, and from lessons gleaned in related aspects from the field, the group published an opinion piece. It describes how astrobiologists can pragmatically refine their search for extraterrestrial life based on lessons from messy prebiotic chemistry data, which can help segregate abiosignatures from true biosignatures, for more effective life detection in the universe.

Figure 2:
Self-assembly behaviour of mono-N-dodecyl phosphate (DDP), a pH-responsive amphiphile. Such systems would have had an inherent advantage for forming early functional cells. They also could be used for engineering tuneable membranes with potential translational implications.
(Dr. Sudha Rajamani's Group)

1.2 CELL, ORGANISMAL, AND DEVELOPMENTAL BIOLOGY

Chromosomal segregation during cell division

Dr. Mridula Nambiar's research focuses on deciphering the molecular basis of chromosomal segregation errors during mitosis and meiosis in *Schizosaccharomyces pombe*. The group is generating a catalogue for segregation error types in different yeast mutants during meiosis. They observe an increase in meiosis I errors in recombination mutants that are either deficient in arm recombination or have increased centromeric recombination. In contrast, cohesion-defective mutants have increased meiosis II errors, mainly due to loss of centromeric cohesion. In an independent study, they have also established sensitivity to drugs that induce chromosomal mis-segregation, DNA damage and replication stress, upon ectopic expression of meiotic cohesins in proliferative cells, as observed in several cancers. The group suggests that inappropriate cohesin loading across the genome to contribute towards this and are currently mapping their chromatin-binding profiles across various genomic loci. To elucidate the mechanism of centromeric cohesin loading in vivo, the group is working out the three-way interaction among cohesin Psc3, heterochromatin protein Swi6 and loader complex, Mis4-Ssl3 and their dependency on each other upon conditional depletion of each. They have also found evidence for possible formation of a three-subunit cohesin complex in absence of the fourth essential core subunit and are working towards characterising its function in wild-type cells.

Regulatory processes that govern growth and development in bacteria

The primary focus of Dr. Sunish Radhakrishnan's group is to understand the fundamental regulatory processes that govern growth and development in bacteria. They are interested in understanding how bacterial cells perceive changes in the environment and relay it to the regulatory signalling processes that control growth and proliferation. Work from the group had demonstrated that the cytoplasm of the bacterial model, *Caulobacter crescentus*, remains oxidised during specific stages of the cell cycle. Furthermore, they discovered that the change in cytoplasmic redox influence the activity of key developmental proteins during the cell cycle. As part of ongoing research, using a combination of genetic and biochemical tools, they have narrowed down the key metabolic pathways that might contribute to the dynamic cell cycle redox. Going ahead, the group is invested towards teasing out the precise role these metabolic pathways play in regulating bacterial cell cycle and developmental processes. Furthermore, they are also in the process of delineating a signalling mechanism that help bacterial cells to fine-tune cellular differentiation and motility.

Molecular principles underlying animal development and disease

Molecular mechanisms underlying the development of organisms are remarkably conserved. Many developmental paradigms and their underlying genetic networks were first elucidated in *Drosophila melanogaster* and have provided insights into the development processes governing other organisms, including humans. Prof. Girish Ratnaparkhi's laboratory utilises *Drosophila* as a model organism to study the regulation of cellular signaling in the context of development and its misregulation in disease. Under this broad theme, the Ratnaparkhi laboratory finds that SUMO conjugation modulates NF-kappB signaling in both DV patterning (Hegde et. al., 2022) as well as in host defence (Kumar et. al., 2022; Soory & Ratnaparkhi, 2022; Hegde et. al., 2022). The group also found that the interactions between VAPB, Caspar/FAF1 and VCP appear to be key for the modulation of proteostasis and inflammation in the context of the neurodegenerative disease Amyotrophic Lateral Sclerosis (Tendulkar et. al., 2022). Further, they are investigating functions for orphan metabolic serine hydrolases in *Drosophila* using a combination of chemoproteomics and CRISPR/Cas9 mediated genome editing.

Cellular mechanisms underlying embryogenesis and stem cell differentiation

Plasma membrane and organelle dynamics occur routinely in embryogenesis and stem cell differentiation. Prof. Richa Rikhy's lab group studies how the regulation of plasma membrane, and organelle dynamics affects key steps of differentiation. The group has found a role for lateral plasma membrane barriers in the syncytial *Drosophila* embryo to be important for restricting the flow of membrane and cytoplasmic molecules in the syncytial embryo (Thukral et al., 2022). This illustrates a potential mechanism for constraining gradients in the embryo. The group has found a key role of mitochondrial fusion in regulating neural stem cell differentiation (Dubal et al., 2022; Stavroula et al., 2022). Further they are investigating the mechanism by which mitochondrial dynamics regulates different aspects of stem cell differentiation.

1.3 CHROMOSOME BIOLOGY AND EPIGENETIC REGULATION

Epigenetics and transcriptional regulation in *Plasmodium falciparum*

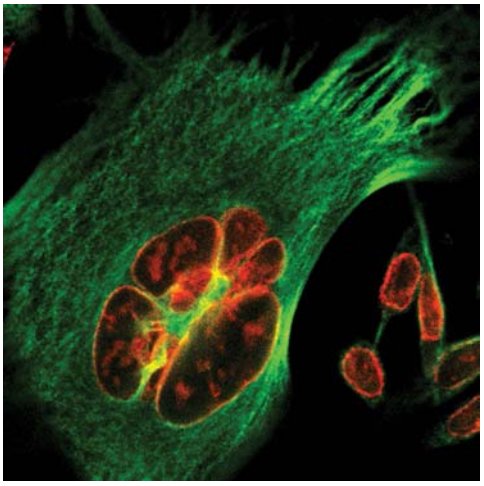
The emergence of drug resistance to frontline treatments such as Artemisinin-based combination therapy (ACT) is a major obstacle to the control and eradication of malaria. There have been reports of declining effectiveness of ACT in the West Bengal and Northeast regions of India, which have traditionally been areas of drug resistance emergence in the country. Monitoring the genetic makeup of a population can help to identify the potential for drug resistance markers associated with it and evaluate the effectiveness of interventions aimed at reducing the spread of malaria. Recently, Dr. Krishanpal Karmodiya's group performed whole genome sequencing of 53 isolates of *Plasmodium falciparum* from West Bengal and compared their genetic makeup to isolates from Southeast Asia (SEA) and Africa. They found that the Indian isolates had a distinct genetic makeup compared to those from SEA and Africa, and were more similar to African isolates, with a high prevalence of mutations associated with antigenic variation genes. The Indian isolates also showed a high prevalence of markers of chloroquine and multidrug resistance but no known mutations associated with artemisinin resistance. The group observed novel mutations in genes involved in ubiquitination and vesicular transport that have been reported to support artemisinin resistance. Thus, their study highlights the importance of region-specific genomic surveillance and the need for continued monitoring of resistance to artemisinin and its partner drugs.

Chromosome biology

The research focus of Prof. Kundan Sengupta's Chromosome Biology Lab (CBL) is on nuclear architecture and cancer. Cancer cells show an increase in blebs, micronuclei and nuclear invaginations are characteristic and serve as diagnostic markers of cancers. The group's recent research focuses on nuclear lamins and especially on the Lamin B Receptor (LBR) - an inner nuclear membrane protein required for reassembly of the nucleus after cell division. Remarkably, in addition to inducing mitotic and nuclear aberrations, LBR knockdown showed losses of specific chromosomes. Interestingly, chromosomes which showed a higher frequency of losses were enriched within the micronucleus. LBR depletion increased tumorigenesis in mouse xenografts. LBR depletion also increased intermingling between translocating chromosome territories, creating a unique chromatin configuration susceptible to chromosomal instability. Overexpression of LBR showed LBR degradation, revealing a stringent control over LBR levels. LBR loss showed an increase in Telomere Repeat-Binding factor 1 (TRF1) levels, the knockdown of which restored chromosomal stability. The group also uncovered a novel sub-interactome of LBR involving the nucleolar protein Fibrillarin (FBL), cytoskeletal protein Î³-Tubulin, and the telomere protein - TRF2, by performing mass-spectrometry. In summary, the group described

that a novel LBR-TRF axis protects cells from chromosomal losses maintaining chromosomal stability in diploid colorectal cancer cells.

Figure 3:
Shown in the image is a giant multinucleated cancer cell (SW480) of colorectal origin. Cells are stained for Lamin B2 (red) which marks the nuclear envelope and microtubules (green) which represent cytoskeleton. Seen at the right bottom are the SW480 cells of regular morphology, whereas seen at the centre is a giant cell having multiple nuclei which are fused to each other. Cancer cells are typically known to show wide range of nuclear and cellular abnormalities. (Prof. Kundan Sengupta's Group)



1.4 ECOLOGY AND EVOLUTION

Population dynamics

Prof. Sutirth Dey's group studies among other things, ecology and evolution of dispersal in the laboratory. Environmental stress is one of the important causes of biological dispersal. At the same time, the process of dispersal itself can incur and/or increase susceptibility to stress for the dispersing individuals. Therefore, in principle, stress can serve as both a cause and a cost of dispersal. The group studied these potentially contrasting roles of a key environmental stress (desiccation) using *Drosophila melanogaster*. By modulating water and rest availability, the group asked whether (a) dispersers are individuals that are more susceptible to desiccation stress, (b) dispersers pay a cost in terms of reduced resistance to desiccation stress, (c) dispersal evolution alters the desiccation cost of dispersal, and (d) females pay a reproductive cost of dispersal. The group found that desiccation was a clear cause of dispersal in both sexes, as both male and female dispersal propensity increased with increasing duration of desiccation. However, the desiccation cost of dispersal was male biased, a trend unaffected by dispersal evolution. Instead, females paid a fecundity cost of dispersal. They discuss the complex relationship between desiccation and dispersal, which can lead to both positive and negative associations. Furthermore, the sex differences highlighted here may translate into differences in movement patterns, thereby giving rise to sex-biased dispersal patterns.

1.5 NEUROBIOLOGY AND COMPUTATIONAL BIOLOGY

Olfactory information processing: Loss of olfaction during COVID-19

Intense research and clinical studies have enabled Dr. Nixon Abraham's group to develop efficient detection and preventive measures against severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The widespread infection enforces the long-term tracking of plausible health complications in the post-COVID-19 era. Despite the debate on the nasal entry route of SARS-CoV-2 to the central nervous system, there are clinical evidences reported on the presence of viral particles in the brain (Pardasani and Abraham (2022 *IntechOpen* DOI: 10.5772/intechopen.108573). Loss of olfaction has been reported as one of the early and prevalent

symptoms for COVID-19 infection. Using the group's custom-built olfactory-action meter, the group quantified olfactory fitness in COVID-19 patients and assessed the extent of olfactory deficits. While only 15% of tested individuals reported unfavorable changes in their smelling abilities upon subjective evaluations, more than 80% of asymptomatic carriers were indeed found to be suffering from olfactory deficits using their method. Such a high precision and sensitivity obtained with this method further encouraged the group to develop a quantification method for assessing the cognitive abilities of COVID-19 patients and recovered subjects based on sense of smell. On analysing approximately 16,000 behavioural readouts from 330 subjects (including patients, recovered, and normal healthy subjects), they observed persistent olfactory learning deficits during the infection and post-recovery periods. Further analysis revealed altered breathing patterns in post-COVID subjects. This non-invasive experimental method enables probing neurocognitive fitness along with sampling strategies using complex decision-making tasks.

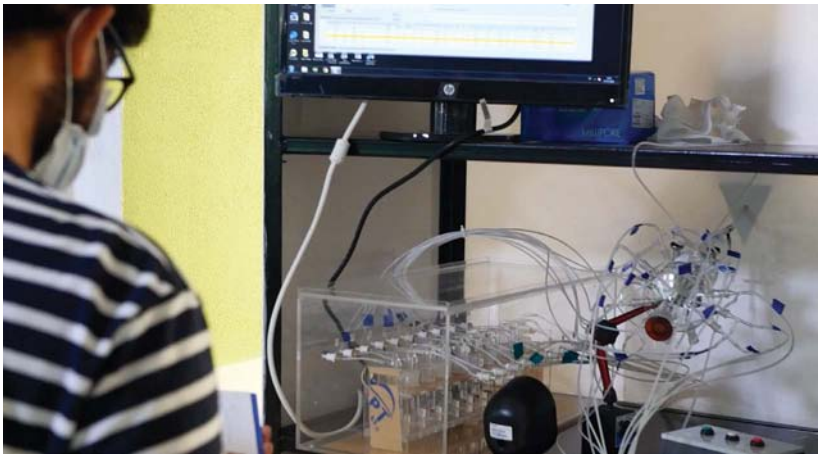


Figure 4:

Dr. Nixon Abraham's group designed and custom-built this olfactory-action meter that can make precise measurements on how well one can smell. This has been used in the study the effect of COVID-19 infection on the sense of smell (Dr. Nixon Abraham's Group)

Neural mechanisms underlying movement initiation in songbirds

A central role of the brain is to respond to stimuli with the appropriate movement. The same movement can be produced in response to an external stimulus or can be triggered by internal stimuli. For eg., you can reach out for a bar of chocolate because someone gave it to you or because you are hungry. Dr. Raghav Rajan's group uses the zebra finch, a songbird, as their model system to understand how the brain initiates movements. The song sequence of the adult male zebra finch consists of a stereotyped sequence of sounds interleaved by silent gaps and is about 0.5 to 1 second in duration. This song sequence begins with a variable number of short syllables called introductory notes. In the last year, the group has been examining neural activity related to introductory notes in the zebra finch brain, to better understand how introductory notes are produced and how they transition to song. They have also been conducting experiments aimed at understanding the function of these introductory notes.

2. CHEMISTRY

2.1 ORGANIC CHEMISTRY AND CHEMICAL BIOLOGY

Synthesis of biologically important heterocycles and macrocyclic lactones

The primary goal of Dr. Gnanaprakasam's research group is to develop sustainable synthetic approaches for the synthesis of biologically important heterocycles and macrocyclic lactones. In this direction, alkylative aromatisation of ketones to synthesise a variety of bioactive naphthols and benzo[e/g]indole derivatives using alcohols has been developed. This approach is general for the tetralone derivatives and transition-metal-free, which avoid inert conditions. In addition, Dr. Gnanaprakasam's research group has also developed a novel method for the synthesis of medium to large sized macrolactones via intramolecular dehydrogenative coupling of primary alcohols by using Ru-MACHO as a catalyst. This method avoids the oxidants and additives and eliminates the use of stoichiometry reagents. Moreover, Dr. Gnanaprakasam's research group has also developed a novel rearrangement reaction using peroxides to generate several derivatives of benzoxazin-3-one-substituted phenols and aryl substituted 1,3-benzooxazin-4-ones in the presence of In- and Fe-catalyst. Furthermore, his research group has established continuous flow processes for macrolactonisation, azidation and molecular rearrangement reactions towards bioactive heterocycles, macrocycles and xanthene derivatives under sustainable conditions.

Extracellular matrix (ECM) glycopeptides for cell surface markers

Heparan sulfate (HS) on the cell surface and extracellular matrix (ECM) provide the first line of defense against heavy metals and metal complexes mediated cytotoxicity. Hence, identifying the precise HS sequences that bind to particular heavy metal is key to developing novel defence strategy. Here, Prof. Raghavendra Kikkeri's group electrografted structurally well-defined HS oligosaccharides on carbon-electrode and employed a label-free technique to validate key insights of HS-heavy metal binding specificity. They employed a divergent strategy to access a small library of structurally HS tetrasaccharides with different sulfation patterns and uronic acid compositions. XPS and cyclic voltameter data confirmed the immobilisation of HS on carbon-electrode. Heavy metal binding affinity screening revealed that L-IdoA based 6-O-HS ligand showed strong selectivity to Hg(II) over Cd(II) or Pd(II) ions. While D-GluA based 6-O HS ligand showed sensitivity binding to Cd(II) ions, the non-sulfated and 3-O-sulfated analogs showed weak binding to all three heavy metal ions. These prototype studies revealed a new insight into HS-metal binding, which is mainly unknown to date. By quantifying the binding affinity of each of the HS analogs with heavy metals, one can understand better the role of metals in HS-mediated interactions.

Figure 5:

On the cover page of the journal Chemistry A European Journal (R. Kikkeri, S. Yitzchaik, M. Hurevich, and co-workers DOI: 10.1002/chem.202202193) (Prof. Raghavendra Kikkeri's Group)

Macromolecular engineering

Non-invasive, real-time, longitudinal imaging of protein functions in living systems with unprecedented specificity is one of the critical challenges of modern biomedical research. Despite several advancements, it is estimated that nearly 35% of the human proteome is not completely characterised. Therefore, the development of new technologies is imperative for shining more light on so-called "dark proteomes". Towards that goal, Dr. Britto Sandanaraj's group developed a platform fusion technology called activity-based protein profiling-bioluminescence resonance energy transfer (ABPP-BRET). This method provides an opportunity to study the post-translational modification of a target protein in real-time in living systems in a longitudinal manner with a high spatiotemporal resolution. This semi-synthetic BRET biosensor method is used for target engagement studies and further for inhibitor profiling in live cells.

Ion transport systems

The research activities of Prof. Pinaki Talukdar's group are to develop supramolecular nanomaterials for various functional applications in membrane transport, water purification, and fluorescent sensors. They developed a pyrrole-2-carboxamide-based transmembrane chloride transport system by bimodal structural tuning to achieve efficient ion transport. In the ion channel area, Prof. Talukdar's group has developed bis(1,3-propanediol)-linked meta-dipropynylbenzene-based small molecules that self-assemble to form chloride channels in the lipid membranes. Following a different approach, they developed benzohydrazide-based self-assembled ion channels that modulate the chloride ion concentration in cancer cells and induce apoptosis by disrupting autophagy. They also developed isophthalic acid-based small molecules that form self-assembled ion channels and are nontoxic to epithelial cells; and a bis(indole) system that forms a double helix in the solution and solid state. The double helix gets converted into a supramolecular polymer that functions as membrane ion channels. Very recently, the group started working on artificial water channels. They have developed peptide-diol-based molecules that showed efficient water transport by excluding ions and protons. The application of these systems as reverse osmosis (RO) membranes for water purification is in progress. In collaboration Dr. Partha Hazra's group at IISER Pune, they are designing 2-hydroxyisophthalamide-based systems that were applied for α-synuclein aggregation.

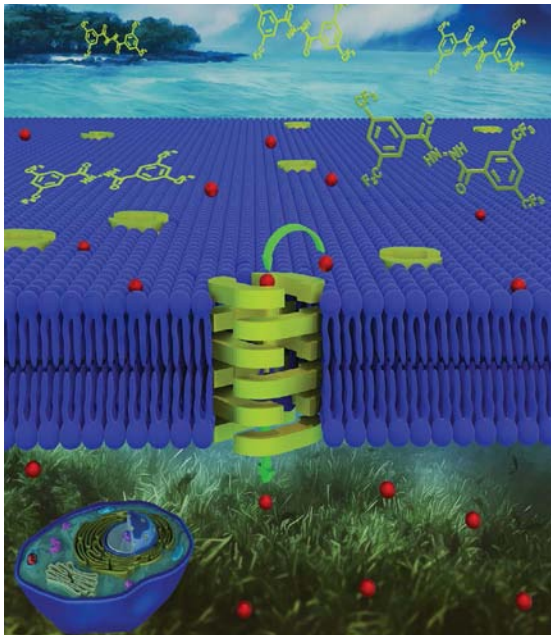


Figure 6:

The design of a benzohydrazide-based small organic molecule that self-assembles to form a nanochannel assembly across cell membranes for the selective transportation of chloride ions. Modulations in chloride ion concentration by this channel induce apoptosis as well as disrupt autophagy, a combination seldom seen in cancer-targeting drugs.
(Prof. Pinaki Talukdar's Group)

2.2 INORGANIC CHEMISTRY AND MATERIALS SCIENCE

Interfacial materials chemistry

The primary research of Prof. Nirmalya Ballav focuses on interfacial materials chemistry, from fundamentals to applications, upon exploring various solid-solid and solid-liquid interfaces. Research platforms include thin films of coordination polymers, composite systems with conducting polymers, 2D materials, and magnetic semiconductors. They have fabricated hetero-structured thin film of a Mott and a band insulating metalorganic frameworks (MOFs) via layer-by-layer method. Electrical transport measurements across the thin film evidenced an interfacial metallic conduction. The origin of such an unusual observation was understood by the first-principles density functional theory calculations; specifically, Bader charge analysis revealed significant accumulation and percolation of charge across the interface. Also, they have applied reduced graphene oxide (rGO) as interfacial layers between a fluorine-doped tin oxide (FTO) coated glass substrate and semiconducting material TiO_2 in a photoanode of a Dye-Sensitized Solar Cell (DSSC) which showed an unusual enhancement in generating a photocurrent in comparison to the control (without rGO layers).

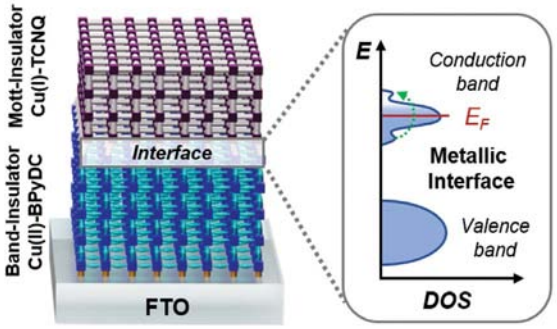
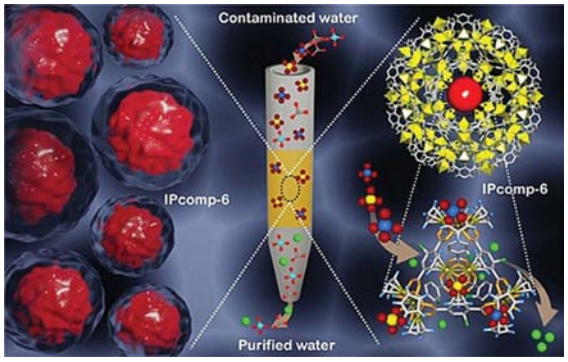


Figure 7:
Emergence of metallic interface in hetero-structured thin films of electrically insulating coordination polymers
(Prof. Nirmalya Ballav's Group)

Hydrolytic and chemical stability of MOFs

In terms of significant impact, the World Economic Forum documented water crisis as the largest worldwide risk. Due to accelerating urbanisation along with rapid industrialisation, an evergrowing number of toxic contaminants are entering the fresh water supplies. In the priority list, the Environment Protection Agency (EPA) listed metal-based oxoanions as potential toxic inorganic pollutants in waste water. Metal-based oxoanions are potentially toxic pollutants that can cause serious health issues. Therefore, the segregation of such species has recently received significant research attention. Even though several adsorbents have been employed for effective management of chemicals, their limited microporous nature along with non-monolithic applicability has thwarted their large-scale real-time application. Herein, Prof. Sujit K. Ghosh's group developed a unique anion exchangeable hybrid composite aerogel material, integrating a stable cationic metal-organic polyhedron with a hierarchically porous metal-organic gel. The composite scavenger demonstrated a highly selective and very fast segregation efficiency for various hazardous oxoanions such as, $HAsO_4^{2-}$, SeO_4^{2-}, ReO_4^- (surrogate for TcO_4^-), CrO_4^{2-}, in water, in the presence of 100-fold excess of other coexisting anions. The material was able to selectively eliminate trace $HAsO_4^{2-}$ even at low concentration to well below the As V limit in drinking water defined by WHO.

Figure 8:
A hybrid composite aerogel as efficient material for sequestration of toxic pollutants (Ref. Angew. Chem. Int. Ed. 2023, 62, e202214095)
(Prof. Sujit K. Ghosh's Group)



Silylene as a ligand in homogeneous catalysis

The advent of N-heterocyclic silylenes (NHSis) and their ability to activate small molecules led to envisage that they could be the alternative ligands to NHCs. However, the area of transition metal silylene complexes had been held back for many years especially because of the very low yield of silylenes. Since the high yield isolation of Si(II) compounds by dehydrohalogenation protocol, there is a significant paradigm shift in the chemistry of transition metal silylene complexes. Dr. Shabana Khan's group is exploring silylene [$PhC(NtBu)_2SiN(SiMe_3)_2$] as a ligand to prepare Cu(I), Ag(I), and Au(I) complexes which are being utilised further for catalytic applications e.g. Click Chemistry, A3 coupling, Glycoside synthesis, borylation, etc.

Main-group and transition metal compounds for catalysis

In the last one-year duration, Dr. Moumita Majumdar's group has majorly focussed on the following three research projects:

1. N,N′-Diboryl-4,4′-bipyridinylidene (BBiPy) has been utilised in catalytic amounts along with anionic base as one electron donor species for both transition metal-free borylation of aryl halides and arene C-H functionalization with aryl iodides for biaryl syntheses. Reaction between BBiPy and potassium tert-butoxide or methoxide has led to the formation of 4,4′-bipyridine radical anion with the release of an electron. The 4,4′-bipyridine radical anion has been structurally characterised. The single electron released is transferred to aryl halides generating aryl radicals, which then reacted with diboron in the presence of methoxide to form aryl boronate and with unactivated benzene in the presence of tert-butoxide to form biaryls. C-C bond coupling on stannylene platform has also been studied.

2. Reactivity study with the Sb(I) cation (Angew. Chem. Int. Ed. 2021) have been studied with various main-group reagents. One of the two lone pair of electrons on Sb(I) cationic site binds to the nucleophiles. They observed transmetallation reactions and umpolung reactivity at the Sb(I) cationic site. Bismuth chemistry has also been explored.

3. The group has rigorously studied the Lewis acidic properties of Ge(IV) dicationic compounds which is hitherto unknown in literature. They emphasised on molecular scheming of these polycationic complexes considering the geometric constraint, metal/ligand cooperative interactions present in the system.

Electrochemistry

The electrochemistry of metal-organic complexes has been primarily confined to electrocatalysis due to the ability of their metal center to conduct challenging electrochemical transformations. Dr. Muhammed Musthafa's group showed that the ligands, the conventionally considered silent entity in the electrochemistry of organometallic platforms, can cause unprecedented

reorganisation of their electrochemical double layer (EDL) via their constitutional isomerism. This adds an entirely new dimension to the electrochemistry of organometallic platforms built around the ligands with a consequence directly impacting their energy storage capability. They further demonstrated that this constitutional isomerism induced interfacial electrification can substantially elevate the energy storage capability of a fully functional supercapacitor device, by nearly 6 times compared to the state-of-the-art porous carbon electrodes. They demonstrated that the potential drop across the EDL of organometallic complexes and its response to charging can be precisely controlled by constitutional isomerism of the ligand, which in turn allows an accurate tuning of the energy stored in their EDL. This part of the work is supported by a deep mathematical model, based on the concept of a compacting parameter developed by Prof. A. Kornyshev of the Imperial College.

The group provided a practical demonstration of this constitutional isomerism-assisted electrification of the interface in the next-generation electrochemical capacitors by integrating the isomeric molecules in a functional two-electrode supercapacitor device. The device containing the beta constitutional isomer at its interface exhibits a capacity that is ~6 times greater than that of state-of-the-art devices (535 F·g-1 as opposed to 100 F·g-1, respectively), while maintaining unprecedented performance even at 50 times higher rate. The decisive roles of constitutional isomerism in tuning the EDL structure thus contribute to the design of high energy supercapacitors in aqueous system, which is otherwise thermodynamically challenged due to their narrow potential window.

Overall, this investigation enriches the electrochemistry of organometallic complexes and significantly contributes to the design of new molecular platforms for charge storage, wherein the less obvious (the ligand) is shown as the indispensable.

Optoelectronic properties of perovskite semiconductors

At present, Dr. Angshuman Nag's group is working on molecular design of hybrid perovskite quantum wells, like A_2PbI_4 (A: organic ammonium cations). Non-centrosymmetric and chiral semiconductor crystals are highly sought after materials for future technologies like, spin-LED, circularly polarised photodetector and LED, bulk photovoltaic, spin-selective catalysis, and nonlinear optical activity. The group has introduced a new material design principle to synthesise a series of new non-centrosymmetric single crystals of hybrid perovskites. The design principle relies on introducing asymmetric non-covalent hydrogen and halogen bonding interaction at the interface of organic and inorganic sublattices. Utilising this principle, they have synthesised four new 2D Pb-I and 1D Bi-I based non-centrosymmetric hybrid perovskites. Owing to the structural non-centrosymmetry, the samples show interesting nonlinear optical properties and anomalous photovoltaic effect.

Another related area that they are currently working on is to design phosphors and LEDs that emit short-wave-infrared (SWIR) radiation, typically in the range of 900 to 1700 nm. The wide band gap of 5.1 eV makes $Cs_2NaInCl_6$ a photo-stable double perovskite material. The group has codoped $Cs_2NaInCl_6$ with Sb^{3+} (s-electron) and $Er3^{+}$ (f-electrons). Sb^{3+} provides sub-bandgap (s to p) allowed optical excitation, which then can de-excite by emitting blue light with 93% quantum yield. In the codoped sample, the excitation energy of Sb^{3+} can also be non-radiatively transferred to Er^{3+} exciting its f-electrons. Subsequently, Er^{3+} can emit sharp f-electron emissions at wavelengths including 1540 nm SWIR radiation. Temperature (6 K to 300 K) dependent photoluminescence spectroscopy revealed the mechanism of excitation and emission processes. Then they fabricated phosphor converted LED (pc-LED) by coating the samples on commercial ultraviolet LED chips.

Functional nanomaterials

The concept of 'interplay of forces' is often practiced by Nature to create various biological machineries from a collection of a limited set of biomolecules, to perform distinct and specific functions. A similar approach is adopted by Dr. Pramod Pillai's group to achieve desired functions in nanomaterials. This task is accomplished by controlling the various interparticle interactions emanating from the ligands on the surface of nanomaterials. The basic idea is to control the interplay of forces by functionalising the 'ligand of choice', without compromising the inherent core properties of nanomaterials. The ability to achieve a balance between attractive and repulsive forces helped in realising many important feats in nanoscience, such as controlling the thermodynamics of self-assembly, outplaying ligand poisoning in nanoparticle catalysis, channelising the flow of energy and electron in light harvesting systems, and so on (Figure). Basically, surface ligands act as 'gatekeepers' in controlling the interactions of nanoparticles with their surroundings. This essentially means that the 'ligand of choice' approach is applicable to a wider set of materials and forces. Looking forward, the fact that a mix and match of a wide-range of surface ligands and forces is possible means that 'ligand directed nanochemistry' will keep on surprising by gifting us the outcomes within and beyond our predictions.

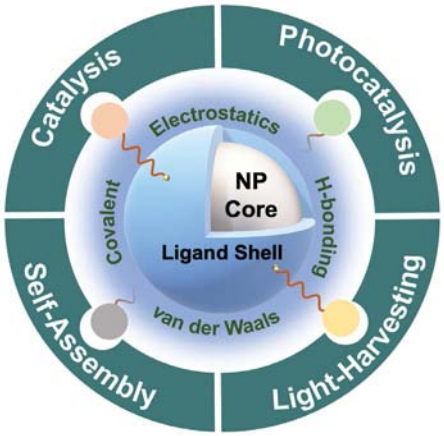


Figure 9:
Schematic showing the importance of finely-tuned interparticle interactions, emanating from the surface ligands, in different areas of nanoscience: catalysis, photocatalysis, self-assembly, and light-harvesting. (Dr. Pramod Pillai's Group)

Synthetic inorganic chemistry: Materials applications

Prof. R. Boomi Shankar's group has made significant contributions in developing molecular ferroelectric materials and studied them for piezoelectric energy harvesting applications. Notables finding have been made in developing examples of single-component organic, two-component organic-inorganic and charge-separated and neutral metal-organic materials with significant polarization attributes. Flexible composites of these compounds with commercial and biodegradable polymers have been prepared and tested as piezoelectric nanogenerators (PENGs) with sizable output voltages and power density values. The electricity generated from these mechanical forces have been subsequently stored in commercial capacitors.

In another project new polyhedral cage assemblies were synthesised by using imido-phosphate ligands and Pd(II) ions and studied for host-guest applications and chiral separation of biologically important small molecules.

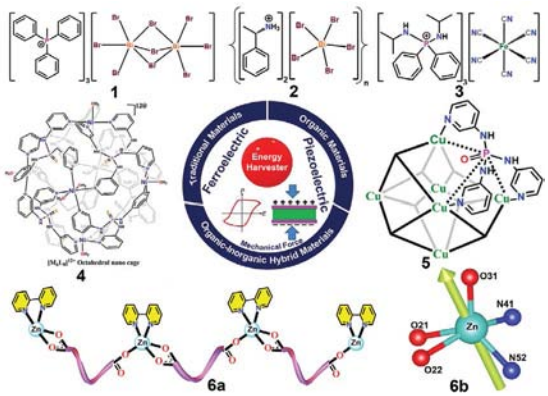


Figure 10:
Representative molecules that display ferroelectric and piezoelectric energy harvesting properties.
(Prof. R. Boomi Shankar's Group)

Study of enzyme reaction mechanisms through synthetic models

Metalloenzymes carry out a wide variety of reactions, including aliphatic hydroxylation and desaturation reactions, N-oxygenation of aminoarenes, and oxidation of tyrosine to tyrosyl radical necessary for DNA biosynthesis, to name a few. Rigorous understanding of reaction mechanism of these enzymes is essential for the development of efficient catalysts. Dr. Debangsu Sil's group studies the synthetic models of these enzyme active sites which can significantly contribute towards our understanding of the coordination environment, function, and reactivity of the corresponding metalloenzymes and their short-lived intermediates.

The class I-c ribonucleotide reductases (RNRIc) and R2-like ligand-binding oxidases (R2lox) contain heterobimetallic MnFe cofactors. RNRIc, found in pathogens like *Chlamydia trachomatis*, is involved in the biosynthesis of DNA, while the R2lox from *Mycobacterium tuberculosis*, is suggested as a virulence factor. It is proposed that the MnFe cofactor allows these pathogens to deal with the oxidative stress produced by the host defence mechanism. RNRs have been targeted for cancer treatment and against multidrug-resistant pathogens. These heterobimetallic MnFe cofactors of RNRIc and R2lox can be excellent targets for the development of new therapeutics against these deadly pathogens. However, the lack of synthetic complexes mimicking the redox-active heterobimetallic MnFe cofactors of RNRIc and R2lox, limits our understanding of the enzyme mechanisms. The group is presently exploring biomimetic MnFe complexes as models of the RNR1c and R2lox cofactors with a specific emphasis on understanding the metal selectivity, structure, redox properties, and reactivity of these enzymes.

MOFs for large-scale carbon capture

In this year, Prof. Ramanathan Vaidhyanathan's group has been focusing on developing cost-effective and stable metal organic frameworks for carbon dioxide remediation. A particular target has been to prepare cheaper transition metal-based MOF using readily available ligands. One of the design aspects is to introduce amine groups and to render the frameworks with ultra-micropores. The group has been successful in making five new MOFs with these structural features and some have been very promising for carbon dioxide-nitrogen, carbon dioxide-methane, and methane-nitrogen separations.

In a separate project, they have been trying to boost the conductivity of covalent organic frameworks by integrating them with conducting polymers. This has been achieved by employing the specific combination of robust cyclic imide COF and polypyrrole chains. The resulting material has superior charge transfer properties and they demonstrated this by using them as electrodes in various batteries and supercaps.

2.3 SPECTROSCOPY, THEORETICAL AND COMPUTATIONAL CHEMISTRY

DNA-Protein recognition, the effect of heterogeneity in catalytic processes

Dr. Srabanti Chaudhury's group has developed theoretical methods based on discrete-state stochastic models to investigate the effect of heterogeneity in catalytic processes at the single-particle level. Using this discrete-state stochastic framework, it was found that the degree of stochastic noise in nanoparticle catalytic systems depends on several factors that include the heterogeneity of catalytic efficiencies of active sites and distinctions between chemical mechanisms on different active sites. Such discrete-state stochastic kinetic models explain DNA-target search processes in quorum-sensing bacterial cells. The group is also interested in understanding the role of electrostatic interactions and salt concentration gradient on the translocation of polyelectrolytes (PE) through a nanopore using coarse-grained molecular dynamics. Such simulations are important in studying the conformational properties of diblock polyelectrolytes of different charged fractions in salt solutions.

Spectroscopic studies of weak non-covalent interactions

Prof. Aloke Das's research group uses various gas phase laser spectroscopy techniques in combination with quantum chemistry calculations to probe various types of weak non-covalent interactions such as hydrogen bonding, n→π* interaction, etc., which are the backbone of biomolecules and materials. Detailed understanding of these weak interactions is the key to designing improved drugs, catalysts, various supramolecular assemblies, etc.

Recently, the group has demonstrated that intramolecular n→π* interaction can induce the conformational preferences of aromatic systems having a flexible side chain. They have explored the conformational landscape of N,N-dimethyl aniline ortho-ethyl acetate (NMe2-Ph-EA) in the gas phase using high-resolution electronic and vibrational spectroscopy in combination with quantum chemistry calculations. Quantum chemistry calculations predict that the structures of the global minimum including two other lowest energy conformers of NMe2-Ph-EA are governed by the n→π* interaction between the lone pair electrons on the nitrogen atom and π* orbital of the C=O group. Gas phase laser spectroscopy experiments confirm the exclusive presence of the global minimum conformer of NMe2-Ph-EA stabilized by the n→π* interaction. The results demonstrate the significance of the weak n→π* interaction in controlling the conformational preferences in molecular systems. They have also demonstrated through detailed quantum chemical calculations on N, N-dimethyl aminophenyl propanal and p-substituted pyridine... aldehyde complexes that the strength of both intra- and inter-molecular n→π* interaction can be modulated by varying the electronic substituents at the para position of the donor group involved in the interaction.

In another work, Dr. Das's group collaborated with Dr. Stephane P. Roche at the Department of Chemistry and Biochemistry of Florida Atlantic University, USA to understand the tunability of the C-H...π interaction within a tryptophan (Trp) zipper motif to stabilise the fold of long beta-hairpin peptides. They have established from circular dichroism (CD) and NMR spectroscopy in combination with DFT calculations of several Trpzip peptides that the stabilisation of these peptides is governed by edge-to-face (EtF) stacking interactions through a combination of alkyl and aryl CH/π interactions between the tryptophan pairs. It has been also shown how electron donating/withdrawing groups on the tryptophan unit can be varied to modulate the CH/π interactions for the improved stability of the Trpzip peptides.

Dr. Das's group has also recently built a setup to measure laser-induced fluorescence (LIF) spectra of various aromatic molecules and their complexes in the isolated gas phase. LIF

spectroscopy provides similar electronic spectra of molecular systems which are obtained from resonant two-photon ionisation (R2PI). However, very often, various molecular systems having higher ionization potentials cannot be studied easily using the R2PI technique while LIF spectroscopy is ideal to study those molecular systems.

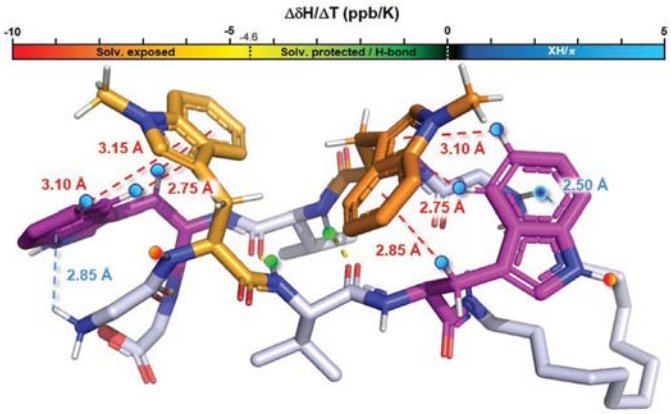


Figure 11:

3D structure of a beta-hairpin peptide with Tryptophan zipper (Trpzip) motif having multiple X-H...pi interactions. (Prof. Aloke Das's Group)

Photophysics of biologically important molecules

Establishing a potent scheme against α-synuclein aggregation involved in Parkinson's disease has been evaluated as a promising route to identify compounds that either inhibit or promote the aggregation process of α-synuclein. In the last two decades, this perspective has guided a dramatic increase in the efforts, focused on developing potent drugs either for retardation or promotion of the self-assembly process of α-synuclein. To address this issue, using a chemical kinetics platform, Dr. Partha Hazra's group developed a strategy that enabled a progressively detailed analysis of the molecular events leading to protein aggregation at the microscopic level in the presence of a recently synthesised 2-hydroxyisophthalamide class of small organic molecules based on their binding affinity. Furthermore, qualitatively, they developed a strategy of disintegration of α-synuclein fibrils in the presence of these organic molecules. Finally, they have shown that these organic molecules effectively suppress the toxicity of α-synuclein oligomers in neuron cells.

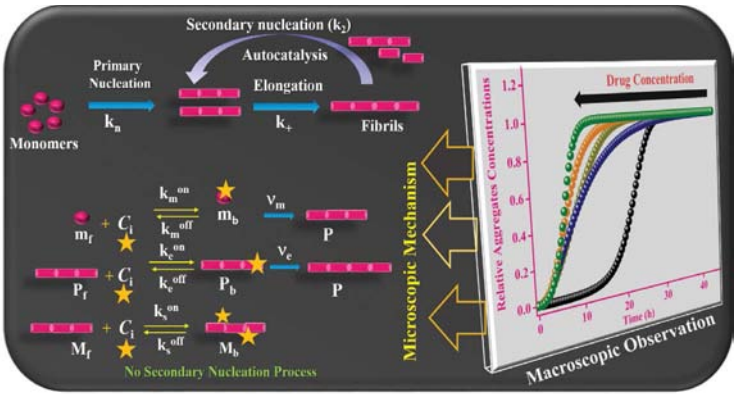


Figure 12:

(Left) Schematic representation of the microscopic mechanism of protein aggregation in the absence and presence of the drug molecules in the study; (Right) Comparison of aggregation kinetics of α-synuclein sample using ThT fluorescence assay in the presence of different concentrations of the drug molecules. (Prof. Partha Hazra's Group)

Nonlinear optical properties in low-dimensional perovskites

Lower dimensional metal halide perovskites have demonstrated highly enhanced nonlinear optical (NLO) properties due to strong quantum and dielectric confinement. Dr. Pankaj Mandal's group studied the nonlinear optical properties in a variety of low-dimensional perovskites ranging from centrosymmetric, non-centrosymmetric, and chiral perovskites. The group demonstrated that these perovskites have significantly high NLO efficiency and high optical stability. They also demonstrated that varying the halide composition can tune the bandgap of lead halide perovskites, which can be employed to achieve the wavelength tunability of the nonlinear optical response. The electronic structure and dynamic disorder of perovskite lattice, and the polarisability of the A-site cations play significant roles towards high NLO efficiency.

Understanding properties of materials through simulation methods

Research in Prof. Arun Venkatnathan's group focuses on the application of computer simulations such as Molecular Dynamics (MD) and quantum chemistry methods to predict and calculate properties of materials for batteries, fuel cells and carbon capture.

In a project related to batteries, the group has investigated a multi-ionic lithium salt which is a rigid poly-oligomeric silsesquinoxanes (POSS) cubes functionalised with eight lithium [(4-styrene-sulfonyl) trifluoromethane-sulfonyl)imide] groups solvated in tetraglyme (G4) with promising application as a lithium-ion battery electrolyte. MD simulations were performed to analyse ion-ion aggregation, ion-solvent interactions, and ion dynamics in this material in several concentrations of the G4 solvent.

In another project, that of carbon capture, the group examined aqueous solutions of piperidine and its methyl derivatives due to its high solubility in water, excellent absorption rate and resistance to thermal and oxidative degradation. In aqueous piperidines, carbon dioxide is chemically absorbed to form carbamate or bicarbonate. Since piperidine exists in an equatorial or axial conformation, this can influence the interaction with carbon dioxide thereby leading to different products. The reaction pathways are investigated for methyl-piperidines and its various positional isomers with axial/equatorial conformations.

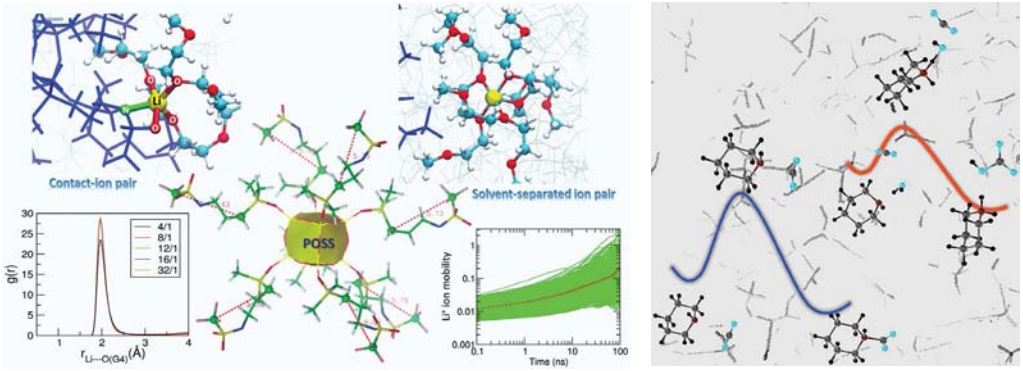


Figure 13:

(Left) Analysis of ion-ion aggregation, ion-solvent interactions, and ion dynamics in G4 solvent through MD simulations; (Right) Schematic diagram of carbamate and bicarbonate formation pathway (Prof. Arun Venkatnathan's Group)

3. DATA SCIENCE

3.1 DATA ASSIMILATION, MACHINE LEARNING

Dynamical systems; Data assimilation

Prof. Amit Apte's group works on various nonlinear filtering algorithms for data assimilation in earth sciences. The main focus is on developing algorithms that work with high dimensional, highly nonlinear and chaotic systems such as the atmosphere and the ocean. In recent work (doi:10.1016/j.dynatmoce.2022.101331), they investigated the linear modal stability of a mean zonal shear flow in rotating shallow water equations, both under the beta-plane approximation and in the full spherical coordinate system, discovering the deficiencies of the beta-plane approximation. They also applied recent machine learning methods for approximating Wasserstein distance using Sinkhorn algorithms to develop methods for assessing the stability of nonlinear filters.

Machine learning; Computational biology; Digital healthcare

Dr. Leelavati Narlikar works on developing machine learning algorithms for problems in healthcare. One example was a collaborative effort with researchers from University of Warwick in the U.K. and the Institute of Mathematical Sciences (IMSc) in Chennai. Women who suffer from gestational diabetes during pregnancy are known to be predisposed to develop type 2 diabetes and/or cardiovascular disease later in life. The model from Dr. Narlikar group's research showed that they could predict, with a high degree of accuracy, which of those women are more likely to develop the disease based on a few biomarkers that are routinely measured during pregnancy (https://europepmc.org/article/ppr/ppr620610). A targeted follow-up of high-risk women as determined by the model, could yield better cardiometabolic outcomes in women with a history of GDM.

4. EARTH AND CLIMATE SCIENCE

4.1 EARTH SURFACE PROCESSES, CLIMATE

Himalayan glaciers

Dr. Argha Banerjee's research focuses on Himalayan glaciers and their interactions with climate, water cycle, and Himalayan landscapes. Over the past year, their research has led to methods that allow a better quantification of surface mass-balance processes at the glacier scale. They improved existing methods to obtain more accurate estimates of the melt rate of glacier ice covered by mantle or rock debris, using in-situ temperature profile data within the debris layer. The large-scale remote-sensing derived mass-balance data are widely used in glacier studies but are accurate only over decadal scales. The group developed a method to extract annual mass balance from the same data, using additional freely-available remote-sensing data of snow cover.

On the catchment scale, they demonstrated that glaciers across the globe, independent of their climatic setting, control the variability of catchment runoff. Glaciers dampen the effects of precipitation-driven variability and extremes but induce temperature-driven fluctuations in runoff. On the scale of an entire mountain range, over a few million years, glacial erosion shapes the mountain crests and peaks. The group developed a steady-state theory of glacial erosion of tectonically uplifting mountains to explain the elevation distribution of glacier cover and the spatial distribution of mountain peak heights. The theory yields spatially-resolved estimates of uplift rates from glacier data for the first time.

Earth structure and its evolution

Dr. Arjun Datta's group works on developing techniques for advanced seismic imaging of the Earth's interior. In recent years the focus has been on passive seismic interferometry using the omnipresent ambient seismic field. During the past year, they worked on building a method for estimating seismic ambient noise sources, by acoustic full waveform inversion of interstation cross-correlations. This work was done by Dr. Arjun Datta in collaboration with a colleague at IIT Bombay and a project associate in the group.

The technique the team developed advances the field of 'full wave' seismic interferometry. Its highlights are that it is able to recover noise sources of arbitrary spatial distribution, both within and outside the receiver array, with complex velocity structure and without the need for a good initial guess for inversion. It allowed them to analyse the extent of biases in source inversion that arise due to inaccurate velocity models. The team found that source inversion using simplified (e.g. homogeneous) velocity models works when lateral variations in velocity structure are limited to 5 or 10% in magnitude, but is vitiated by strong variations of 20% or higher.

3D inverse modelling of large-scale magnetotelluric data

Magnetotellurics is a method employed by geophysicists to measure the electrical resistivity at the Earth's sub-surface using the natural magnetic and electric fields of the Earth. Three-dimensional inversion of the magnetotelluric (MT) data of a large survey is a computationally challenging task. Dr. Rahul Dehiya's group developed an efficient algorithm for computing 3-D MT forward responses. The algorithm is particularly useful for large models resulting from fine discretisation or the large survey area. The proposed technique overcomes the iterative solvers' slow convergence in large modelling problems due to a sizeable ill-conditioned system matrix that ought to be solved. Primarily, the slow convergence occurs due to the grid stretching

required to apply the boundary conditions (BCs). The group's technique partly removes the grid stretching, thus enhancing the computational efficiency.

In this technique, a model is represented using two different meshes. One is a coarse mesh with grid stretching, and another is a fine mesh of the desired discretisation excluding grid stretching. Using the electric field calculated for the coarse mesh, a radiation boundary (RB) vector is computed at the outer boundary of the fine mesh, and it is used to compute the required BCs along with an initial guess to be used by the iterative solver for the fine mesh. The RB vector can be calculated at any arbitrarily shaped interface, thus permitting more flexibility in the shape of the fine mesh boundary. It is a significant advantage compared to the traditional finite difference (FD)-based algorithms where the boundaries must be the same as the cuboid surfaces. Through different resistivity models, both synthetic and real, the group demonstrated that the proposed technique improves the computational efficiency without compromising the accuracy of the solution while delivering more flexibility in the shape of the fine mesh.

Weather prediction and understanding natural variability

Dr. Neena Joseph Mani's group works on understanding atmospheric teleconnection processes which modulate the monsoon variability in the interannual to multidecadal timescales. The Northern hemispheric circum global teleconnection (CGT) pattern is thought to be maintained by two main forcings, namely, diabatic heating associated with the Indian summer monsoon (ISM) and barotropic instability generation over the jet exit region over the North Atlantic. The CGT and ISM impact one another through the circulation responses over West central Asia (WCA). In this study, the group revisited the CGT-ISM interactions focusing on the WCA region and tried to understand whether the downstream impact of CGT on ISM dominates over the ISM feedback on CGT.

Analysis indicated that the Atlantic forced CGT responses play a lead role in modulating the ISM in the interannual timescale, by modulating the upper-level anticyclones over WCA and in turn affecting the ISM easterly vertical wind shear. Atlantic multi-decadal oscillation (AMO) is a major driver of ISM variability in the multi-decadal time scale. The AMO is associated with an arching wave-train of teleconnection across Eurasia. The group's analysis indicated significant modulation of WCA anomalies by the AMO in the multi-decadal time scale, implying that the Atlantic-CGT-WCA-ISM pathway of teleconnection has a low frequency counterpart. They further demonstrated that the observed out-of-phase relationship between AMO and ISM in the recent decades may be attributed to the relatively stronger high latitude warming over the North Atlantic during the recent AMO warm phase. The equivalent barotropic responses to the extra-tropical North Atlantic sea surface temperature (SST) anomalies alter the entire downstream teleconnection pattern producing cyclonic anomalies over WCA and in turn, weakening the ISM.

Climate system, heatwaves in South Asia

The main research areas in Dr. Joy Monteiro's group are to improve the understanding of the physical processes underlying heatwaves in South Asia and their potential health impacts; and to develop novel computational tools for climate science.

In the past year, the group used station-level data to understand the relationship between the dry and wet bulb temperature over the diurnal cycle, and they were able to explain the observed relationship using boundary layer variations. The team used this insight and experimental evidence from physiology to show that hazardous heat conditions can occur both in the mornings and evenings away from peak heat times during heat waves.

The group has also implemented a rare event sampling algorithm in their Python-based climate model. They used this to derive return times for extreme heatwaves and explain the resulting return times using changes in intensity, duration, and frequency of heatwaves in the model.

Mapping Arctic methane leakage through glacial sediments using seismic data

Methane seeps are observed at the feather edge of hydrate stability on the upper continental slope off west Svalbard at 390–400 m water depths. Lithological heterogeneity in the glaciomarine sediments influences fluid accumulation and migration. Dr. Sudipta Sarkar's group improved the glaciomarine stratigraphic framework of the inter-fan region between the Kongsfjorden and Isfjorden cross-shelf troughs over the past 200 kyr using high-frequency seismic SYSIF data and shallow subsurface core information. The group constructed a glacial-stratigraphic framework based on the new piston core GS10-164-09PC retrieved from deeper water. Previous studies have demarcated the glacial events from the past 2.7–0.2 Ma; however, due to limited resolution of seismic data in the interfan region, the glaciation and deglaciations episodes during the Saalian, Weichsalian, and the Holocene were not resolved. This study provided new insights into the glacial history of the interfan region in the past 200 kyr. The team correlated the episodes of ice advancement and retreat and found different seismic units and facies. The improved glacial-stratigraphy helped to categorise the potential fluid reservoir and delineate the possible fluid migration pathways, leading to methane emission in the interfan region. Based on seismic envelope attribute they observed isolated gas pockets trapped under glacial debris lobes. The gas migrates upward through debris toes and feeds the methane seeps on the seabed.

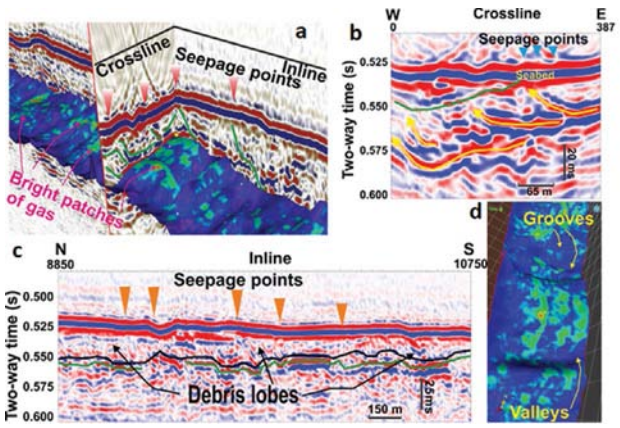


Figure 14:

Seismic anomalies show gas accumulation and migration. (a) Chair-cut section shows chaotic reflections, which indicates the presence of glacial debris lobes. The horizon slice shows the seismic envelope attribute highlighting occurrences of gas pockets in bright green and red colours. (b) Eastward dipping toe thrusts connect deeper gas pockets to the surface seepage points. (c) The lateral extent of glacial debris is shown in the east-west seismic profile. (d) The map view of the seismic attribute envelope shows the continuity of gas pockets disturbed by erosional grooves. (Dr. Sudipta Sarkar's Group)

Weathering and erosion

The research group of Dr. Gyana Ranjan Tripathy mainly studies chemical erosion pattern of the Himalayan rivers to assess their importance in the global carbon dioxide (CO_2) cycle. The chemical erosion of (CO_2-mediated) silicate minerals is a major sink of atmospheric CO_2, whereas the oxidation of sulfides and organic matter release CO_2 into the atmosphere. In a recent study, the group analysed the dissolved major ions concentrations and sulfur isotopic ($\delta^{34}S$) data for the Indus headwater and its tributaries samples, which were collected during the

monsoon season (July-August, 2021). These data are used to apportion sulfate sources and quantify the CO_2 release rate via sulfide oxidation for this Himalayan river basin. The average silica concentrations of these samples (80 ± 42 µM; n = 61) are found to be lower by about two times than average SO_4 concentrations (~195 µM), hinting at high sulfide oxidation in the basin. The $\delta^{34}S$ of the samples although vary widely (-11.5 to 5.5 ‰; n = 49), fall between typical sulfur isotopic compositions reported for gypsum (~17 ‰) and pyrites (~-12 ‰). The mean $\delta^{34}S$ (~ -1.2 ‰) of the Indus headwater samples is depleted compared to the global average $\delta^{34}S$ reported for rivers (~4.4 ‰), and also, that reported earlier for the Indus river near the mouth (0.8 ‰) during summer season. As pyrite-$\delta^{34}S$ are generally lower than the characteristic $\delta^{34}S$ values for gypsum, the depleted $\delta^{34}S$ in headwaters point to relatively higher sulfide oxidation in the mountainous regions than the floodplains. Intense sulfide oxidation in the western Himalayas may be linked to continuous exposure of fresher minerals in these regions with higher physical erosion.

4.2 RESPONSE OF ECOSYSTEMS

Ancient and recent marine ecosystems

Dr. Devapriya Chattopadhyay's group addresses questions related to the faunal response to physical and biological triggers in ancient and recent marine ecosystems using the fossil record and ecological samples.

Tectonic changes have influenced the evolution of the marine community by changing the land and seaway configuration through time. The seaway configuration around India has changed significantly. Thirty million years ago, a seaway (Tethys Ocean) surrounding the northwestern part of India continued from India up to the Mediterranean. This continuous seaway was disconnected from its western arm and formed the present Arabian Sea around 19ma. This disconnection led to an interesting natural experiment where marine biota that evolved together for millions of years were divided into distinct communities. To understand how the communities responded to this event, in the past year Dr. Chattopadhyay's team studied the fossils of marine shells from the western part of India, including Kutch and Kerala. Their study demonstrates limited changes in the community as a response to such tectonic events. It also highlights how such events can lead to the development of strong endemism of tropical biota observed today.

Figure 15:

(Left) Sampling of fossils from 20 million-year-old rock formations of Kerala (Photo courtesy: Avinash Dahakey); (Right) ECS student field trip to Kutch in January 2023: Students walking on the dried river (Photo courtesy: Vikrant Bartakke) (Dr. Devapriya Chattopadhyay's Group)

5. HUMANITIES AND SOCIAL SCIENCES

5.1 HISTORY OF SCIENCE, ARCHITECTURE, MATERIAL CULTURE

Material expression of cultural practices

Dr. Pushkar Sohoni is interested in the material expression of cultural practices, particularly architecture. His research interests encompass urban history, numismatics, archaeology, and epigraphy. In 2022, he co-authored the book *Sultanate Ahmadabad and its Monuments: The City of the Muzaffarids* (New Delhi: Primus, 2022), and early in 2023 his book on colonial architecture *Taming the Oriental Bazaar: Architecture of the Market-Halls of Colonial India* (New York: Routledge, 2023) was published. Several other research essays were also published in this period. Later this year, two books are expected: one is the two-volume work on the architecture of Maharashtra, co-edited with three other collaborating architects; this will be published by the Maharashtra State Board for Culture and Literature, and will be in Marathi and English editions. A festschrift for Prof. Michael W. Meister is also under preparation with a co-editor and should be published by Routledge later this year.

Dr. Sohoni is currently working on a translation of the great inscription in the Brihadeshwara temple in Thanjavur, and on a study of late medieval temples in Maharashtra. He has recently received permission to explore the site of Bahadurgad, which he will investigate with his students.

5.2 DEVELOPMENT STUDIES

Water, sustainability, and development

Dr. Bejoy Thomas works on two broad, interrelated areas, (a) water management, with particular focus on adaptation, access and use in agricultural and domestic sectors, and (b) environmental sustainability and development, including normative implications of climate action. Dr. Thomas and collaborators continued research, fieldwork and community engagement on the food-water-biodiversity nexus collaborative project on the Bhima basin during the year. Consultations were held with different stakeholders to identify current challenges and issues within the food-water-biodiversity context and their relevance to the basin. This is expected to result in a situational analysis document on Upper Bhima basin.

Dr. Thomas was part of a multi-institutional network involving Indian and Japanese research organisations that began during the pandemic looking at the systemic risks from events such as COVID-19. His work focused specifically on the socio-economic and environmental impacts of the lockdown in India. The group organised a workshop in Tokyo where research results were shared. Dr. Thomas continued his engagements with civil society and policy-level stakeholders on water resources management and sustainable development issues.

Figure 16:
Water management structure in Upper Bhima basin (Dr. Bejoy Thomas's Group)

5.3 HUMANITIES

History of ideas, Modern Indian political thought, Gandhism after Gandhi

Dr. Chaitra Redkar is interested in analysing the way idea of rural development evolved in modern India. Currently she is working on two projects - (1) Social History of Sugarcane: This work involves a case study of Harigaon village of Ahmednagar district and its surroundings. It looks into the colonial policies that led to the establishment of the first sugar factory of the Bombay province at Harigaon and the way erection and layer closure of the factory affected the political economy of the region. (2) Dhiren Majumdar and the Gandhian Ideas of Rural Development: This work tries to understand lesser known Gandhian Dhiren Majumdar's contribution to the Gandhian discourse on development.

School students visiting fossil exhibits as part of the Fossil Day celebration at IISER Pune organised by the Earth and Climate Science department on October 15, 2022

6. MATHEMATICS

6.1 ALGEBRA AND NUMBER THEORY

Moduli of curves

Dr. Debargha Banerjee describes his work as follows. Fix a prime p and E a finite extension of Q_p with ring of integers O_E, uniformiser ω and maximal ideal with residue field κ(m) := O_E=m. Let $\rho : G_Q := Gal(Q/Q) \rightarrow GL_2(E)$ be a pro-modular global Galois representations. In other words, $\rho \simeq \rho_f$ for a cuspidal p-adic modular eigenform of possibly non-integral weights with associated Galois representation ρf .

Let $\rho_p := \rho|_{Gp} : G_p \rightarrow GL_2(E)$ be the local Galois representation obtained by the restriction of the Galois representation to the decomposition group $G_p := Gal(Q_p=Q_p)$. They also assume that the residual Galois representation ρ: $G_Q := Gal(Q\backslash Q) \rightarrow GL_2(\kappa(m))$ is absolutely irreducible. Now, ramified primes will give rise to levels of the p-adic modular forms, we are starting with. They assume that the levels of p-adic modular forms are of the form $\Gamma(p^m) \cap \Gamma_1(N)$ with (N, p) = 1. The local Galois representation ρ_p can be very complicated and most importantly are vast. However, thanks to the work pioneered by Fontaine on p-adic Hodge theory and developed by several mathematicians (including Colmez, Breuil, and Berger), they have a better understanding of these local Galois representation ρ_p. Assume that these local Galois representations satisfy the hypothesis of Fontaine-Mazur conjecture, namely ρp is de-Rham and hence potentially semi-stable.

They further assume that ρ_p is potentially crystalline. Now Fontaine-Mazur conjecture has been proved in a great generality. Hence, they conclude that $\rho \simeq \rho_f$ for a global Galois representation ρ_f associated to an elliptic modular form f of level $\Gamma(p^m) \cap \Gamma_1(N)$ with (N, p) = 1. By a program initiated by Breuil starting from the beginning of this century, we can associate a p-adic admissible, unitary automorphic representation $B(\rho_p)$ of the group $G := GL_2(Q_p)$ to these local Galois representations.

These Galois representations appear in the completed cohomology groups of the modular curves. Thanks to the work of Scholze, the modular curves break into the ordinary and supersingular parts. It is natural to ask under what condition of ρ_p, the corresponding automorphic representation $B(\rho_p)$ will appear in the completed cohomology of the ordinary or supersingular part of the cohomology. This article aims to investigate this condition. Dr. Banerjee's work showed that ordinary representations appear in the ordinary parts of the cohomologies. For ρ_p absolutely irreducible, a similar theorem was proved by Chojecki for mop p situation and for p-adic situation.

Chojecki asked if the above theorem can be generalized to the situation when ρp is reducible, non-split. Their theorem answers the question raised by Chojecki. For totally real fields, they generalize Chojecki's theorem in the mod p situation again under the assumption that ρ_p is absolutely irreducible.

Whitehead group of general orthogonal modules

Dr. Rabeya Basu's work is based on problems in classical K-theory which are related to Serre's problem on projective modules. This famous theorem says that finitely generated projective modules over a polynomial ring over field are free. This involves problems in lower K-theory, in particular the study of the Whitehead group K1 due to Hyman Bass, which generalises the

group of units of a ring. Dr. Basu's recent work includes the following main results for the general quadratic (Bak's unitary) groups over graded rings:

1. The relative cases of Quillen–Suslin's local-global principle for the general quadratic (Bak's unitary) groups, and its applications for the (relative) stable and unstable K1-groups.

2. Graded version of the local-global principle for the general quadratic groups and its application to deduce a result for Bass' nil groups.

At present, Dr. Basu is working on related problems over monoid rings along with an IISER postdoctoral fellow.

Witt vector functors

The theory of Witt vectors is one of the highly active areas in algebra and representation theory. Dr. Supriya Pisolkar has been working on comparison of two constructions of Witt vectors with coefficients in associative rings which need not be commutative. One of constructions due to L. Hesselholt is a functor W from the category of Associative rings to the category of abelian groups. The other construction due to Cuntz-Deninger is of a functor E from the Associative rings to Associative rings. Although these constructions match on the category of commutative rings, not much is known about how they are related in non-commutative set up. It's very natural to ask how these constructions are related for non-commutative rings. Hesselholt asked us a question whether for a associative ring A, the group $HH_0(A)$ is isomorphic to W(A)? In Dr. Pisolkar's previous joint work with Dr. Amit Hogadi and in her independent work, she has established some negative results in this direction. In the last academic year along with PhD student Biswanath, Dr. Pisolkar has been trying to compare the short length witt vectors $E_n(A)$ and $W_n(A)$ n any natural number. They are also trying to establish a natural transformation from E(A) to W(A) that gives a natural isomorphism at the commutative level. This is a work in progress.

Analytic number theory and arithmetic of modular forms

An important theme that connects probability and number theory is that of comparing the spacing statistics of a uniformly distributed sequence in [0,1] (which arises from interesting arithmetic objects such as Fourier coefficients of modular forms, zeta zeroes of families of curves over finite fields and eigenvalues of regular graphs) with that of a sequence of random points chosen uniformly and independently on [0,1]. This comparison is done with the help of explicitly defined notions such as pair correlation, m-level correlations and level spacing distribution. These small-scale statistics have been extensively studied for various types of deterministic sequences, including those mentioned in the above examples, and help us to understand the random nature of a deterministic sequence. During the reporting year, Dr. Kaneenika Sinha investigated fundamental questions about the behaviour of asymptotically distributed sequences in mesoscopic regimes in the context of modular forms.

In previous joint work with Baskar Balasubramanyam in 2019, Dr. Sinha initiated a study of the pair correlation statistics of these sequences motivated by some conjectures of Katz and Sarnak. They showed that under suitable growth conditions for families of Hecke newforms, the expected value of the local pair correlation function of the Hecke angles for a random newform converges to the Poissonnian pair correlation. In collaboration with her PhD student, Jewel Mahajan, Dr. Kaneenika Sinha took this study forward last year. Bounds for all higher moments of this pair correlation function, and estimates for lower order error terms in the computation of these moments have been obtained. In particular, the convergence of the second moment of this local pair correlation function is derived, and it is shown that the variance goes to 0 under

suitable growth conditions for the families of Hecke newforms. Thus, the local pair correlation function of a random newform in large families is Poissonnian. This work is currently under review (arXiv:2206.01911v2).

Many questions about distribution and local spacings of arithmetic sequences can be reduced to questions about discrepancy (or in other words, effective rates of convergence) in the asymptotic distributions of these sequences. This has been a recurring theme in Dr. Kaneenika Sinha's research over the last decade, and the most recent development in this context is an omega-type result about discrepancies in the distribution of Satake parameters corresponding to Hilbert modular forms. This is joint work with Baskar Balasubramanyam and their joint PhD student, Jishu Das. This work is currently under review (arXiv:2307.16736).

6.2 ANALYSIS, DIFFERENTIAL EQUATIONS, APPLICABLE MATHEMATICS

Elliptical particle differential equations

In a joint work with Debdip Ganguly, Debabrata Karmakar and Saikat Mazumdar, Dr. Mousomi Bhakta has established quantitative gradient stability of Poincar´e-Sobolev inequality and the corresponding Euler-Lagrange equation locally around a bubble in the hyperbolic space. Their result generalises the sharp quanti-tative stability of Sobolev inequality in Euclidean space of Bianchi and Eg-nell (J. Funct. Anal. 100 (1): 18–24. 1991) and Ciraolo, Figalli and Maggi (Int. Math. Res. Not. IMRN (21): 6780–6797, 2018) to the Poincar´e-Sobolev inequality on the hyperbolic space. It's known from Dr. Bhakta's joint work with Sandeep, CVPDE'2012 that if $u \geq 0$ and $\|\Delta_B n\, u + \lambda u + u^p\|_H - 1 \to 0$, then $\delta(u) := \text{dist}(u, M_\lambda) \to 0$,. Here $\delta(u)$ denotes the H^1– distance of u from the manifold of sums of superpositions of hyperbolic bubbles and (localized) Aubin-Talenti bubbles. In the subcritical case, it is known that M_λ consists of only hy-perbolic bubbles. In their recent works, they have proved that even when p is critical exponent, up to a countable set of $\lambda \in [n(n-2)/4, (n-1)^2/4]$ there are only hyperbolic bubbles present in the manifold M_λ at the energy level of an integer multiple of the energy of a hyperbolic bubble. In the case of multi bubble, they have proved under certain bounds on L^2 norm of the gradient, the inequality $\delta(u) \lesssim \|\Delta_B n\, u + \lambda u + u^p\|_H - 1(_B{}^n)$, holds whenever $3 \leq n \leq 5$. This generalises a recent result of Figalli and Glaudo, ARMA'2020 on the Euclidean case to the context of the hyperbolic space.

Furthermore, combining their stability results and implementing a novel and refined smoothing estimates, in spirit of Bonforte and Figalli (Comm. Pure Appl. Math. 74 (4): 744--789, 2021), they prove a quantitative extinction rate towards its basin of attraction of the solutions of the sub-critical fast diffusion flow for radial initial data. In another application, they derive sharp quantitative stability of the Hardy-Sobolev-Maz'ya inequalities for the class of functions which are symmetric in the component of singularity.

Probability theory and control theory

Over the last year, Dr. Anup Biswas worked on a couple of projects involving nonlocal operators. Some of the recent important works includes ergodic control problem for jump diffusions, Liouville property for infinity Laplacian, boundary regularity of mixed local-nonlocal operators etc.

Several complex variables

An offshoot of the classical Levi problem is the so-called Union Problem. In short, given an increasing family of Stein manifolds, it asks whether their union is also Stein. In general, the

answer is no, and a counterexample was given by Fornaess in 1976. A variant of this problem is the following: Let M be a complex manifold which is the union of an increasing sequence of open subsets M_j each of which is biholomorphic to a fixed domain $\Omega \subset C^n$. The question is: Is M biholomorphic to Ω? In a joint project with G.P. Balakumar, P. Mahajan, and K. Verma, Dr. Diganta Borah investigated this question. Building on work of Fornaess–Sibony, they studied two cases namely, M is Kobayashi hyperbolic and the other being the corank one case in which the Kobayashi metric degenerates along one direction. In both these cases, description of M is obtained when the domain Ω has a certain property, namely, it is amenable to scaling.

The squeezing function of a domain $D \subset C^n$ is a biholomorphic invariant introduced by Deng–Guan–Zhang in 2012. In recent years, a lot of the research on the squeezing function has focused on a diagnostic that this function provides for detecting (local) strong Levi pseudoconvexity of ∂D. In a joint project with G. Bharali and S. Gorai, Dr. Diganta Borah is investigating a class of problems that the squeezing function was initially associated with: namely, computation of the squeezing function and its connections with the intrinsic complex geometry of D.

Shape sensitivity analysis

In collaboration with a PhD student at IIT Madras (who is also a joint PhD student with Dr. Chorwadwala), Dr. Anisa Chorwadwala considered the optimisation problem for the first Dirichlet eigenvalue λ_1(Ω) of the p-Laplacian Δp, 1 < p < ∞, over a family of doubly connected planar domains Ω = B \ P, where B is an open disk and P \subset B is a domain which is invariant under the action of a dihedral group D_n for some n ≥ 2, n ∈ N. They studied the behaviour of λ_1 with respect to the rotations of P about its centre. They proved that the extremal configurations correspond to the cases where Ω is symmetric with respect to the line containing both the centres. Among these optimizing domains, the OFF configurations correspond to the minimizing ones while the ON configurations correspond to the maximizing ones. Furthermore, they obtained symmetry (periodicity) and monotonicity properties of λ_1 with respect to these rotations. In particular, they proved that the conjecture formulated in a previous publication (Chorwadwala-Roy, Journal of Optimization Theory and Applications (2019) doi:10.1007/s10957-019-01483-1) for n odd and p = 2 holds true. As a consequence of their monotonicity results, they showed that if the nodal set of a second eigenfunction of the p-Laplacian possesses a dihedral symmetry of the same order as that of P, then it can not enclose P. This research work is published here: Anisa-Mrityunjoy, J. Math. Anal. Appl., 508(2), 2022.

Mathematical finance

Research carried out in Dr. Anindya Goswami's group is described below.

1. Regime recovery using implied volatility in Markov modulated market model with Dr. Kedar Nath Mukherjee, Mr. Irvine Homi Patalwala, and Mr. Sanjay Nadahalli Satish. In the regime switching extension of Black–Scholes–Merton model of asset price dynamics, one assumes that the volatility coefficient evolves as a hidden pure jump process. By assuming regime switching is Markov, and pretending that the theoretical price of European vanilla options on that asset as traded prices, they compute the implied volatility (IV) process. For this they make use of a novel scheme for computing option price that is shown to be stable. Then by performing several numerical experiments on ternary regime models they observed a clear evidence of volatility smile that is at par with the empirically observed stylized facts. Furthermore, they have experimentally validated that IV time series, obtained from practical contracts with moneyness and TTM varying in a particular narrow range, can recover the transition instances of the hidden Markov chain having three states. Such regime recovery for any arbitrary state-space and transition parameters has also been established in a theoretical setting.

2. Semimartingale Representation of a Class of Semi-Markov Dynamics with Dr. Subhamay Saha, and Mr. Ravishankar Kapildev Yadav: They consider a class of semi-Markov processes (SMP) such that the embedded discrete time Markov chain may be non-homogeneous. The corresponding augmented processes are represented as semi-martingales using stochastic integral equation involving a Poisson random measure. The existence and uniqueness of the equation are established. Subsequently, they showed that the solution is indeed a SMP with desired transition rate. Finally, they derive the law of the bivariate process obtained from two solutions of the equation having two different initial conditions.

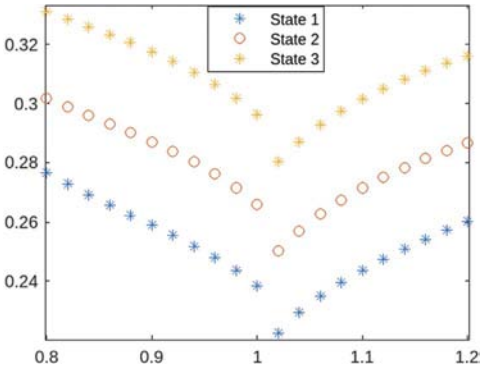


Figure 17:
Under each scenario of three possible regimes in a Markov modulated GBM dynamics of spot price, the plot shows how Implied volatility varies with strike price with fixed spot price 1. (Dr. Anindya Goswami's Group)

Functional Analysis, Operator Theory

Dr. Haripada Sau works in an interdisciplinary area of complex analysis, function theory and operator theory. Jointly with Dr. B. Krishna Das of IIT Bombay, Dr. Sau in 2021 proposed a very natural problem, which is named (by one of the reviewers) "A Constrained Ando Dilation Problem". The problem was solved only partially. This year a substantial progress is made in this direction, which, in turn, answered another problem that was left open in a recent work by S. Sarkar (J. Operator Theory, 2022). This new development is currently in preparation, and is shown to demonstrate the subtlety of the rational dilation theory associated to the bidisk.

6.3 GEOMETRY AND TOPOLOGY

Low-dimensional topology

Three-dimensional manifolds can be cut into pieces which either have hyperbolic geometry or are Seifert fiber spaces. The latter are precisely the 3-dimensional manifolds which are foliated by circles. Dr. Tejas Kalelkar's group has introduced the notion of prism complexes in place of simplicial complexes and shown that while every 3-manifold has a prism complex structure, it has a special prism complex structure if and only if it is a Seifert fibered space. Incompressible surfaces are an interesting class of embedded surfaces along which a 3-manifold can be cut and simplified. Such surfaces are well-studied in orientable Seifert fiber spaces but not much work has been done in the non-orientable case. They have shown that incompressible surfaces in non-orientable Seifert fibered spaces are of one of two types, pseudo-horizontal or pseudo-vertical. This is Dr. Tejas Kalelkar's joint work with his student Ramya Nair.

Benedetti-Petronio fine-tuned Pachner's result using the dual view-point of spines to show that any two triangulations of a 3-manifold with the same number of vertices are related by local triangulation changes called Pachner moves through triangulations with the same number of vertices. This is useful both for defining 3-manifold invariants using triangulations and also for improving efficiency in making surveys of 3-manifolds. They are currently working on extending

this result to triangulations of higher dimensional manifolds. This is joint work with Henry Segerman.

Toric vector bundles and tensor triangular geometry

Algebraic geometry is the study of geometric objects described by polynomials. Such objects carry a rich structure if they have a lot of symmetry. Toric varieties contain a torus (analogous to the product of circles, like a doughnut) whose dimension is equal to that of the variety. Advancing a previous work done by Dr. Vivek Mohan Mallick and Mr Kartik Roy (https://arxiv.org/abs/2212.00314), Dr. Vivek Mohan Mallick studied the relationship between various Proj-like constructions on toric varieties. These constructions were done by Brenner-Schroer and Perling. This work showed that the two constructions give us closely related spaces.

In two preprints with Pavan Dighe, Dr. Mallick studied how to compute algebraic geometric invariants of spaces called equivariant Chow groups for algebraically defined geometric objects called T-varieties. T-varieties are spaces defined using polynomials whose group of symmetries contain a torus. This allows one to describe such spaces combinatorially, as was observed by Altman, Hausen and Suss. They provide a way to describe the combinatorial data if one replaces the torus in the group of symmetries with a smaller torus.

With Dr. Umesh Dubey, Dr. Mallick is working on a version of Vistoli and Vezzosi's result describing the K-theory equivariant tensor triangulated categories in terms of the usual K-theory. Tensor triangulated categories are abstract objects which unify the essence of various results spanning a wide range of mathematics, including Algebraic Geometry, Representation Theory and KK-theory of C*-algebras.

Dr. Mallick is also working on two projects with his student Kunal.

With Jose Ignacio Burgos Gil, Dr. Mallick is studying the positivity properties of line bundles on toric varieties.

Geometry and topology of complex manifolds and varieties

Prof. Mainak Poddar's research studies geometric phenomena in which symmetry plays a major role, by using algebraic, complex analytic and symplectic tools. It also aims to extend concepts and constructions in the smooth or non-singular case to the singular situation. His research group has recently developed a theory of logarithmic connections for principal bundles over normal algebraic varieties, extending the classical theories that apply to either holomorphic principal bundles over complex manifolds or vector bundles over algebraic varieties. They have also introduced an invariant for 3-dimensional cyclic orbifolds using bordered Heegaard Floer theory. They have also been investigating a new notion of generalised holomorphic principal bundle over a generalised complex manifold, generalised complex structures on a class of principal torus bundles over a complex manifold, and a new notion of Dirac vector bundle over a Dirac manifold, etc.

6.4 DISCRETE MATHEMATICS

Parameterized algorithms

Dr. Soumen Maity's research primarily focuses on parameterized algorithms and combinatorics. Many computational problems that we want to solve are often NP-hard or worse, but somehow, they need to get solved. Over the years multiple paradigms for coping with NP-hardness have been introduced: for instance, approximation algorithms, average-case analysis, and randomised algorithms were all borne out of a desire to solve hard problems by relaxing the problem or strengthening the model. Within the last 20 years, a new paradigm has been introduced, where one measures the time complexity of an algorithm not just in terms of the input length but also a small parameter. The overall goal is to identify interesting parameterizations of hard problems where they can design algorithms running in time polynomial in the input length but possibly exponential (or worse) in the small parameter. Such an algorithm is called "fixed-parameter tractable" and it is the gold standard for parameterized algorithms. Dr. Soumen Maity's group works on the parametrized complexity of globally and locally minimal defensive alliances, edge deletion to restrict the size of an epidemic, the harmless set problem in social network, upper edge dominating set problem and knot free vertex deletion (KFVD) problem.

The Erdos-Hajnal Conjecture: Dr. Soumen Maity's group works on the Erdos-Hajnal conjecture. They proved that every graph is an induced subgraph of some primitive Paley graph, and all Paley graphs are substitution prime. Thus, they have reduced the Erdos-Hajnal conjecture, by showing that it suffices to prove the Erdos-Hajnal property for primitive Paley graphs only.

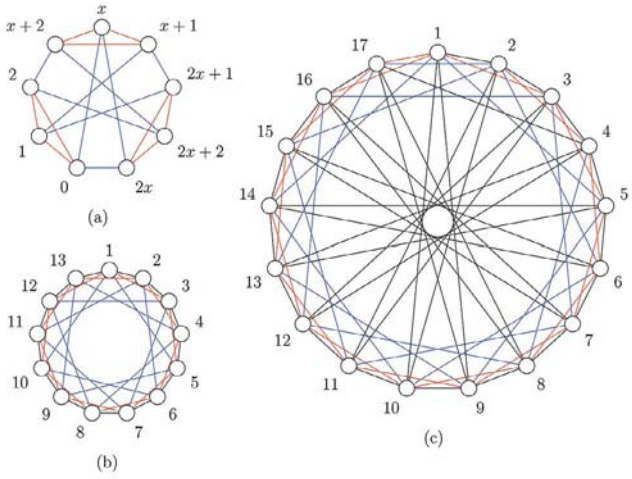


Figure 18: *Examples of Paley graphs: (a) Paley-9, (b) Paley-13, and (c) Paley-17. (Dr. Soumen Maity's Group)*

7. PHYSICS

7.1 ATOMIC AND MOLECULAR PHYSICS, OPTICS, AND QUANTUM INFORMATION

Quantum transport properties

Dr. Bijay Kumar Agarwalla's research is towards understanding the transient and steady-state anomalous quantum transport properties in low-dimensional systems. The group develops analytical and computational tools, open quantum system dynamics beyond the Markovian regimes, towards understanding universal properties of non-equilibrium fluctuation and its impact on quantum devices.

Correlated quantum systems, statistical mechanics, Fractional Quantum Hall effect

FQH systems form the best understood experimental realisations of interacting topologically ordered systems. Dr. Sreejith G.J.'s group presents exact solutions to eigenstates of specific fine-tuned models that qualitatively reproduce the physics of the FQH systems. They obtain solutions on the torus geometry and also work on inverse problems and disorder physics in related systems. Extending their previous works on entanglement structures, they recently demonstrated hidden affine Lie algebra structures in the entanglement between FQH subsystems.

Fluctuating surfaces appear in the physics of surface roughening. A tractable scenario is a steady ensemble of smooth surfaces with a Gaussian weight. They obtain exact results on the probability that two points on the landscape can be reached through a constant height contour. Contour lines of fluctuating membranes form an instance of loop 'gas'. Ensembles of loops occur routinely in constrained systems, graph cycles, conformal field theories, spin chains, topological order, and graph stabilisers in quantum computing. The group studies the phase diagram of loop models with simple interactions between loop segments defined on a square lattice.

Tensor networks allow efficient studies of quantum dynamics, and in one of the projects, the group employs them to study anomalous transport in an interacting integrable quantum spin chain. The QR decompositions involved are more efficient on GPUs than on CPUs. In a recently started project, the group explored using TPUs and GPUs for speed up. In another project they initiated, in conjunction with techniques borrowed from quantum algorithms, they use tensor network techniques to explore phase transitions induced by measurements on quantum circuits.

Low temperature complex plasma

Dr. Surabhi Jaiswal's research group focuses on low temperature complex plasmas and understanding the behavior of microparticle cloud in plasma. Micron sized particles when introduced into the plasma gets charged and make a third component in addition to electron and ions. These charged particles have variable coupling strength based on the background discharge parameters. Over the past year, the group has had two major focus areas. One is to develop the python-based analysis techniques to extract the behavior of microparticle in plasmas. Understanding the statistical behavior of these particle in different plasma condition is important for fundamental physics of charged particles and predictive control of dust for material science applications. These particles exhibit phase transition and multiphase coexistence by varying plasma condition which can be utilised to understand the coupling strength and interactive potential between multibody system of charge particles. The second focus was to perform collaborative studies on understanding the magnetic field effect on plasmas and dusty plasmas. Magnetic field affects the diffusion of charge particles and depending on the strength

of magnetic field the particle can be magnetised which further affects the charging of dust particles and its ability to transform into different phases. Magnetic field may also affect the interaction potential and screening isotropy of these systems. Therefore, group is developing techniques to understand these physical phenomena via experiments and simulations.

Ultra cold dipolar gases and Rydberg atoms

In Dr. Rejish Nath's group, the research during this period was mainly focused on the self-bound condensates. In particular, bright polar solitons in spinor condensates and droplet states in dipolar Bose-Einstein condensates. Their studies revealed that overlapping polar bright solitons led to various interesting dynamical scenarios, which converted into ferromagnetic and even more exotic oscillation states. In the case of dipolar BEC, they have shown that various droplet crystal states emerge as ground states in the presence of a harmonic trap. A notable one being the array of pancake droplets.

Optothermal trapping, thermoplasmonic systems

Some projects under exploration in Prof. G.V. Pavan Kumar's group are
1) Brownian dynamics in structured optical landscape
2) Pattern formation in opto-thermally driven systems
3) Statistical optics of optothermal fields

The group made novel observations on optothermal trapping and dynamics of colloids in thermoplasmonic systems, which may have interesting consequences on studying out-of-equilibrium physics.

7.2 CONDENSED MATTER, STATISTICAL PHYSICS, MATERIALS

Soft and living matter

Dr. Apratim Chatterji's group is working on the mechanisms of emergent organisation and dynamics of macromolecules, or collection of macromolecules in the microns to nano-meter length scales.

1. Spatio-temporal organisation of bacterial chromosomes in fast growth conditions: *E. coli* cells grow with overlapping cell cycles in all but the slowest growth conditions. The fast growing bacteria can have four or more copies of the replicating DNA of different lengths. This makes the spatial segregation and the subsequent organisation of the DNA a difficult task with two rounds of replication going on simultaneously. They show how the principles of entropy maximisation of topologically modified confined ring DNA-polymers can achieve this. Thus polymer physics principles, previously used to understand chromosome organisation in slow growing *E. coli* cells, also resolves DNA-organisation mechanisms in more complex scenarios. The time evolution of loci positions quantitatively match the corresponding experimentally reported results (FISH data), including observation of the cohesion time and the ter-transition.

2. Emergent organisation of topologicallly modified Ring polymers with spherical confinement: It is well established that loops continuously get extruded in chromosomes of bacterial as well as eukaryotic cells. The aim of this investigation is to unravel basic mechanisms by which loops of different sizes get organised within spherical confinement, with the

expectation that the basic physics developed will be useful to understand biologically relevant scenarios in the future.

3. Emergent helicity in free-standing charged, semiflexible polymers: Helical motifs are ubiquitious in macromolecular systems. The mechanism of spontaneous emergence of helicity is unknown, especially in cases where torsional interactions are absent. Emergence of helical order needs coordinated organisation over long distances in polymeric macromolecules.

   The group established a very generic mechanism to obtain spontaneous helicity by inducing screened Coulomb interactions between monomers in a semiflexible heteropolymer. Due to changes in solvent conditions, different segments (monomers) of a polymeric chain can get locally charged with charges of differing polarities and magnitudes along the chain contour. This in turn leads to spontaneous emergence of transient helical structures along the chain contour for a wide range of Debye-lengths. They have avoided using torsional potentials to obtain helical structures and rely only on radially symmetric interactions. Lastly, transient helices can be made long-lived when they are subjected to geometric confinement, which can emerge in experimental realisations through a variety of conditions.

4. Modelling a porous sponge made of polymer nano-composites where the nano-particles are rod shaped: This investigation is in continuation of previous work, where the nano-particles considered were spherical particles. If the spherical particles are replaced by rod like particles response of the sponge to external stresses is very different. The aim of the current investigations is to identify the microscopic mechanisms which result in very different macroscopic response of the sponge.

5. Multiscale simulation to investigate aggregation of passive particles in an active matter bath: Corresponding experiments are being done in Dr. Vijay Chikkadi's lab with passive colloidal particles in a bacterial Bath.

Optoelectronics

Research in Dr. Shouvik Datta's group is described below.

1. Presence of coherent 'resonant' tunneling in quantum dot (zero-dimensional) - quantum well (two-dimensional) heterostructure is necessary to explain the collective oscillations of average electrical polarisation of excitonic dipoles over a macroscopically large area. This was measured using photo excited capacitance as a function of applied voltage bias. Resonant tunneling in this heterostructure definitely requires momentum space narrowing of charge carriers inside the quantum well and that of associated indirect excitons, which indicates bias dependent 'itinerant' Bose-Einstein condensation of excitons. Observation of periodic variations in negative quantum capacitance points to in-plane coulomb correlations mediated by long range spatial ordering of indirect, dipolar excitons. Enhanced contrast of quantum interference beats of excitonic polarisation waves even under white light and observed Rabi oscillations over a macroscopically large area also support the presence of density driven excitonic condensation having long range order. Periodic presence (absence) of splitting of excitonic peaks in photocapacitance spectra also demonstrate collective coupling (decoupling) between energy levels of the quantum well and quantum dots with applied biases, which can potentially be used for quantum gate operations. All these observations point to experimental control of macroscopically large, quantum state of a two-component Bose-Einstein condensate of excitons in this quantum well - quantum dot heterostructure. Therefore, in principle, millions of two-level excitonic qubits can be intertwined to fabricate large quantum registers using such hybrid heterostructure by

controlling the local electric fields and by varying photoexcitation intensities of overlapping light spots.

2. No-cloning theorem in quantum cryptography prevents an eavesdropper from perfectly duplicating any arbitrary quantum state. Here the group argues that an experimental scheme to produce a quantum superposition of interacting Bose-Einstein condensates can generate N bosonic clones of any arbitrary single quantum state at large N limit of thermodynamic equilibrium with high fidelity and thus operationally 'bypass' the restrictions imposed by the above mentioned theorem. This is possible because quantum statistical nature of this 'cloning operation' does not require strict unitary evolution of standard quantum mechanics within a single Hilbert space.

3. The momentum space distributions of photons coming out of any light emitting device provide a lot of information about the underlying long-range spatial correlation of its physical origin. Thus, for measuring such momentum resolved data, first the group tried to measure the spatial coherence function of light, whose Fourier Transform can then yield the required momentum space distribution. Conventional methods of determining such properties impose specific instrumentational difficulties for probing samples kept within a low temperature cryostat. There were past attempts to measure such two-dimensional (2D) coherence function which could then be used for extracting momentum space information, but each of these come up with additional experimental complexities. Dr. Shouvik Datta's group proposed a simple interferometry setup to measure the 2D coherence function of emitted light and then use that to estimate the 2D in-plane momentum space distribution from the Fourier transform of the 2D optical coherence function. In this work, the group discussed how this experimental method and subsequent data analyses can overcome the past obstacles. They used this setup to measure the 2D coherence function as well as the 2d momentum space distribution of light from a laser diode as a function of its bias voltage and observed the expected narrowing of the momentum space during the onset of lasing.

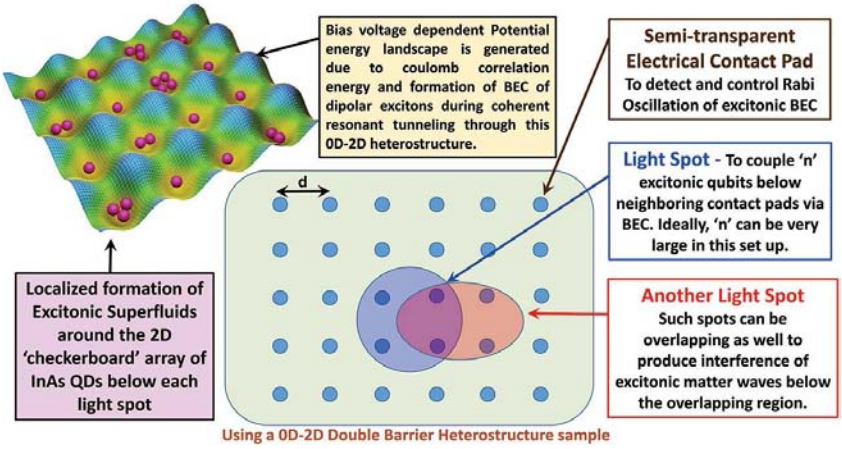


Figure 19: *Schematic on how to make N-Qubit quantum register using excitonic BEC (Dr. Shouvik Datta's Group)*

Phase transitions, sorting dynamics

In the last year, Prof. Deepak Dhar's research has been mainly on models of interacting hard rotors which are pivoted at lattice sites, but can have arbitrary orientations, subject to the constraints that two rotors cannot overlap. They find that such a system, for given shapes of molecules undergoes a sequence of phase transitions as a function of the ratio of lattice spacing to particle size.

Quantum magnetism

Research in Prof. Surjeet Singh's group focuses on the synthesis and study of magnetic properties of novel quantum materials and their application in the areas of clean energy generation and emerging quantum technologies. During the year, the group reported crystal growth of a 'defective' half-Heusler with quasi-long-range vacancy ordering - a phenomenon of fundamental interest with various potential applications. They devised a new method, which does not involve high-temperature heating or sintering, for the fabrication of high-density pellets of thermometric material Ag_2Te. This helps solve the problem of Ag migration associated with high-temperature sintering. By adopting the hierarchical nanostructuring at all length scales strategy for phonon scattering, they obtained a very high zT 1.2 at 300°C. Main contributions from the group in the fundamental or basic research during this period include:

(a) A detailed experimental investigation of the electronic structure of pyrochlore iridates using synchrotron data. This led us to give the correct interpretation of the photoemission satellite peaks in Iridates (Ir^{4+}) as the "screened" and "unscreened" components, and are not indicative of two different valence states of Ir as was commonly believed. (b) Taking their investigation on spin-ladders further, the group showed that off-ladder impurities in these materials can affect both the low-energy magnetic excitation and superconducting correlations in the CuO_4 plaquettes. (c) In collaboration with BARC Mumbai, they showed the emergence of superconductivity in type-II Dirac semimetal candidate Ir_2In_8S. (d) In the triangular lattice compound $Ca_3NiNb_2O_9$, they investigated the ground state of ordered and disordered variants. They show that while the disordered variant exhibits spin-glass-type freezing, the ordered variant undergoes two successive phase transitions with a 120-degree ground state and the occurrence of the 1/3 magnetisation plateau.

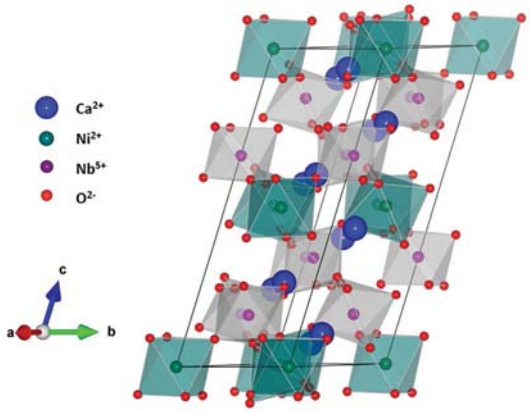


Figure 20:
Unit cell of the triangular lattice compound $Ca_3NiNb_2O_9$ (Prof. Surjeet Singh's Group)

7.3 COSMOLOGY, PARTICLE PHYSICS, AND GRAVITY

Quantum Field Theory

Scattering amplitudes in a Quantum Field Theory represent the 'physics' in the theory and are the objects measured in experiments like the LHC. The past two decades have seen significant advances in our understanding of how to compute these objects efficiently. An extremely interesting finding has been the remarkable simplicity underlying amplitudes.

Prof. Sudarshan Ananth's research focus has been on understanding the origin of this 'simplicity' and work, with his students, suggests that a lot of this simplification stems from sacrificing two properties in the theory: manifest-locality and manifest Lorentz invariance. Another focus has been on the inverse soft approach which allows for the construction of higher-point (more

complicated) amplitudes from lower-point (simpler) ones. This approach has been successfully used to derive a compact quartic interaction vertex for N=8 supergravity in the light-cone gauge, an essential step towards a finiteness analysis of the model.

Another research focus has been on classifying interaction vertices in field theories, formulated in the light-cone gauge. Specifically for gravity, new bounds and restrictions, on permitted interactions were identified. Highlights in this direction include all-order results on the structure of interaction vertices in light-cone gravity and an explicit expression for all 6-point interaction vertices in gravity - the first order at which truly non-MHV vertices appear in the theory.

Astrophysics and Cosmology

Dr. Arka Banerjee's research group focuses on using the structures in our Universe on the largest cosmological scales to constrain fundamental physics at the smallest scales. Over the past year, the group has had two major focus areas. One is to develop techniques for and run cosmological N-body simulations of structure formation in the presence of additional light massive relics, both thermal and nonthermal in origin. By quantifying the effects such light massive species have on structure formation in the Universe, one can then compare to the data collected by cosmological surveys to constrain such models, which are well-motivated from the particle physics side. The second major focus of the group has been to develop and deploy statistical measures for cosmological analyses which exploit non-Gaussian information in the clustering of galaxies, beyond the reach of the traditional two-point function analyses employed in cosmology. These measures promise to yield better constraints and detection for various models for Dark Matter, Dark Energy and so on.

Experimental high energy physics

Dr. Sourabh Dube is an experimental particle physicist and a member of the CMS collaboration at the Large Hadron Collider at CERN, Geneva. The large Run 2 dataset of the CMS experiment continued to be analysed. The publication of the multilepton search resulted in the strongest constraints on the type-III seesaw fermions and on a doublet model of vector-like tau leptons. To target the singlet model of vector-like taus, a new analysis based on a single lepton final state is under development. Along with a same-charge dilepton final state, they expect to improve the constraints on the singlet model. A reinterpretation of Run 1 results is also being carried out to establish if lower collision energy leads to higher sensitivity for lower mass vector-like taus in the singlet model.

Additionally, the group expanded its expertise in the use of machine learning techniques by examining generative adversarial networks (as well as autoencoders) and their capabilities to act as generators for simulation of collision events. These will play a crucial role at HL-LHC and its large datasets.

Complex networks, quantum systems

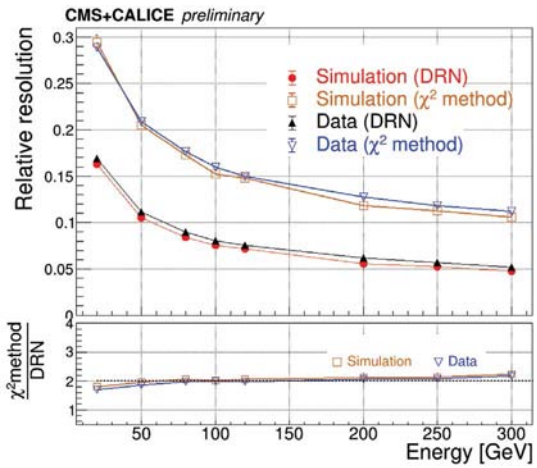
Prof. M.S. Santhanam's work broadly falls in the areas of (a) quantum dynamics and quantum computation, (b) statistical physics and complex networks. As part of work on quantum dynamics and computation, their group focusses on transport and dynamical localisation in interacting chaotic quantum systems. On quantum computation front, their work explores collective qubit dynamics, quantum walk algorithms, and quantum machine learning. On complex networks, the group is interested in broad questions about flows and extreme events on networks and resilience of networks against extreme events. They are also interested in the properties of intermittently monitored stochastic processes.

Experimental high energy physics

The endcap calorimeters of the CMS experiment at LHC CERN, Geneva will be replaced by a high granularity calorimeters based on silicon and scintillator technologies (HGCAL) in view of high luminosity operations of the LHC expected to commence in 2029. These detectors are used to measure the energy deposited by high energy electrons, photons, and hadrons such as protons and pions which create a shower of particles as these traverse through material. Dr. Seema Sharma's group is leading the performance of full depth detector prototype in beam test experiments for charged pions and developing algorithms to measure their energies. The group's investigations based on data of beam test experiments of 2018 have been accepted by the Journal of Instrumentation for publication (https://arxiv.org/abs/2211.04740). These are the first performance results for charged pions using real data. The group is presently developing algorithms using on state-of-art machine learning techniques to reconstruct energies of charged pions.

Figure 21:

The algorithm based on graphical neural networks shows a significant improvement over conventional methods (denoted X2), by a factor of two, in the energy resolution of charged pions both in real data and simulated data. The preliminary results have been endorsed by the CMS Collaboration and are publicly available as CERN-CMS-DP-2022-022 at https://cds.cern.ch/record/2815404?ln=en.
(Dr. Seema Sharma's Group)



Probing new physics

Over the last year, Dr. Arun Thalapillil's research and that of his students has been focused mainly on two areas. The first was finding model-agnostic ways to detect new physics imprints in cosmic rays using machine learning techniques, specifically anomaly finders. The second area was theoretically understanding a class of non-topological astrophysical objects and investigating their observational consequences. In the former, along with colleagues and students at IIT Bombay, they were the first to broach this topic using anomaly detection paradigms. In the latter project, they discovered hitherto unknown and novel bounds on the size of these non-topological objects that may form astrophysical objects.

Gravitation and mathematical physics

Dr. Suneeta Vardarajan's research area is Gravitation and black holes. Recently there have been advances in understanding near-extremal black holes using results in Jackiw-Teitelboim gravity. The crucial finding is that the degrees of freedom of this theory are boundary time reparametrisations. This feature affects the thermodynamics in theT->0 limit, leading to drastic changes such as divergence of entropy in this limit. In the last year, there was an interesting proposal for how to find a similar boundary action for general non-extremal black holes. The group quantised this boundary action and showed that the boundary partition function in the case of non-extremal black holes does not affect the black hole thermodynamics, unlike the near-extremal case. This work will appear in the journal Physical Review D. The group is now working on the 1-loop bulk partition function for a general non-extremal black hole. They plan to investigate if it reproduces the T behaviour already found in the near-extremal limit.

PUBLICATIONS AND PATENTS

Total Publications during 2006-2022
(Publications in 2022 calendar year)

TOTAL: **4435** *(554)*

798 *(99)*
BIOLOGY

1357 *(150)*
CHEMISTRY

5 *(4)*
DATA SCIENCE

110 *(28)*
EARTH AND CLIMATE SCIENCE

55 *(16)*
HUMANITIES AND SOCIAL SCIENCES

286 *(49)*
MATHEMATICS

1824 *(208)*
PHYSICS

Publications

IISER Pune has published a total of 4435 papers since inception to the end of 2022. During the 2022 calendar year, institute members published 554 publications: 526 research papers, 22 book chapters, 1 book, and 5 conference papers.

The list of publications from IISER Pune members in the 2022 calendar year is given in the *Appendix* section of this report.

Patents

Since inception and as of December 31, 2022, IISER Pune has filed 77 patent applications, and had 55 published patents and 16 granted patents.

During the 2022 calendar year, IISER Pune filed 18 patent applications, had 12 patents published, and 6 patents granted. In addition, 2 applications were filed and 1 published for PCT approval.

PATENTS

Here is the list of patents filed / published / granted during the 2022 calendar year.

Granted *Published and Granted* *Published* *Filed and Published* *Filed*

Sr. No.	Inventors	Title	Country and Patent Info
1	Ramanathan, Vaidhyanathan; Nandi, Shyamapada	Ultra-microporous metal organic frameworks based on isonicotinate and its derivatives for CO_2 separation applications	**India** Application No.: 2381/MUM/2014 Publication No.: IN391487B Granted No.: 391487
2	Ramanathan, Vaidhyanathan; Mullangi, Dinesh; Nandi, Shyamapada	Covalent organic frameworks as porous supports for non-noble metal based water splitting electrocatalysts	**India** Application No.: 4301/MUM/2015 Publication No.: IN20150430113 Granted No.: 394736
3	Halder, Sattwick; Roy, Kingshuk; Nandi, Shyamapada; Vaidhyanathan, Ramanathan	Self-exfoliated triazole-triformyl phloroglucinol based covalent organic nanosheets for high and reversible lithium ion storage	**India** Application No.: 201721019419 Publication No.: IN392721B Granted No.: 392721
4	Haldar, Sattwick; Chakraborty, Debanjan; Vaidhyanathan, Ramanathan	Covalent organic framework as flexible white light emitter	**India** Application No.: 201821028796 Publication No.: IN412657B Granted No.: 412657
5	Hotha, Srinivas; Neralkar, Mahesh; Hotha, Sanjeev	Insect repellent	**India** Application No.: 201921017887 Publication No.: IN410917B Granted No.: 410917
6	Hotha, Srinivas; Sutar, Yogesh; Walke, Gulab; Kasdekar, Niteshlal	Silver assisted gold catalysis for the preparation of fondaparinux pentasaccharide and intermediates	**India** Application No.: 202021050409 Publication No.: IN413595B Granted No.: 413595
7	Galande, Sanjeev; Naik, Rutika	Combined expression pattern of SATB family chromatin organizers as improved biomarker tool for cancer prognosis	**Japan** Application No.: Japan (2021-530331) Publication No.: JP2022502072
8	Abraham, Nixon Mundathukudiyil	Olfactory-action meter for precise quantification of olfactory deficits	**India** Application No.: 202021035482 Publication No.: IN432345B
9	Abraham, Nixon Mundathukudiyil	Olfactory-action meter for precise quantification of olfactory deficits	**U.S.A.** Application No.: US (17/443,527) Publication No.: US20220054075A1
10	Kikkeri, Raghavendra, Kumar, N. Vijendra, Shanthamurthy, Chethan D., Jain, Prashant, Raigawali, Rakesh, Vered Padler-Karavani, Leviatan Ben-Arye Shani	Heparan sulfate compounds as chemokine inhibitors	**India** Application No.: 202121003052 Publication No.: IN423269B

Sr. No.	Inventors	Title	Country and Patent Info
11	Britto, Sandanaraj Selvaraj; Bathla, Punita; Abhijit De	Assay for determining target engagement in real time	**India** Application No.: 202121011849 Publication No.: IN421037B
12	Rapol, Umakant D.; Hotha, Srinivas; Nair, Sunil; Patel, Kushal H.; Dutta, Pranab; Maurya, S. Sagar; Biswas, Korak; Das, Pratim Kumar	Chemical oxygen generator	**India** Application No.: 202121020842 Publication No.: IN417410B
13	Datta, Shouvik; Bhunia, Amit; Singh, Mohit Kumar; Mohamed, Henini; and Maryam Al Huwayz	Excitonic Bose-Einstein condensate (BEC) as qubits using semiconductor nanostructures for quantum technologies	**India** Application No.: 202121025498 Publication No.: IN202121025498A
14	Britto, Sandanaraj Selvaraj; Bathla, Punita; Abhijit De	Assay for determining target engagement in real time in living system	**U.S.A.** Application No.: US (17/698,397) Publication No.: US20220298541A1
15	Haldar, Sattwick; Vaidhyanathan, Ramanathan	Method of tuning the electronic energy level of covalent organic framework for crafting high-rate Na-ion battery anode	**Singapore** Application No.: (SG)11202253550X Publication No.: SG11202253550A1
16	Haldar, Sattwick; Vaidhyanathan, Ramanathan	Method of tuning the electronic energy level of covalent organic framework for crafting high-rate Na-ion battery anode	**China** Application No.: (CN)202180025586.5 Publication No.: CN115348985A
17	Haldar, Sattwick; Vaidhyanathan, Ramanathan	Method of tuning the electronic energy level of covalent organic framework for crafting high-rate Na-ion battery anode	**Korea** Application No.: KR 2022-7037905 Publication No.: 1020227037905
18	Sidharth Chopra; Harinath Chakrapani; Grace Kaul; Pooja Kumari	Heterocylic iodonium compounds as broad-spectrum antibacterial agents	**India** Application No.: 202211005732
19	Gokul M.A.; Atikur Rahman	Process for synthesis of monolayer transition metal dichalocogenide	**India** Application No.: 202221005450
20	Wable, Minal; Furquan, Mohammad; Banerjee, Abhik; Ogale, Satishchandra	Microgradient patterned carbon coated current collector for alkali metal battery and method of preparation thereof	**India** Application No.: 202221006134
21	Jakhar, Navita; Singh, Surjeet	Method for making high figure-of-merit nanostructured thermoelectric materials	**India** Application No.: 202221018408
22	Gnanaprakasam, Boopathy; Pandey, Akanksha M.; Mondal, Shankhajit	A continuous flow process for synthesis of organic azides	**India** Application No.: 202221031963

Sr. No.	Inventors	Title	Country and Patent Info
23	De, Avirup; Prabhakaran, Dharmalingam; Nair, Sunil	Device and method for measuring topologically protected surface magnon	**India** Application No.: 202221043561
24	Haldar, Sattwick; Vaidhyanathan, Ramanathan	Method of tuning the electronic energy level of covalent organic framework for crafting high-rate Na-ion battery anode	**U.S.A.** Application No.: (US)17/914,925
25	Haldar, Sattwick; Vaidhyanathan, Ramanathan	Method of tuning the electronic energy level of covalent organic framework for crafting high-rate Na-ion battery anode	**Japan** Application No.: JP2022-558106
26	Vaidhyanathan, Ramanathan; Singh, Himan Dev	Three-dimensional (3d) hydrophobic amine-rich metal organic framework with a high selectivity for humid CO_2 capture	**India** Application No.: 202221061108
27	Venkatnathan, Arun; Dev, Rabin Siva	Quantum mechanical model simulator	**India** Application No.: 202221064464
28	Chakrapani, Harinath; Kumar, T. Anand; Singh, Amit	Fluoroquinolone derivatives for treatment of active and latent tuberculosis	**India** Application No.: 202221069131
29	Ogale, Satishchandra Balkrishna; Furquan, Mohammad; Kumar, Nikhil; Bobade, Richa Amod; Varma, Karikath Sukumar	A process for coating integrative patterning and functionalization of glass, and uses thereof	**India** Application No.: 202221070801
30	Wable, Minal; Furquan, Mohammad; Banerjee, Abhik; Ogale, Satishchandra	Process for graphene-like carbon coating on substrates	**U.S.A.** Application No.: 18/085,540
31	Goel, Pranay; Phatak, Sanat	System and method to detect inflammatory arthritis of joint areas using artificial intelligence	**India** Application No.: 202221074344
32	Kikkeri, Raghavendra; Kumar, N. Vijendra; Shanthamurthy, Chethan D.; Jain, Prashant; Raigawali, Rakesh; Padler-Karavani, Vered; Leviatan, Ben-Arye Shani	Heparan sulfate compounds as chemokine inhibitors	Application No.: PCT/IB2022/050566
33	Datta, Shouvik; Bhunia, Amit; Singh, Mohit Kumar; Mohamed, Henini; and Maryam Al, Huwayz	Excitonic Bose-Einstein condensate (BEC) as qubits using semiconductor nanostructures for quantum technologies	Application No.: PCT/IB2022/054992
34	Hotha, Srinivas, Sutar, Yogesh, Walke, Gulab, Kasdekar, Niteshlal	Silver assisted gold catalysis for the preparation of fondaparinux pentasaccharide and intermediates	Application No.: PCT/IB2021/060650 Publication No.: WO/2022/107013

EXTRAMURAL GRANTS

IISER Pune faculty members have been consistently securing competitive research funds from various government science and technology departments. In the 2022-23 financial year, ₹38.82 crores of research funds have been received by / assigned to the institute for 132 research projects.

The list of new extramural grants sanctioned during the 2022-23 financial year is given in the Appendix section of this report.

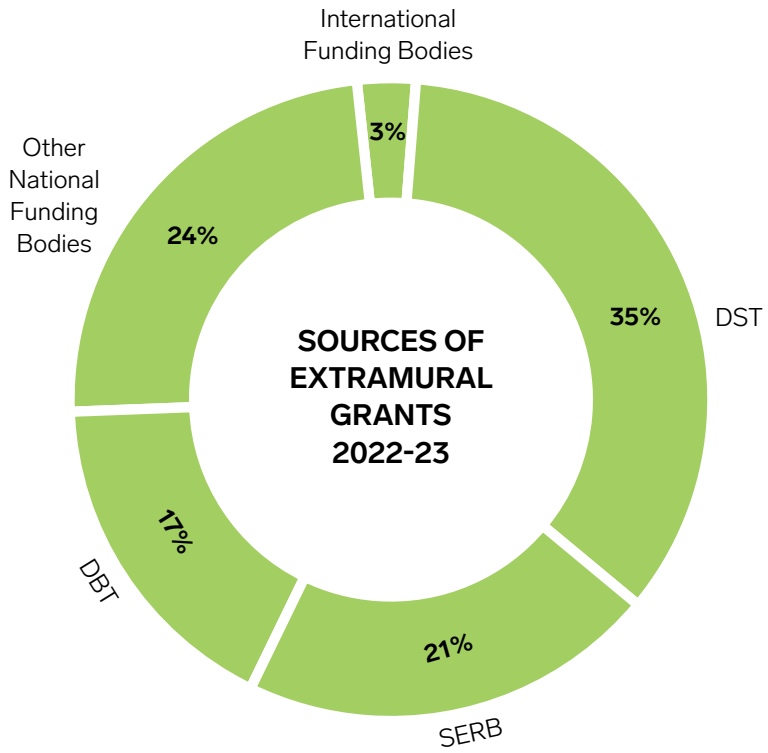
NEW PROJECTS SANCTIONED IN 2022-23

In the 2022-23 financial year, 44 new research projects have been initiated. Some of the projects initiated in the 2022-23 financial year are highlighted here:

- Grant from the Department of Biotechnology to harness the potential of global regulator SATB1 as a novel molecular target for cancer therapy using statins (to Prof. Sanjeev Galande)
- Grant from DST towards Indian participation in the CMS Experiment at CERN: Maintenance, operation and upgradation (to Dr. Seema Sharma).
- Wellcome Trust / DBT India Alliance's Senior Fellowship to Prof. Richa Rikhy; SERB-POWER Fellowship to Dr. Moumita Majumdar; Raja Ramanna Fellowship to Prof. Srinivasan Ramakrishnan; and J C Bose Fellowship to Prof. Jayant Udgaonkar have been initiated during the year
- Please see the full list in the *Appendix* section of the report for information on all new grants secured during the FY 2022-23

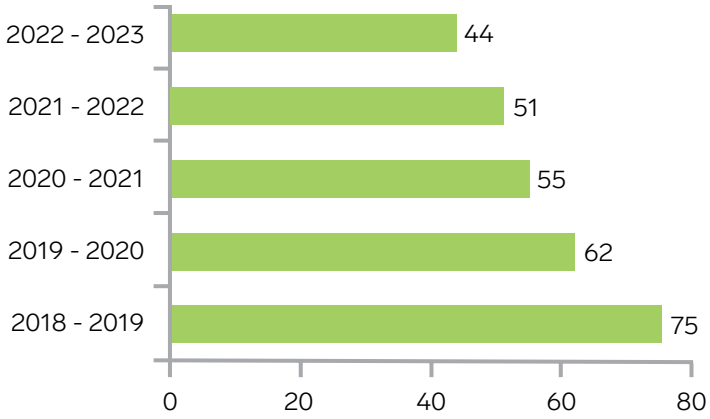
SOURCES OF EXTRAMURAL GRANTS IN 2022-23

Majority of the funds received through extramural grants have been from government bodies, with research funds from DST contributing to 35%, followed by SERB (21%), and DBT (17%), of the research funds received (in 93 projects) in 2022-23. Funding from other Indian funding bodies (Wellcome Trust-DBT India Alliance, IFCPAR, MoES, MHRD, DAE, ICMR, etc) has contributed to 24% of funds for research in sectors such as education, defense, atomic energy, etc (in 30 projects). The International funding bodies (AOARD, EMBO, Swansea University, Max Planck, etc) have contributed to 3% of the total research funds (in 9 projects).



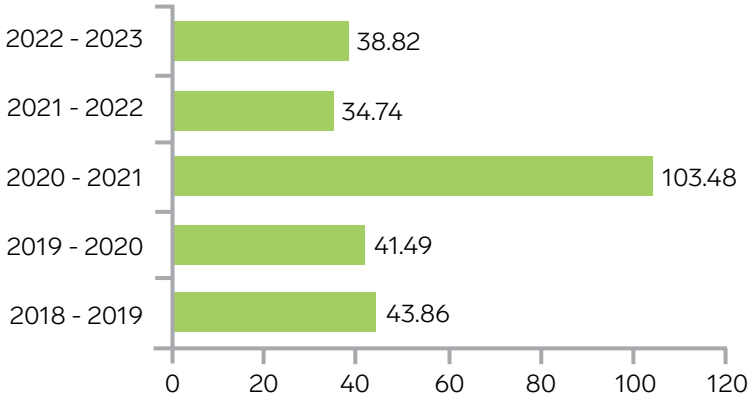
NUMBER OF NEW EXTRAMURAL GRANTS SANCTIONED

Data is as per the last 5 financial years



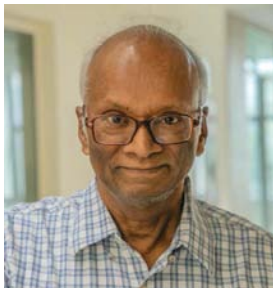
EXTRAMURAL FUNDS RECEIVED / ASSIGNED

Data is as per the last 5 financial years; Amount is in crore rupees



AWARDS AND HONOURS

PADMA AWARDS TO TWO FACULTY MEMBERS ASSOCIATED WITH IISER PUNE



Prof. Deepak Dhar

Distinguished Professor Emeritus and NASI-Senior Scientist, Physics

Padma Bhushan Award (2023) in Science and Engineering conferred by the Government of India

During the year, Prof. Dhar also received R.D. Birla Memorial Award in Physics (2022) from the Indian Physics Association (IPA); and Distinguished Alumnus Award (2022) from IIT Kanpur. Prof. Deepak Dhar is a physicist with a long-standing research career in the area statistical physics and stochastic processes. An alumnus of University of Allahabad and IIT Kanpur, Prof. Deepak Dhar received his PhD in 1978 at the California Institute of Technology. Over a period of four decades, at the Tata Institute for Fundamental Research in Mumbai, Prof. Dhar took on several areas of statistical physics to understand the behaviour of self-organised critical systems, explain the dynamics at phase interfaces, and define the spectral dimension of fractals. Prof. Dhar has been at IISER Pune since 2016 and is working on phase transitions and lattice models. In February 2022, the Commission on Statistical Physics of the International Union of Pure and Applied Physics announced Prof. Deepak Dhar as one of the two recipients of the prestigious Boltzmann Medal, for the year 2022.

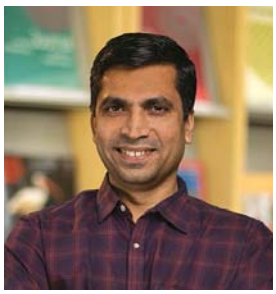
Prof. K.N. Ganesh

Founder Director of IISER Pune and Adjunct Faculty in the Department of Chemistry of IISER Pune

Padma Shri Award (2023) in Science and Engineering conferred by the Government of India

Prof. K.N. Ganesh's research is in the area of the chemistry and biology of nucleic acids. He is internationally recognised for his original and creative contributions to the design of Peptide Nucleic Acid (PNA) analogues for effective cell permeation. Prof. Ganesh did his PhD in 1976 from Delhi University. Through a Commonwealth Fellowship to pursue higher studies at the University of Cambridge, U.K., he obtained a second PhD degree in 1980. Prof. Ganesh worked at CSIR-Centre for Cellular and Molecular Biology, Hyderabad during 1981-1986 and at the CSIR-National Chemical Laboratory (1987 to 2005) before taking on the role of IISER Pune Director during 2006 to 2017 and that of IISER Tirupati during 2017 to 2023. As the Founding Director of IISER Pune, Prof. Ganesh led IISER Pune through the initial years of developing the campus and expanding the institute's research and academic programmes.

Padma Awards are one of the highest civilian awards of India, and are conferred in three categories, namely, Padma Vibhushan, Padma Bhushan, and Padma Shri. The awards are announced on the occasion of Republic Day (January 26) every year. It is a matter of great pride for the IISER Pune community that two members associated with the institute have been recognised through the Padma awards.



Dr. Nixon Abraham
Assistant Professor, Biology
DBT/Wellcome Trust India Alliance Senior Fellowship for Basic Biomedical Research (2023-2028)

Dr. Bijay Kumar Agarwalla
Associate Professor, Physics
Regular Associateship of International Centre for Theoretical Physics (ICTP), Trieste, Italy (2023-2028)

Dr. Ramana Athreya
Associate Professor, Physics and Biology
Sanctuary Wildlife Service Award (2022) from the Sanctuary Nature Foundation

Dr. Devapriya Chattopadhyay
Associate Professor, Earth and Climate Science
Featured as a Future Hope in *Vigyan Vidushi, 75 Women Trailblazers of Science*, a resource book by Vigyan Prasar

Dr. Srabanti Chaudhury
Associate Professor, Chemistry
SERB-Power Fellowship from the Science and Engineering Research Board (2023); Featured as a Future Hope in *Vigyan Vidushi, 75 Women Trailblazers of Science,* a resource book by Vigyan Prasar

Dr. Siddhesh Kamat
Associate Professor, Biology
Elected Member, Royal Society of Chemistry, U.K. (2022)

Prof. Sujit K. Ghosh
Professor, Chemistry
Named a Fellow of the Royal Society of Chemistry, U.K. (2023); Bronze Medal of the Chemical Research Society of India (2023)

Dr. Moumita Majumdar
Associate Professor, Chemistry
SERB-POWER Fellowship (2022); Alexander von Humboldt Fellowship for Experienced Researchers (2022)

Dr. Suhita Nadkarni
Associate Professor, Biology
Featured as a Future Hope in *Vigyan Vidushi:75 Women Trailblazers of Science,* a resource book by Vigyan Prasar

Dr. Angshuman Nag
Associate Professor, Chemistry
Silver Medal from Society for Materials Chemistry (2022)

Dr. Venketeswara Pai R.
Associate Professor, Humanities and Social Sciences
Mahakavi Kalidas Sanskrit-Vrati National Award in the Young Scholar category (2022) from Kavikulaguru Kalidas Sanskrit Vishwavidyalaya, Ramtek

Dr. Gayathri Pananghat
Associate Professor, Biology
Women Involvement in Science and Engineering Research (WISER) Award by the Indo-German Science and Technology Centre

Dr. Kalika Prasad
Associate Professor, Biology
Elected as a Fellow of the Indian Academy of Sciences (IAS), Bengaluru

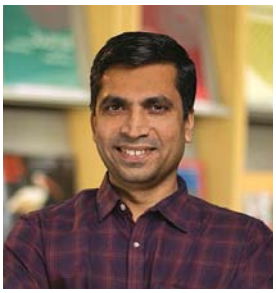
Prof. Srinivasan Ramakrishnan
Distinguished Professor Emeritus, Physics
Raja Ramanna Fellowship, Department of Atomic Energy

Prof. Richa Rikhy
Professor, Biology
Senior Fellowship of the DBT/ Wellcome Trust India Alliance

Dr. Seema Sharma
Associate Professor, Physics
Featured as a Trailblazer in *Vigyan Vidushi: 75 Women Trailblazers of Science,* a resource book by Vigyan Prasar

Prof. Jayant B. Udgaonkar
Professor, Biology
J C Bose Fellowship, Science and Engineering Research Board

MEMBERSHIPS AND AFFILIATIONS



Dr. Nixon Abraham
Assistant Professor, Biology
Member of Society for Neuroscience (U.S.A.)

Prof. Nirmalya Ballav
Professor, Chemistry
Appointed as Associate Editor, *Journal of Chemical Sciences,* Indian Academy of Sciences, Bengaluru

Dr. Argha Banerjee
Associate Professor, Earth and Climate Science
Member, International Glaciological Society

Dr. Mousomi Bhakta
Associate Professor, Mathematics and Rahul Bajaj Chair Professor
Member, Ramanujan Mathematical Society

Dr. Devapriya Chattopadhyay
Associate Professor, Earth and Climate Science
Renewal of Editorship: Scientific Editor, *Ameghiniana*

Dr. Anisa Chorwadwala
Assistant Professor, Mathematics
Member, Asia-Oceania Committee for Women in Mathematics (AOWM) Ambassador (since August, 2022)

Prof. Deepak Dhar
Distinguished Professor Emeritus and NASI-Senior Scientist, Physics
Honorary Fellow of TIFR (2022-) by TIFR Governing Council

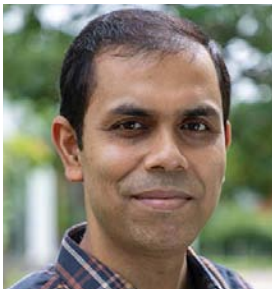
Prof. Sujit K. Ghosh
Professor, Chemistry
Editor, *Chemical Engineering Journal,* Novel Materials section

Dr. Siddhesh Kamat
Associate Professor, Biology
Elected Member, Guha Research Conferences (2022); Editorial Board Member, *British Journal of Pharmacology* (December 2022-present); Department of Biotechnology (DBT): (i) Technical Evaluation Committee (TEC) Member on Chronic Disease and Neurobiology (2022-present); (ii) Selection Committee Member of the MK Bhan Research Fellowship (2022-present)

Dr. Shabana Khan
Associate Professor, Chemistry
Editorial Advisory Board Member, *Inorganic Chemistry* (ACS) (2023-2025)

Dr. Moumita Majumdar
Associate Professor, Chemistry
Editorial Advisory Board Member, *Inorganic Chemistry* (ACS) (2023-2026)

Dr. Mridula Nambiar
Assistant Professor, Biology
Member, Genetics Society of America

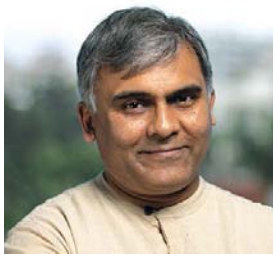


Dr. Angshuman Nag
Associate Professor, Chemistry
Editorial Advisory Board Member, *ChemistrySelect* (2022 onward)

Prof. G.V. Pavan Kumar
Professor, Physics
Member, Michael S. Feld Biophotonics Award Committee, Optical Society of America

Dr. Pramod P. Pillai
Associate Professor, Chemistry
Editorial Board Member, *ChemNanoMat*

Dr. Chaitra Redkar
Associate Professor, Humanities and Social Sciences
Subject expert in Political Science on the Board of Studies in Political Science at the following: Modern College (Autonomous), Pune; Abasaheb Garware College (Autonomous), Pune; Kirti College (Autonomous), Mumbai; Vaze-Kelkar College (Autonomous), Mumbai; External Expert of the Library Committee of the Dhananjyarao Keer Library of Gokhale Institute of Economics & Politics (Deemed University), Pune



Prof. Kundan Sengupta
Professor, Biology
Guest Editor, Cell Growth and Division, *Frontiers in Cell and Developmental Biology;*
Guest Editor, *Cells* (MDPI Publishers); Life Member, Indian Association for Cancer Research; Member, Indian Cancer Genome Atlas

Dr. Bejoy Thomas
Associate Professor, Humanities and Social Sciences
Adjunct Fellow, ATREE, Bengaluru
(renewed 2022-2025)

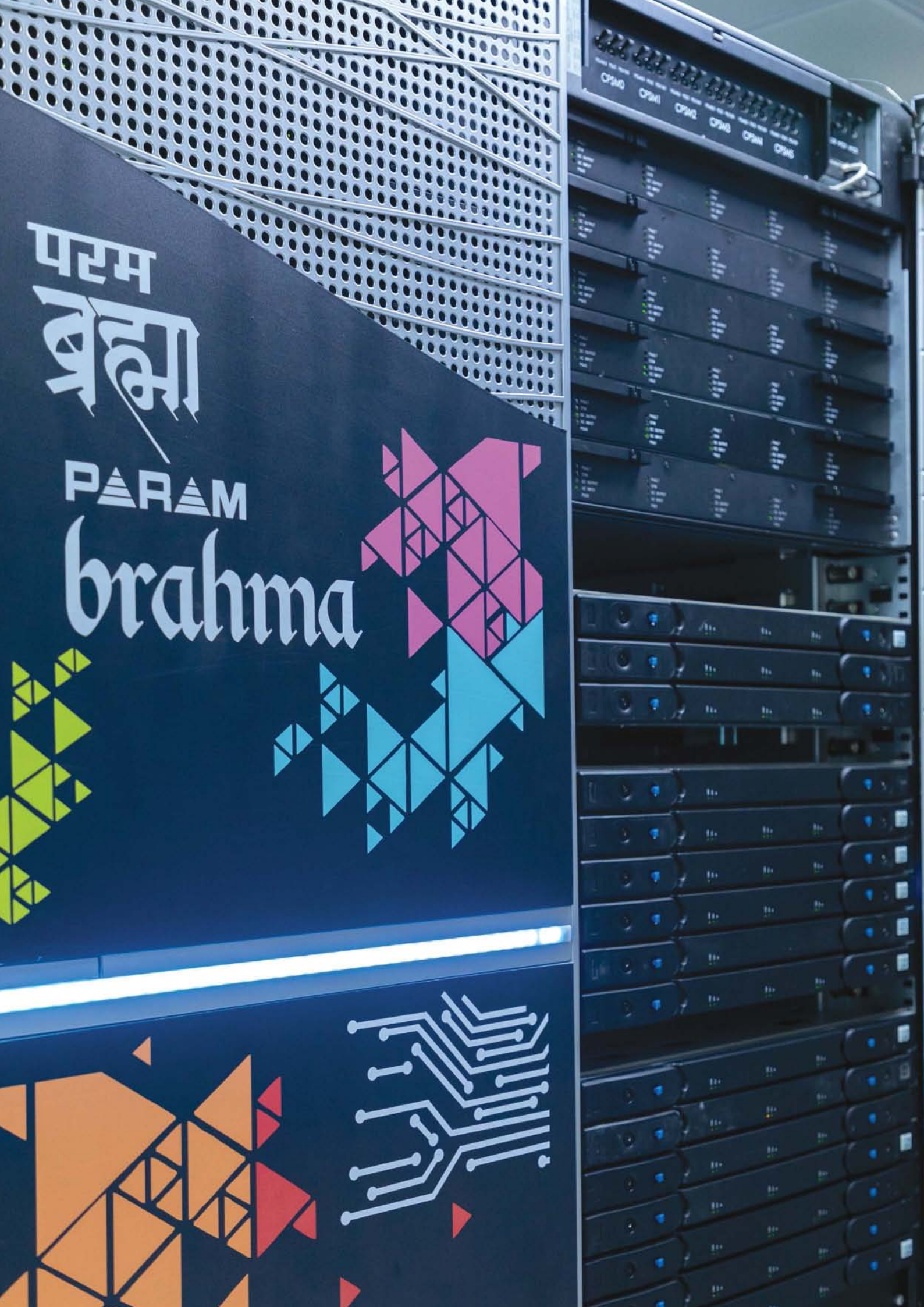
Dr. Gyana Ranjan Tripathy
Associate Professor, Earth and Climate Science
Associate Editor, *Aquatic Geochemistry*

Prof. Ramanathan Vaidhyanathan
Professor, Chemistry
Associate Editor, *Chemistry of Materials*

Shown above are new memberships and affiliations obtained during 2022-23. Many other faculty members have ongoing editorial board memberships and other academic recognitions through which they contribute to the scientific community and the education sector. Every year, faculty members are invited to present their research work at conferences, workshops, and other events across India and elsewhere. Faculty members are also involved in organising scientific conferences in topics relevant to their research.

The list of invited lectures given by the faculty members and academic events they have organised during 2022-2023 is given in the Appendix section of this report.

Academic Programmes


परम ब्रह्म
PARAM
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PhD PROGRAMME

PhD student numbers across departments as on March 31, 2023

TOTAL: 471

134
BIOLOGY

182
CHEMISTRY

1
DATA SCIENCE

30
EARTH AND CLIMATE SCIENCE

16
HUMANITIES AND SOCIAL SCIENCES

31
MATHEMATICS

77
PHYSICS

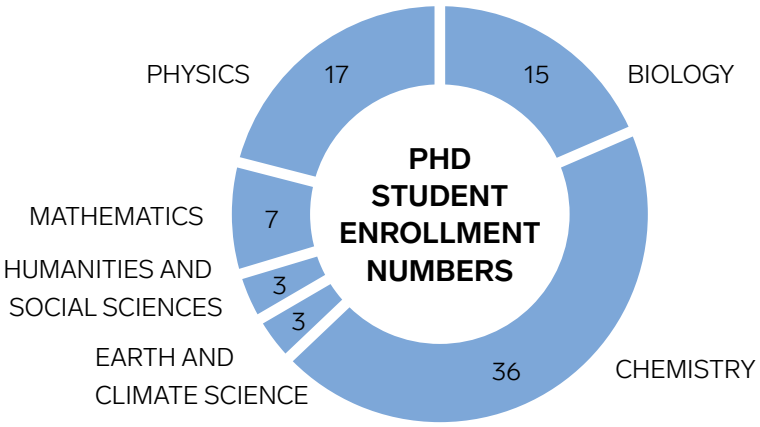
PhD students are the main driving force in the research programmes at the Institute. The PhD programme has a year-long coursework before the research work begins. Admission to PhD programmes at the Institute is through national-level tests followed by interviews conducted separately for each department.

During the August 2022 and January 2023 admission sessions, 81 (Men 60, Women 21) PhD students were admitted to the PhD programme: 15 (Men 10, Women 5) in Biology; 36 (Men 26, Women 10) in Chemistry; 3 (Men 3) in Earth and Climate Science; 3 (Men 1, Women 2) in Humanities and Social Sciences; 7 (Men 7) in Mathematics, and 17 (Men 13, Women 4) in Physics.

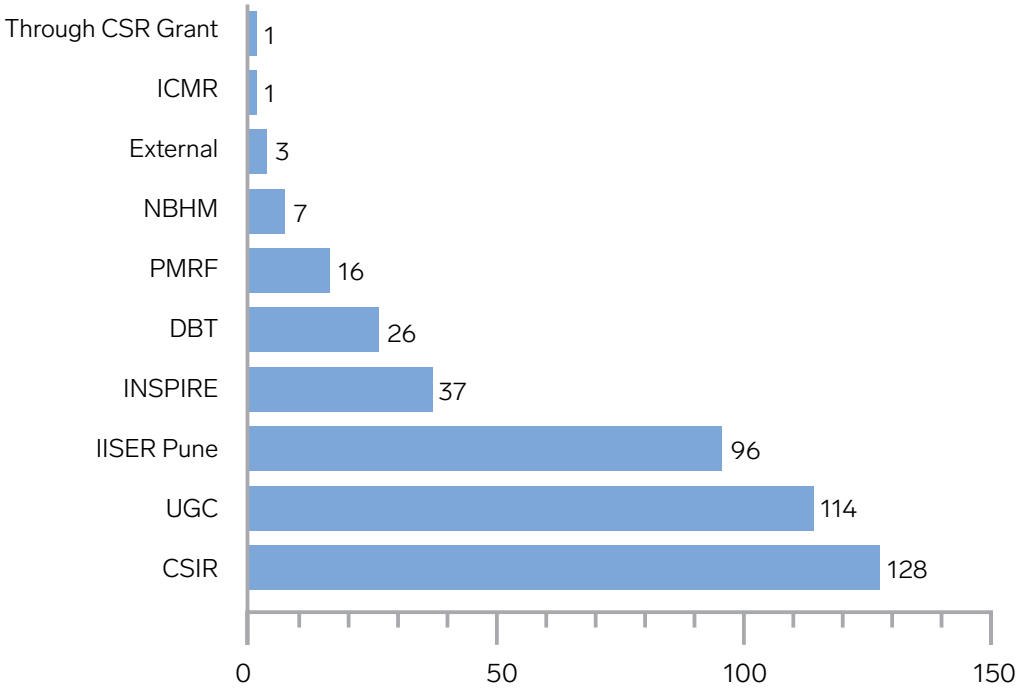
The strength of PhD students at the Institute as of March 31, 2023, is 471 (Men 285, Women 186). Here is a break-up of the numbers across departments: 134 (Men 63, Women 71) students in Biology; 182 (Men 117, Women 65) in Chemistry; 1 (Women 1) in Data Science; 30 (Men 18, Women 12) in Earth and Climate Science; 16 (Men 5, Women 11) in Humanities and Social Sciences; 31 (Men 25, Women 6) in Mathematics; and 77 (Men 57, Women 20) in Physics.

PHD STUDENT ENROLLMENT DURING AUGUST 2022 AND JANUARY 2023 SESSIONS

The subject-wise distribution of the 81 PhD students admitted during the year is as follows:



SOURCES OF FELLOWSHIPS FOR PhD STUDENTS



Category-wise Numbers of PhD Students (as on March 31, 2022)

Gender	GE	OBC	SC	ST	PD	EWS	Total
Men	177	62	19	4	6	17	285
Women	142	28	7	2	1	6	186
Total	**319**	**90**	**26**	**6**	**7**	**23**	**471**

During the May 2022 and January 2023 rounds of selection for the Prime Minister's Research Fellowship (PMRF), six PhD students were selected to receive the fellowship: Mabel Maria (Biology) (transferred from IISER TVM); Nilotpal Deka (Chemistry); Ashutosh Shukla (Physics); Dhodi Lobo Saunri Brian (Biology); Srijan Das (Mathematics); and Rakesh S. Kumar (Chemistry).

A total of 15 PhD students received one or more travel grants for participating in international conferences and for carrying out collaborative research work. The funding agencies that the students secured travel awards from include DESY, CSIR, Infosys Foundation, DST-SERB, Fulbright-Nehru Doctoral Fellowship, King Abdullah University of Science and Technology (KAUST), and Temple University, U.S.A., and European Association of Geochemistry.

In the 9th convocation held on May 26, 2022, 21 students were conferred PhD degrees.

The following 46 students have completed their requirements for the award of PhD degree (completed thesis defense between April 1, 2022 and March 31, 2023). Of these, 13 students have received their degrees in the 9th Convocation held on May 26, 2022.

Sr. No.	Student	Department	Advisor	Thesis Title
1	**Ramtirtha Yogendra Kiran** 20143311	Biology	M.S. Madhusudhan	Computational prediction of SUMOylation sites in proteins
2	**Ashok Kumar B.** 20143324	Chemistry	V.G. Anand	2D and 3D Isophlorinoids: Synthesis, structural characterization, redox and electronic properties
3	**S. Balamurugan** 20143334	Chemistry	Raghavendra Kikkeri	The effect of epimers, glycosidic linkage and the sulfation pattern of glycosaminoglycan components in glycomics research
4	**Sanjit Dey** 20143337	Chemistry	Hosahudya N. Gopi	Construction of ordered self-assembled architectures from peptide foldamers composed of non-natural amino acids
5	**Nisal Rahul Rajendra** 20143340	Chemistry	M. Jayakannan	Design and development of β-sheet polypeptides for biomedical applications
6	**More Yogeshwar Dnyaneshwar** 20153360	Chemistry	Sujit K. Ghosh	Syntheses and functional studies of Advanced Porous Materials (APMs): A promising platform for aquatic pollutant remediation and energy applications
7	**Rishabh Gupta** 20153367	Chemistry	R. Boomi Shankar	Design and synthesis of discrete coordination driven self-assemblies supported by P-N scaffolds and their functional studies

Sr. No.	Student	Department	Advisor	Thesis Title
8	**Pooja Kumari** 20153371	Chemistry	Harinath Chakrapani	Development of iodonium-based gram-negative antibacterial compounds and target identification using a chemoproteomics approach
9	**Patil Shalaka Tatyasaheb** 20153390	Biology	Kundan Sengupta	Role of Lamin B Receptor (LBR) in nuclear organization and chromosomal stability
10	**Nishant Singh** 20153393	Biology	Suhita Nadkarni	Form-function relation: Implications of synaptic design on neuronal function
11	**Selveshwari S.** 20153396	Biology	Sutirth Dey	Investigating the effects of genetic variation and environmental fluctuations on the evolution of laboratory populations of *Escherichia coli*
12	**Dheeraj Chandra Joshi** 20153400	Chemistry	M. Jayakannan	L-Amino acid based amphiphilic polymers for drug delivery application
13	**Adhav Vishal Annasaheb** 20153401	Biology	Saikrishnan Kayarat	Understanding the roles of chalcogen and van der Waals dispersion interaction in biomolecules
14	**Suddhasattwa Mandal** 20153413	Physics	Bhas Bapat (IISER Pune) & Vandana Sharma (IIT Hyderabad)	Inter-atomic/molecular decay in doped helium nanodroplets induced by extreme-ultraviolet radiation
15	**Anweshi Dewan** 20153414	Physics	Shouvik Datta & Muhammed Musthafa	Transition metal oxide-based electrochromic materials for energy-saving fenestration and smart energy storage devices
16	**Ajith V.J.** 20153416	Physics	Shivprasad Patil	Translational diffusion of a tracer molecule in nanoconfined water
17	**Satish Kumar** 20153422	Chemistry	Aloke Das	Probing secondary structures of small peptides in gas phase as well as condensed phase
18	**Todkari Iranna Annappa** 20163425	Chemistry	K.N. Ganesh	Supramolecular assemblies of Ca-bimodal PNAs to tetraplexes and triple duplexes and biophysical studies of C5 substituted Uracil PNA oligomers
19	**Khade Vikas Vilas** 20163426	Chemistry	Ramakrishna G. Bhat	The construction of Carbon-heteroatom bonds (C-X; X = N, O, S) under metal-free conditions to access useful heterocyclic scaffolds
20	**Debashis Mondal** 20163427	Chemistry	Pinaki Talukdar	Development of biomimetic systems for the transportation of ions and water across lipid bilayer membranes
21	**Prachi Gupta** 20163429	Chemistry	V.G. Anand	Synthesis, characterization and redox properties of expanded isophlorinoids containing six, seven, eight, nine and ten heterocyclic units
22	**Dharpure Pankaj Dhanraj** 20163430	Chemistry	Ramakrishna G. Bhat	Unveiling the reactivity of cyclic dithioacetals under visible light photoredox catalysis via C–S bond cleavage

Sr. No.	Student	Department	Advisor	Thesis Title
23	**Sutar Yogesh Vishnu Vaishali** 20163431	Chemistry	Srinivas Hotha	Designing of linkers and solid-phase oligosaccharide synthesis by silver-assisted gold-catalyzed glycosidations
24	**Prerona Bora** 20163433	Chemistry	Harinath Chakrapani	Stimuli-responsive small molecule persulfidating agents
25	**Manesh Prakash Joshi** 20163437	Biology	Sudha Rajamani	Elucidating different aspects of protocell emergence on the early earth
26	**Abinaya R.** 20163442	Biology	Siddhesh S. Kamat	Human ABHD14B: A novel lysine deacetylase regulating transcription of metabolic genes
27	**Rintu M. Umesh** 20163446	Biology	Mayurika Lahiri	Role of TopBP1 during breast tumorigenesis
28	**Alakananda Maitra** 20163449	Biology	Ramana Athreya	Abundance patterns of species along elevational gradients
29	**Sourav Laha** 20163452	ECS	Argha Banerjee	Studies of glacier mass-balance processes and the climate response of glacier-fed rivers in the Himalaya
30	**Anupam Samanta** 20163453	ECS	Gyana Ranjan Tripathy	Weathering and climate linkage at seasonal to kilo-year timescales: Evidence from water and sediment chemistry
31	**Subhajit Dutta** 20163456	Chemistry	Sujit K. Ghosh	Syntheses and functional studies of cationic Metal-organic Frameworks (MOFs) toward Light hydrocarbons separation and environmental pollutants remediation
32	**Kanika Kohli** 20163461	Chemistry	Prasenjit Ghosh	First principles study of thermally activated processes on transition metal surfaces
33	**Mardhekar Sandhya Namdev** 20163464	Chemistry	Raghavendra Kikkeri	Synthesis of heparan sulfate oligosaccharides to study heavy metals binding and adjuvant activity
34	**Abdul Shiraj** 20163469	Chemistry	Krishna N. Ganesh	Structural control of peptide nucleic acid rotamers: Aza-PNA and optical properties of gemdimethyl PNA, bimodal PNA monomers and oligomers
35	**Sk Mujaffar Hossain** 20163471	Chemistry	Prasenjit Ghosh & Satishchandra Ogale	Combined theoretical and experimental studies of some antiperovskite systems for energy applications
36	**Aswathi Mohan T.** 20163472	Chemistry	Prasenjit Ghosh	First principles investigation of Ti_2C MXene as catalyst and support in CO_2 activation and CO oxidation reactions
37	**Warghude Prakash Kashinath** 20163475	Chemistry	Ramakrishna G. Bhat	Diastereoselective construction of structurally diverse spirooxindoles via annulation of Morita-Baylis-Hillman adducts of isatin
38	**Suraj Prakash Yadav** 20163485	Mathematics	Amit Hogadi	Topics in motivic homotopy theory

Sr. No.	Student	Department	Advisor	Thesis Title
39	**Vandana Sharma** 20163494	Physics	G.V. Pavan Kumar	Plasmon assisted optothermal control and manipulation of colloids and fluids
40	**Manzoor Ahmad** 20173503	Chemistry	Pinaki Talukdar	Development of biomimetic photo-responsive artificial carriers for the transmembrane chloride transport
41	**Kasdekar Niteshlal Motilal** 20173534	Chemistry	Srinivas Hotha	Synthesis of anticoagulant idraparinux and development of new glycosylation methods
42	**Saikat Panja** 20173547	Mathematics	Anupam Kumar Singh	Powers and skew braces for classical groups
43	**Prasun Roychowdhury** 20173549	Mathematics	Anup Biswas	Study of Poincaré-Hardy type inequalities and eigenvalue problems for second-order elliptic PDEs
44	**Chetna Taneja** 20173557	Physics	G.V. Pavan Kumar	Plasmonic nanowire photonics: Light propagation and field enhancement
45	**Sushant Saryal** 20173558	Physics	Bijay Kumar Agarwalla	Universal bounds on fluctuations in thermal machines and thermal transport junctions
46	**Madhura Bhattacherjee** 20193637	ECS	Devapriya Chattopadhyay	Effect of taphonomy and sampling on inferences of spatio-temporal distribution of molluscan assemblages and its paleobiological implications

INTEGRATED PhD PROGRAMME

Integrated PhD student numbers across departments as on March 31, 2023

TOTAL: 189

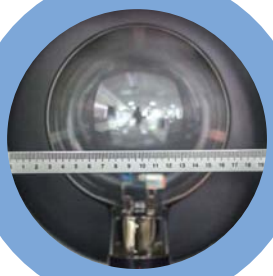
73
BIOLOGY

45
CHEMISTRY

19
MATHEMATICS

52
PHYSICS

The Integrated PhD programme offers students with a bachelor's degree in science a head-start in identifying an area of research leading to a PhD. The programme begins with a 1.5–2 years of coursework followed by research. Admission is through national-level tests followed by interviews conducted separately for each department.



During the August 2022 session, 14 (Men 9, Women 5) students took admission to post-BSc Integrated PhD programme: 7 (Men 4, Women 3) in Biology; and 7 (Men 5, Women 2) in Physics.

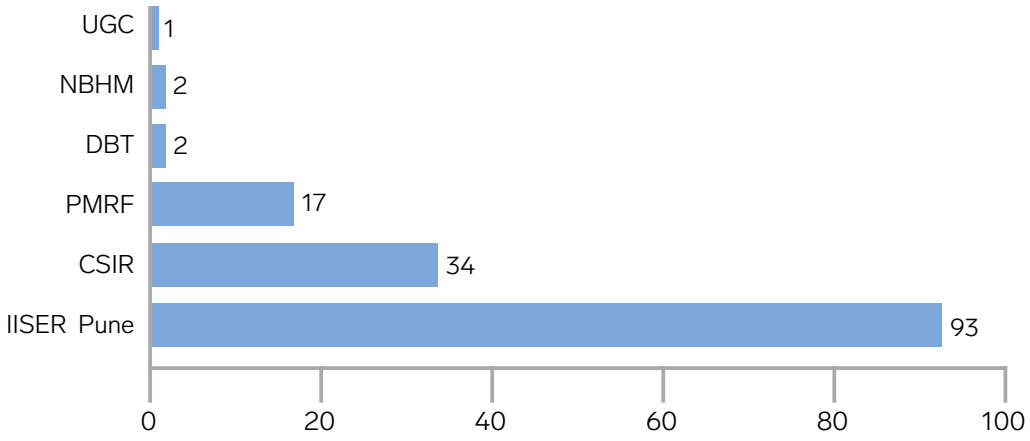
The strength of Integrated PhD students as of March 31, 2023 is 189 (Men 119, Women 70). Here is the break-up of the numbers across departments: 73 (Men 28, Women 45) students in Biology; 45 (Men 33, Women 12) in Chemistry; 19 (Men 16, Women 3) in Mathematics; and 52 (Men 42, Women 10) in Physics.

Category-wise Numbers of Integrated PhD Students (as on March 31, 2023)

Gender	GE	OBC	SC	ST	EWS	Total
Men	101	13	4	0	1	119
Women	66	4	0	0	0	70
Total	**167**	**17**	**4**	**0**	**1**	**189**

SOURCES OF FELLOWSHIPS FOR INTEGRATED PhD STUDENTS

All Integrated PhD students are provided with fellowships, subject to fulfilling the prescribed academic criteria.



Prizes for Academic Excellence were awarded to the following Integrated PhD students:

Integrated PhD Batch 2020: For the Integrated PhD programme, among students who have completed four semesters of course work, the student with the highest CGPA in each department is considered for the award.

Ojal Saharan (Biology); Bikirna Roy (Chemistry); Kaustabh Mondal (Mathematics); K.S. Dhruva (Physics)

During the 2022-23 period, six Integrated PhD students were selected to receive Prime Minister's Research Fellowship (PMRF): Aniket Ravindra Vartak (Biology); Kaustabh Mondal (Mathematics); Ojal Saharan (Biology); Purva Gupta (Biology); Rhea Kiran Vinchhi (Biology); and Supritha Bhowmick (Physics)

A total of 18 Integrated PhD students received one or more **travel grants for participating in international conferences or workshops.** The funding agencies that the students secured travel awards from include DBT-CTEP grant, CSIR, EMBO, Gordon Research Seminar and Conference, PMRF, and SERB

In the 9th convocation held on May 26, 2022, 10 Integrated PhD students were awarded dual Master's and PhD degrees and 1 student received MS degree.

The following 25 students have completed their requirements for the award of MS and PhD degrees through the Integrated PhD programme (completed thesis defense between April 1, 2022 and March 31, 2023). Of these, 5 students have received their degrees as well in the 9th Convocation held on May 26, 2022.

Sr. No.	Student	Department	Advisor	Thesis Title
1	**Harpreet Singh Kalsi** 20132005	Biology	Anjan K. Banerjee	Investigating the role of miRNA160 and miRNA166 in defence response of potato
2	**Aditi Dixit** 20132008	Chemistry	Jeet Kalia	The choline metabolite-interacting proteome of mammalian cells: Discovery and significance
3	**Nair Sanjana Santosh Darshana** 20142004	Biology	M.S. Madhusudhan	Discovering the molecular basis of DNA-Protein interaction specificity
4	**Dipti** 20142021	Physics	Shouvik Datta	Study of 1-D Photonic crystals incorporated with thermochromic materials for energy efficient smart window applications
5	**Shubham Pandey** 20142022	Physics	Seema Sharma	Performance of high granularity calorimeter prototypes for the CMS HL-LHC upgrade in beam test experiments at CERN
6	**Mohit Kumar Singh** 20142029	Physics	Shouvik Datta	Study of opto-electrical properties of excitonic heterostructures and measurement of spatio-temporal coherence using a single interferometer
7	**Shende Mayur Bhaskar** 20142030	Physics	Prasad Subramanian	Relativistic outflows from Active Galactic Nuclei (AGN) and their connection to accretion disks
8	**Kumar Saurabh** 20142032	Physics	Surjeet Singh	Study of half heusler and related structure as high-temperature thermoelectrics
9	**Vikhyaat Ahlawat** 20142033	Physics	Shivprasad Patil	Mechanics of single flexible polymer chains using AFM nanorheology
10	**V. Aishwarya** 20152001	Biology	Mayurika Lahiri	Effect of DNA damage on microtubule dynamics
11	**Joyeeta Chakraborty** 20152003	Biology	Gayathri Pananghat	Characterization of spiroplasma FtsZ: Insights into kinetic polarity and inhibitor binding
12	**Meenakshi Pardasani** 20152004	Biology	Nixon M. Abraham	Neural circuit mechanisms of early life stress induced olfactory perceptual deficits in mice
13	**Sathe Rupali Ravindra Madhuri** 20152008	Biology	Amrita B. Hazra	Cross-feeding of Vitamin B1, purines, and their biosynthesis intermediates in *Escherichia coli* co-cultures

Sr. No.	Student	Department	Advisor	Thesis Title
14	**Shikha Dagar** 20152012	Biology	Sudha Rajamani	Role of metal ions and their complexes in the catalysis of pertinent prebiotic reactions
15	**Sushmitha Hegde** 20152016	Biology	Girish Ratnaparkhi	The Small Ubiquitin-related Modifier (SUMO) regulates *Drosophila* NF-κB signalling
16	**Susovan Sarkar** 20152017	Biology	Sudha Rajamani	Influence of amphiphile composition on properties of model primitive membranes and its implications for the origins of early cellular life
17	**Tumuluri Vinayak Sadasivam** 20152019	Biology	Saikrishnan Kayarat	Biochemical and structural characterization of a Type IV restriction endonuclease SauUSI
18	**Yamini Mathur** 20152020	Biology	Amrita B. Hazra	Methylation reactions in the anaerobic biosynthesis of the lower ligand of Vitamin B12
19	**Saptashwa Chakraborty** 20152027	Chemistry	Srinivas Hotha	[Au]/[Ag] Catalyzed synthesis of benzyl ethers, N-glycosides and molnupiravir
20	**Neha Malik** 20152033	Mathematics	Steven Spallone	Stiefel-whitney classes of representations of some finite groups of lie type
21	**Angira Rastogi** 20152034	Physics	Sourabh Dube	Inclusive nonresonant multilepton probes of new phenomena
22	**Naveen Nishad** 20152039	Physics	Sreejith G.J.	Numerical studies of non-equilibrium dynamics in Z3 chiral clock model
23	**Shailendra Kumar Chaubey** 20152040	Physics	G.V. Pavan Kumar	Optical cavities coupled to 2D materials: Wavevector and polarization studies
24	**Shuvam Kant Tripathi** 20162031	Mathematics	Soumen Maity	Alliances in graphs: A parameterized perspective
25	**Diptabrata Paul** 20162035	Physics	G.V. Pavan Kumar	Light-Matter interaction with focused optical fields: Directional scattering and dynamics of active colloids

The following 7 students have completed their requirements for the award of MS degree between April 1, 2022 and March 31, 2023. Of these, 1 student has received degree as well in the 9th Convocation held on May 26, 2022.

Sr. No.	Student	Department	Advisor	Project Title
1	**Gaurav Beniwal** 20162014	Chemistry	Harinath Chakrapani	Development of chemical platforms to deliver latent electrophils
2	**Pranav U.** 20162026	Chemistry	M. Jayakannan	Star block polycaprolactone biodegradable unimolecular micelles for drug delivery
3	**Saswati Kar** 20192007	Biology	Kundan Sengupta	Investigating the role of nuclear lamins in regulating the stemness and neuronal differentiation of NT2/D1 embryonal carcinoma cells

Sr. No.	Student	Department	Advisor	Project Title
4	**Liya S. Leo** 20192020	Chemistry	Ramanathan Vaidhyanathan	Encapsulating tin dioxide nanoparticle into COF to develop Li ion battery anodes
5	**Sriram S.** 20192023	Chemistry	Pramod Pillai	Light-coupled chemical fuel triggered dynamic self-assembly in gold nanoparticles
6	**Niturkar Pranav Pravin** 20192026	Mathematics	Collins Assisi	Timetabling by coloring and clustering by neuronal networks
7	**Prajjwal** 20192033	Physics	Pranay Goyal	Investigating sparse model for continuous glucose monitoring in Type 2 Diabetes

MSc PROGRAMME

MSc student
numbers across departments
as on March 31, 2023

TOTAL: 28

15
CHEMISTRY

7
EARTH AND
CLIMATE SCIENCE

6
MATHEMATICS

A new two-year Master of Science (MSc) programme has been launched in 2022-2023. Aimed at highly motivated students with a bachelor's degree in any branch of science, the MSc programme has an increased emphasis on course-work with research experience gained through short semester credit projects, summer training and a major research project in the second year. MSc programmes in Chemistry, Geology, and Mathematics were offered by the Departments of Chemistry, Earth and Climate Science, and Mathematics, respectively, in the Academic Year 2022-23.

During the August 2022 session, 30 (Men 19, Women 11) students took admission to the MSc programme. This included 17 (Men 10, Women 7) in Chemistry; 7 (Men 6, Women 1) in Earth and Climate Science; and 6 (Men 3, Women 3) in Mathematics.

Category-wise Distribution of Masters' Students Enrolled in 2022

Gender	EWS	GE	KM	OBC	PD	SC	ST	Total
Boys	2	9	0	5	0	3	0	**19**
Girls	0	6	0	3	0	2	0	**11**
Total	**2**	**15**	**0**	**8**	**0**	**5**	**0**	**30**

Subsequent to admission, 2 students discontinued from the programme, as they got admission in other courses, making the final number of students enrolled in the 2022-23 academic year to 28.

The strength of MSc students as of March 31, 2023 is 28 (Men 17, Women 11). Here is the break-up of the numbers across departments: 15 (Men 8, Women 7) in Chemistry; 7 (Men 6, Women 1) in Earth and Climate Science; and 6 (Men 3, Women 3) in Mathematics.

Overall Category-wise Distribution of Existing Masters' Students (as of March 31, 2023)

Gender	EWS	GE	KM	OBC	PD	SC	ST	Total
Boys	1	8	0	5	0	3	0	**17**
Girls	0	6	0	3	0	2	0	**11**
Total	**1**	**14**	**0**	**8**	**0**	**5**	**0**	**28**

BS-MS PROGRAMME

Fifth year projects carried out by the outgoing batch of BS-MS students during 2022-23

TOTAL: 207

82
BIOLOGY

24
CHEMISTRY

12
DATA SCIENCE

13
EARTH AND CLIMATE SCIENCE

8
HUMANITIES AND SOCIAL SCIENCES

4
INTER-DISCIPLINARY

17
MATHEMATICS

47
PHYSICS

The 5-year BS-MS programme gives students a well-rounded exposure to all areas of science by combining undergraduate level teaching with research. Basic training in Biology, Chemistry, Data Science, Earth and Climate Science, Humanities and Social Sciences, Mathematics, and Physics is imparted in the first two years. In the next two years, students can choose courses offered by one or more departments according to their liking and future career perspective. The fifth year is allocated to a research project or an internship, leading to a thesis.

FIFTH-YEAR PROJECTS AS PER HOST ORGANISATION

99	**67**	**41**
IISER PUNE	NATIONAL	INTERNATIONAL

The academic year 2022-23 saw 223 students (151 boys and 72 girls) taking admission to the BS-MS programme. Of these, 179 were admitted through the state and central boards' stream, via the IISER Aptitude Test; 27 through the IIT-JEE stream; and 17 through the KVPY stream.

Category-wise Distribution of Students Enrolled in 2022

Gender	EWS	GE	KM	OBC	PD	SC	ST	Total
Girls	6	19	0	17	8	12	10	**72**
Boys	16	69	0	40	1	15	10	**151**
Total	**22**	**88**	**0**	**57**	**9**	**27**	**20**	**223**

Overall Category-wise Distribution of Existing BS-MS Students (as of March 31, 2023)

Gender	EWS	GE	KM	OBC	PD	SC	ST	Total
Girls	13	113	2	99	11	55	29	**322**
Boys	59	397	4	194	16	93	41	**804**
Total	**72**	**510**	**6**	**293**	**27**	**148**	**70**	**1126**

Total BS-MS Student Strength During 2022-23

Shown as per enrolment year of students

Batch	2015	2016	2017	2018	2019	2020	2021	2022	Total
Girls	0	1	4	52	41	86	69	69	**322**
Boys	1	2	12	158	153	169	160	149	**804**
Total	**1**	**3**	**16**	**210**	**194**	**255**	**229**	**218**	**1126**

Subsequent to admission of the 2022-23 batch, 5 students discontinued from the programme, as they got admission in other courses, making the final number of students enrolled in 2022 from 223 to 218. In addition, from the previous batches, 1 student opted to discontinue the programme.

From the 2022 batch, 48 students were found eligible for receiving DST-INSPIRE scholarship and 38 students qualified for KVPY scholarship.

The total number of BS-MS students receiving DST-INSPIRE and KVPY scholarships is as follows:

DST-INSPIRE= 247, KVPY=233

Details of the fifth-year projects carried out by the outgoing batch of BS-MS students during 2022-23

Sr. No.	Student	Supervisor	Project Title
	BIOLOGY		
1	**Rubna P.R.** 20161114	Raghav Rajan, IISER Pune	Respiration monitoring during introductory notes of zebra finch song
2	**Bhavesh Kumar Verma** 20161158	Rakesh Sengupta, SR University Warangal	A dynamical recurrent neural network model for visual perception of numerosity
3	**Rajdip Sarkar** 20161170	Saikrishnan Kayarat, IISER Pune	Studying DNA polymerase slippage at simple sequence repeats
4	**Saifee Aasim Khalid** 20161176	Chaitanya Athale, IISER Pune	Design and calibration of a 3D printed magnetic tweezer combined with cellphone-based microscope for biomolecular force spectroscopy
5	**Apurva Saha** 20171084	Alwin Köhler, Max Perutz Labs, Vienna BioCenter (VBC)	Understanding the regulation of chromatin by phase separation
6	**Pawara Punam Sundarsing** 20171088	Gayathri Pananghat, IISER Pune	Domain-wise biochemical characterization of *Myxococcus xanthus* FrzE
7	**Rishika Mohanta** 20171096	Glenn Turner, Janelia Research Campus, VA, U.S.A.	Deciphering value learning rules in fruit flies using a model-driven approach
8	**Nafisa Andrea Pathaw** 20171111	Anand Krishnan, IISER Pune	Geographical variation in bird song at different scales and its potential utility in monitoring the effects of habitat fragmentation
9	**Anisha Ajay Karnail** 20171112	Mahesh Sankaran, NCBS, Bengaluru	Tree growth and environmental variability in forests of South India
10	**Monali Vasant Patre** 20171113	Kartik Shanker, IISc, Bengaluru	A study of microplastics in marine organisms across trophic levels on the west coast of India
11	**Chadalavada Madhu Priya** 20171117	Nixon Abraham, IISER Pune	Effect of environmental enrichment on complex olfactory behavioral readouts in male and female mice
12	**Saismit H. Naik** 20171142	Emanuel A. Fronhofer, University of Montpellier, France	Eco-evolutionary dynamics of temperature adaptation during range expansions
13	**Vasudha Kishor Aher** 20171193	Rejji Kuruvilla, Johns Hopkins University, U.S.A.	Investigating the sources and functions of nerve growth factor in pancreatic islet development
14	**Arpan Kumar Nayak** 20171201	Nixon M. Abraham, IISER Pune	Behavioral mechanisms underlying rapid responses of rodents in an operant conditioning paradigm
15	**Masram Gitesh Vilasrao** 20171205	P.V. Shivaprasad, NCBS, Bengaluru	Understanding the role of a novel miRNA: target module in DNA damage repair in rice

Sr. No.	Student	Supervisor	Project Title
16	**Adithyan Unni** 20181002	Carlos Óscar Sorzano Sánchez, National Center of Biotechnology, Madrid, Spain	Predicting residue-residue contacts at protein-protein interfaces using surface features – a machine learning approach
17	**Siddharth Deogam** 20181006	Chaitanya Athale, IISER Pune	Quantitative image analysis and modelling of *Phallusia* oocytes and *Caenorhabditis elegans* egg
18	**Saillesh Aravindhan Chinnaraj** 20181008	Nishad Matange, IISER Pune	Linking protein sequence to structure and function in bacterial DHFR enzymes
19	**Nandu T.S.** 20181009	Raghav Rajan, IISER Pune	Universality of introductory vocalizations
20	**Sultan Ahmed Nazir** 20181010	Brian Ingalls, University of Waterloo, Canada	A growth-induced dispersal model of non-motile cells calibrated against time-lapse microscopy
21	**Swarag T.** 20181013	K.M. Sharika, IIT Kanpur	Effect of valence and uncertainty on reinforcement learning
22	**Akhilesh Uthaman** 20181019	Gayathri Pananghat, IISER Pune	Characterization of *Spiroplasma citri* MreB1
23	**Ananda Shikhara Bhat** 20181024	Vishwesha Guttal, IISc, Bengaluru	Eco-evolutionary dynamics of finite populations from first principles
24	**Ranjana Nataraj** 20181027	Gayathri Pananghat, IISER Pune	Tracing functional evolution in P-loop NTPases
25	**Yadhusankar S.** 20181030	Kalika Prasad, IISER Pune	Inducible CRISPR/CAS9 genome editing to modulate autophagy during de novo organ regeneration
26	**Desai Milie Mitesh** 20181031	Dipyaman Ganguly, CSIR-IICB	Exploring the role of Piezo1 mechanosensor in human monocyte derived dendritic cell migration
27	**J.G. Harini Sudha** 20181033	Jörg Conradt, KTH Royal Institute of Technology, Stockholm	Event-based line tracking with neuromorphic systems
28	**Arsh Shrikant Chavan** 20181034	Olivier Tenaillon, University of Paris, France	Conjugation Mediated Bacterial Genome Mixing (CoMBacGeMi) to transfer and detect genes of interest in *Escherichia coli* and unravel the recombination patterns
29	**M. Sarath** 20181038	Sanjeev Galande, IISER Pune	Understanding the role of promoter priming prior to cell fate specification in zebrafish
30	**Dhanajkar Darshan Rajesh** 20181039	Raghav Rajan, IISER Pune	Song learning in juvenile Zebra-Finches
31	**Gaurav S. Athreya** 20181042	Chaitanya S. Gokhale, Max Planck Institute for Evolutionary Biology, Plön, Germany	Endosymbionts, eukaryotes, and evolutionary transitions
32	**Rupal Gehlot** 20181055	Didier Stainier, Max Planck Institute for Heart and Lung Research, Bad Nauheim, Germany	Dissecting the direct downstream targets of Hand2 during zebrafish cardiac development

Sr. No.	Student	Supervisor	Project Title
33	**Petkar Riddhi Sandeep** 20181056	Sabine Liebscher, Ludwig-Maximilians-University, Munich, Germany	Microglial response to neurons expressing aberrant TDP-43
34	**Khushboo Jain** 20181059	Shashank Tripathi, IISc, Bengaluru	Investigating cellular redox modulation upon influenza a virus infection
35	**Samyuktha Ramadurai** 20181060	Raghav Rajan, IISER Pune	Variability in the male zebra finch song and its role in female mate choice
36	**Anisha Rai** 20181061	Siddhesh Kamat, IISER Pune	Validation of potential protein ligands of monoacylglycerol signaling lipid
37	**Mihir Shridhar Dingankar** 20181066	Florent Ginhoux, A*STAR, Singapore	Development of microglia sufficient vascularized brain organoids to study three-way neuro-immune-vascular interactions
38	**K.T. Abdul Rishad** 20181069	Chaitanya Athale, IISER Pune	Optimization of affinity-based tubulin purification and polymerization kinetics from goat brain and mung seedlings
39	**Kirubeswaran O.R.** 20181070	Tim C. Kietzmann, University of Osnabrück, Germany	Modelling fixational eye movements to achieve super-resolution in deep neural networks
40	**Muhammed Navas P.** 20181077	Saikrishnan Kayarat, IISER Pune	Biochemical studies of exonuclease and methyltransferase of SARS-CoV-2 virus
41	**Richa Agarwal** 20181078	Suhita Nadkarni, IISER Pune	Shaping of neural activity by homeostatic plasticity
42	**Wadhwa Omika Sanjay** 20181082	Michael Reiser, HHMI Janelia Research Campus, VA, U.S.A.	Optimising virtual reality for visual behaviour experiments in tethered walking flies
43	**Antony Kiran K. David** 20181083	Aurnab Ghose, IISER Pune	Visually guided behaviours in Zebrafish larvae and the role of Fmn2b
44	**Varun G. Mallya** 20181084	Suhita Nadkarni, IISER Pune	Modelling the postsynaptic effects of homeostatic plasticity in the hippocampus
45	**Shahare Aishwarya Vinod** 20181093	Gayathri Pananghat, IISER Pune	Use of helical assembly scaffolds as tools for alleviating preferred orientation problem in cryo electron microscopy
46	**Mulewar Sahil Sunil** 20181099	Sudha Rajamani, IISER Pune	A systems approach to understanding the emergence of functional protocells
47	**Nikose Saket Namdeo** 20181105	Kalika Prasad, IISER Pune	Evidence for the presence of PLETHORA homologs in plant species displaying diverse regenerative responses
48	**Ganesh Ashish Nair** 20181107	Nixon Abraham, IISER Pune	Investigating the role of thermosensation in multimodal olfactory perception
49	**Srishti Patil** 20181110	Robert Noble, University of London, U.K.	Mathematical modelling of extinction therapy: Preventing evolutionary rescue in cancer populations
50	**Merrin Vincent** 20181116	Swadhin Chandra Jana, TIFR-NCBS, Bengaluru	Investigating roles of centrosome/ciliary proteins in cilia biogenesis & homeostasis

Sr. No.	Student	Supervisor	Project Title
51	**Nila P.B.** 20181117	Narahari Gramapurohit, SPPU, Pune	Changes in corticotropin-releasing hormone (CRH) in the larval *Euphlyctis cyanophlyctis* exposed to predation risk
52	**Kanikar Shrihar Atul** 20181126	Florian R. Greten, Georg-Speyer-Haus Institute for Tumor Biology and Experimental Therapy, Germany	Validation of AGK knockout as a target of immune checkpoint blockade therapy for colorectal cancer
53	**Shivam Tikoo** 20181128	Sudha Rajamani, IISER Pune	Self-assembly of nucleotides and its implications for prebiotic chemistry
54	**Jugnahkar Purvesh Prakashbabu** 20181129	Anand Ghosalkar, Praj Matrix R&D Centre, Pune	Studies on flocculation characteristics in industrial yeast strain
55	**Prajwal Punnamraju** 20181133	Siddhesh Kamat, IISER Pune	Screening for lysophosphatidylserine lipases in mouse tissues
56	**Sattaru Krishna Chaitanya** 20181134	Sutirth Dey, IISER Pune	Investigating metabolite levels and stress responses of *Drosophila melanogaster* populations selected for increased dispersal
57	**G.V. Anuraag Aithal** 20181135	Sudha Rajamani, IISER Pune	Metalloporphyrins in prebiotic photocatalysis and bioenergetics
58	**Ghodke Shruti Prakash** 20181136	Kalika Prasad, IISER Pune	Characterization of intragenic cis regulatory modules in transcription during de novo shoot regeneration.
59	**Madheshvaran S.** 20181144	Farnoush Farahpour, University of Duisburg-Essen, Germany	A preliminary Quantitative Systems Pharmacology (QSP) model of immune interactions along the 'Gut-Lung Axis'
60	**Jadhav Avadhoot Sandeep** 20181149	Hidde Ploegh, Boston Children's Hospital, MA, U.S.A.	Design and delivery of nanobody fusions as immunotherapy for COVID19
61	**Jatin Bedi** 20181151	Christoph Merten, Laboratory for Biomedical Microfluidics, Switzerland	Mammalian cell display for high throughput antibody screening
62	**Hutke Shantanu Prashant** 20181154	Krishanpal Karmodiya, IISER Pune	Characterization of tissue tropism in *Plasmodium falciparum* malaria
63	**John Thampi** 20181159	Pau Formosa-Jordan, Max Planck Institute for Plant Breeding Research, Cologne, Germany	Quantitative analysis and modeling of the *Arabidopsis* shoot apical meristem during floral transition
64	**Saanchi Naresh Thawani** 20181162	Tobias H. Donner, University Medical Center Hamburg, Germany	Investigating the influence of arousal on belief updating under uncertainty
65	**Animesh Anand** 20181164	Saikrishnan Kayarat, IISER Pune	Designing an aptamer based diagnosis kit for malaria
66	**Ohal Bhavesh Anil** 20181168	Richa Rikhy, IISER Pune	Analysis of regulation of epithelial-like architecture formation by mitochondrial dynamics in *Drosophila* embryogenesis

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67	**Ninad Ajay Thulkar** 20181172	Raghav Rajan, IISER Pune	Influence of distance in the courtship song produced by male zebra finch
68	**Rohith C.S.** 20181173	Siddhesh Kamat, IISER Pune	Biochemical characterization of CG15111 and CG1309, the fly orthologs of human ABHD12 and ABHD16A respectively
69	**Ghadage Kalyan Pradip** 20181175	Krishanpal Karmodiya, IISER Pune	Identification and characterization of insulator elements and proteins in *Plasmodium falciparum*
70	**Pazare Mrunal Ashok** 20181184	Girish Ratnaparkhi, IISER Pune	A role for the orphan serine hydrolase CG17192 in the *Drosophila* immune response
71	**Vaishnavi V.** 20181194	Venkatakrishnan Ramaswamy, BITS Pilani, Hyderabad Campus	Supervised spike time learning with an adaptive learning rate in spiking neural networks
72	**Patwardhan Chinmay Anirudha** 20181198	Dennis Claessen, University of Leiden, Netherlands	Production of industrially relevant proteins using cell-wall deficient cells
73	**Deshpande Shivani Nachiket** 20181199	John Rasko, Centenary Institute of Cancer Medicine and Cell Biology, Sydney, Australia	The WDR11 protein as a novel host factor for AAV transduction
74	**Pagrut Sakshi Jayvant** 20181200	Aurnab Ghose, IISER Pune	The capping activity of Eps8 regulates axonal F-Actin patch dynamics and the formation of collateral branch
75	**Akanksha Ingale** 20181201	Deepak Barua, IISER Pune	Understanding the ecological strategies and habitat association of invasive species of Northern Western Ghats and Konkan
76	**Aishwarya Juneja** 20181204	Shovamayee Maharana, IISc, Bengaluru	Inflammation associated altered nucleic acid levels and localization
77	**Patil Gunwant Dnyaneshwar** 20181205	Eirini Trompouki, Institute for Research on Cancer and Ageing, Nice, France	The role of transposable elements in hematopoietic stem and progenitor cell development
78	**Shruti Pawar** 20181209	Girish Ratnaparkhi, IISER Pune	Role of caspar and Ter94 in early *Drosophila* development
79	**Agrawal Sanskar Nitinkumar** 20181215	Anjan Banerjee, IISER Pune	Functional characterization of cis-acting regulatory elements in the promoters of MSL family genes from the moss *Physcomitrium patens*
80	**Trimbake Pradeep Kumar Hanumant** 20181218	Niels Rattenborg, Max Planck Institute for Biological Intelligence, Starnberg, Germany	Sleep-swimming in Canada geese (*Branta canadensis*)
81	**Wadate Adesh Rajaram** 20181224	Sanjeev Galande, IISER Pune	Characterization of the oligomeric complex formed by SATB1 and SATB2 proteins and their interactors
82	**Reshmi Suresh** 20181227	Girdhari Lal, NCCS Pune	Role of Neurokinin-1 receptor signalling in immunomodulation of tumor development

Sr. No.	Student	Supervisor	Project Title
	CHEMISTRY		
1	**Rakesh Kumar Meena** 20161021	Shabana Khan, IISER Pune	Silylene supported first-raw transition metal complexes and their catalytic applications
2	**Snehash Kumar Behera** 20161108	Arnab Mukherjee, IISER Pune	Simulating azeotropic clusters at vapor-liquid equilibrium using MD simulations
3	**Namonarayan Meena** 20161134	R. Boomi Shankar, IISER Pune	Organic-inorganic hybrid ammonium halogenobismuthates and their piezoelectric properties
4	**Gopi Krishnan R.** 20171069	Arnab Mukherjee, IISER Pune	Exploring protein phase space using machine learning based enhanced sampling
5	**Harini P.** 20171074	R. Karvembu, NIT Trichy	Synthesis of Thio(S)/Seleno(Se)/Telluro(Te)-urea/ semicarbazone derivatives for anti-Alzhemier studies
6	**Dipti Chimnapure** 20171090	Raghavendra Kikkeri, IISER Pune	Design and synthesis of sulfate oligo-idose analogs: Potential heparan sulfate glycomimetics
7	**Shubham Amritraj Sawle** 20171181	Aloke Das, IISER Pune	Study of unconventional sulfur and selenium hydrogen bonding using FTIR and NMR spectroscopy combined with quantum chemical calculations
8	**Ladole Atharva Harshawardhan** 20171208	Beatriz Mendoza Sanchez, IAM-ESS, Germany	Investigation and comparison of the energy storage performance of MXenes in dilute aqueous electrolytes and highly concentrated water-in-salt electrolytes
9	**Rajesh Kumar Meena** 20171209	Mangesh Kulkarni, Praj Matrix, Pune	Development of novel catalyst for single step conversion of lactic acid to lactide
10	**Komal Kumar Meena** 20181020	Shubhangi B. Umbarkar, CSIR-NCL, Pune	Ceria based heterogeneous catalysis for organic transformation
11	**Patil Durvesh Nitin** 20181023	Sailja Krishnamurty, CISR-NCL, Pune	Exploration of 2D catalyst to investigate CO_2 reduction pathways computationally using density functional theory based calculations
12	**Aleena Jose** 20181062	Ramanathan Vaidhyanathan, IISER Pune	Metal-organic framework derived electrocatalysts for alkaline oxygen evolution reaction
13	**Aishwarya Singh** 20181063	Ch. Subrahmanyam, IIT Hyderabad	Development of an efficient photocathode CuO/Sb_2S_3 heterojunction for photoelectrochemical water splitting
14	**Rabin Siva Dev** 20181068	Jens Noack, Fraunhofer Institute for Chemical Technology ICT, Pfinztal, Germany	Performance and techno-economic investigation of organic redox flow batteries: An experimental and modeling study
15	**Swastik Biswas** 20181072	Debabrata Maiti, IIT Bombay	Palladaelectro-catalyzed olefination reaction: distal and asymmetric approach
16	**Thushar S.M.** 20181080	Satish Patil, IISc, Bengaluru	Ion size dependence in electrochemical polymerization for organic 3D porous networks

Sr. No.	Student	Supervisor	Project Title
17	**S. Rohan** 20181088	Amrita B. Hazra, IISER Pune	Structural redesign of riboflavin kinases from bacteria and archaea for altered nucleobase specificity
18	**Rapti Pal** 20181092	Prasenjit Ghosh, IISER Pune	C-vacancy mediated methane activation and C-C coupling on TiC(001) surface: A first principles investigation
19	**Akshaya Maria Prasad** 20181115	M. Jayakannan, IISER Pune	Photo-cross-linked polypeptide nanoparticles via ROPISA methodology
20	**Anish Das** 20181119	Srinivas Hotha, IISER Pune	Novel synthetic routes for the synthesis of nucleotide active pharmaceutical ingredients
21	**Venkata Sai Sreyas Adury** 20181138	Arnab Mukherjee, IISER Pune	Combining physics-based and machine-learning methods for de-novo drug design
22	**Ziyad Thekkayil** 20181139	Eric Borguet, Temple University, U.S.A.	Nonlinear optical spectroscopic study of topological weyl semimetals
23	**Aritra Das** 20181140	Srinivas Hotha, IISER Pune	Synthesis of protodioscin
24	**Aditya Bhattacharyya** 20181165	Amrita B. Hazra, IISER Pune	Exploring the nucleotide promiscuity of Escherichia coli methionine adenosyltransferase mutants

DATA SCIENCE

1	**Harshit Pateria** 20181032	Antonio Scialdone, Institute of Epigenetics and Stem Cells, Munich, Germany	Benchmarking of graph autoencoder models for gene regulatory network inference with prior knowledge
2	**Lubdhak Mondal** 20181064	Abhijeet Chandra, IIT Kharagpur	Econometric study of credit cycles and sectoral risk with NLP-based Credit risk index construction
3	**Goirik Chakrabarty** 20181079	Soma Biswas, IISc, Bengaluru	Continual domain incremental learning during test-time
4	**Parmar Purva Maheshkumar** 20181081	Aniruddha Pant, AlgoAnalytics, Pune	Semantic search and question-answering systems
5	**Prantik Pramanick** 20181100	Manmeet Singh, IITM Pune	Data-driven prediction of crop yield over Germany
6	**Pranav M.** 20181146	M.S. Santhanam, IISER Pune	Exploring random walks on networks: An analysis of extreme events
7	**Dipayan Pal** 20181148	Sudhir Kumar, Coriolis Technologies, Pune	Developing AI-based surveillance software
8	**Chapke Rashmi Sanjayrao** 20181150	Pranay Goel, IISER Pune	Segmentation of pediatric hand radiograph using UNet for bone aging
9	**Chandak Kapil Girish** 20181174	Arnab Kumar Laha, IIM Ahmedabad	Quantitative risk management and data analytics with applications to finance

Sr. No.	Student	Supervisor	Project Title
10	**Hrishikesh Kailas Haral** 20181176	Bipin Kumar, IITM Pune	Meteorological variables nowcasting using machine learning and deep learning techniques
11	**Sankhe Suyog Rajendra** 20181214	Pranay Goel, IISER Pune	Modeling the neural network to test the basis of working memory in chimpanzee
12	**Devarsh P. Patel** 20181222	Hima Patel, IBM Research, Bengaluru	Application of imitation learning in automating end to end exploratory data analysis

EARTH AND CLIMATE SCIENCE

1	**Thaware Rakshit Anup** 20161067	Suvarna Fadnavis, IITM Pune	Variability of anthropogenic and fire aerosols and their impact on the Indian summer monsoon
2	**Sujith M.S.** 20171078	Rahul Dehiya, IISER Pune	Development of 2D full waveform inversion algorithm of seismic data
3	**Mohit Bokariya** 20171128	Shyam Sundar Rai, IISER Pune	Crustal structure of the Western Himalaya
4	**Abel Shibu** 20181001	Joy Merwin Monteiro, IISER Pune	Impact of land surface parameters and large-scale warming on near-surface temperature extremes: A study using rare event sampling
5	**Om Adarsh** 20181012	Devapriya Chattopadhyay, IISER Pune	Variation in the marine bivalve diversity with depth: A case study from benthic assemblages of Bay of Bengal
6	**Anuja Raorane** 20181048	Ramon Brasser, Research Centre for Astronomy and Earth Sciences, Konkoly, Budapest, Hungary	Formation of saturn and distribution of its growth times
7	**Abdul Rauf P.** 20181054	Shreyas Managave, IISER Pune	Sources of soil leachable sulphate in the Indian region using sulphur isotopic analysis
8	**Priyasha Negi** 20181091	Gyana Ranjan Tripathy, IISER Pune	Geochemical and Sr-Nd isotopic study of Bay of Bengal sediments: Reconstruction of erosional changes during last Glacial-Interglacial cycle
9	**Jadhav Prajwal Prakashrao** 20181112	Sreejith O.P., Indian Meteorological Department (IMD), Pune	Sub-seasonal forecasting of temperature and precipitation over India using machine learning approach
10	**Aharna Sarkar** 20181121	Supriyo Chakraborty, IITM Pune	Evaluating tree-ring proxies for ecosystem productivity in India through observations and model products
11	**Sandhya Vijayan K.** 20181196	Sooraj K.P., IITM Pune	A study on the factors causing the enhanced inland penetration of monsoon depressions into the Indian landmass
12	**Bharath Krishnan U.** 20181197	Sarvesh Kumar Dubey, IIT Delhi	Investigation of in scale and mean flow interactions of MRG waves using spectral energetic framework
13	**Gadankush Sonal Sharad** 20181225	Amzad Hussain Laskar, Physical Research Laboratory, Ahmedabad	Soil organic carbon dynamics in tropical Indian forests: an investigation using radiocarbon and stable isotopes

Sr. No.	Student	Supervisor	Project Title
	HUMANITIES AND SOCIAL SCIENCES		
1	**Adarsh Subash Pradhan** 20161088	Sara Ahmed, IISER Pune	Agriculture in Odisha: Challenges due to climate uncertainty
2	**Divyansh Tandon** 20171032	Chaitra Redkar, IISER Pune	Right-wing authoritarianism in India and its impact on tribal communities
3	**Mohammad Wasim** 20171099	Tarun Menon, Azim Premji University, Bengaluru	Causation, responsibility and climate change
4	**Rajashree Nayak** 20171144	Bijoy Krishna Panda, Jadavpur University, Kolkata	A database of M.A. in education dissertations at Public State Universities in West Bengal
5	**Suryadeepto Nag** 20181073	David Stern, Australian National University, Australia	The impacts of electricity access: Evidence from rural India
6	**Ningnung Jakoinao** 20181143	Parth R. Chauhan, IISER Mohali	An exploratory study of experimental cut marks on mammalian bones and its implications for understanding tool selection and butchery skill in prehistory
7	**Abhishek Saroha** 20181170	Nitinkumar Yashwant Tagade, SPPU, Pune	Do caste and religion matter in shaping economic inequality?
8	**Sutar Srijay** 20181203	Anandita Pan, IISER Bhopal	Ambedkar, Periyar, and Feminisms in India
	INTER-DISCIPLINARY		
1	**Ankit Bhaskar** 20161179	Bipin Kumar, IITM Pune	Investigation of mixed layer depth through the lens of artificial intelligence
2	**Udhay Vershwal** 20171067	Anil Sharma, IIT Roorkee	Foreign institutional investors: Trends and investment preferences in India
3	**Gaikwad Sushrut Ishwar** 20171197	Bipin Kumar, IITM Pune	Forecasting air pollutants using deep learning
4	**Adish Assain Illikkal** 20181047	Amit Apte, IISER Pune	Socio-ecological systems model to study Indian oil sardine fisheries dynamics in Kerala

Sr. No.	Student	Supervisor	Project Title
	MATHEMATICS		
1	**Mohan Mouli Karra** 20161105	Soumen Maity, IISER Pune	Centrality measures in social network
2	**Shamant Basidoni** 20171011	Anindya Goswami, IISER Pune	American option pricing in regime switching models
3	**Tanuj Mathur** 20171055	Debargha Banerjee, IISER Pune	Modular forms, Bianchi groups, torsion growth, and exploring the Bergeron-Venkatesh conjecture
4	**Pavith R.** 20171107	Supriya Pisolkar, IISER Pune	Topics in homological algebra
5	**Ajaykrishnan E.S.** 20181004	Soumen Maity, IISER Pune	Exact exponential algorithms & knot-free vertex deletion
6	**A.P. Aravintakshan** 20181041	Supriya Pisolkar, IISER Pune	Characterization of uniform pro-p groups
7	**Karthik Suraj Vasisht** 20181087	Steven Spallone, IISER Pune	Fibrations over topological groups
8	**Shruthi Prusty** 20181094	Sofiat Olaosebikan, University of Glasgow, U.K.	Computational complexity of the pilot assignment problem in cell-free massive MIMO
9	**Vantipalli Ritvik** 20181097	Swarnendu Sil, IISc, Bengaluru	The Yamabe Problem
10	**Sreedev M.** 20181106	Rukmini Dey, ICTS, Bengaluru	On the Bj*orling problem for born-infeld solitons and the interpolation problem for timelike minimal surfaces
11	**Anand Rao Tadipatri** 20181122	Siddhartha Gadgil, IISc, Bengaluru	Proved algorithms in geometric group theory
12	**Ipsa Bezbarua** 20181124	Jennifer Schultens, University of California, Davis, U.S.A.	Simplicial complexes on seifert surfaces of links
13	**Siddharth Gita Jayanta Mohapatra** 20181142	Rituparna Sen, ISI, Bengaluru	Network modeling of extreme dependence in high dimensional financial time series
14	**Mihir Neve** 20181163	Soumen Maity, IISER Pune	Self-complementarity and the erdos-hajnal conjecture
15	**Hrishikesh V.** 20181189	Vishnu Narayanan, IIT Bombay	A polyhedral perspective of the lonely runner conjecture
16	**Rachuri Anirudh Raghava** 20181193	Soumen Maity, IISER Pune	Vertex deletion on chordal graphs and their subclasses
17	**Riddhi Manna** 20181217	Masato Wakayama, NTT Institute for Fundamental Mathematics, Tokyo, Japan	Study on the spectral zeta function of the jaynes-cummings model

Sr. No.	Student	Supervisor	Project Title
	PHYSICS		
1	**Robin K.P.** 20171010	Sunil Nair, IISER Pune	Investigating spin seebeck effect in various types of hexaferrites
2	**Ayan Biswas** 20171020	Janaki Balakrishnan, IISc Bengaluru	Studies of nonlinear phenomena in sensory systems
3	**Ananth Kamath** 20171024	Ashna Bajpai, IISER Pune	Exploring linear and non-linear AC susceptibilities of single crystal gadolinium around curie & spin-reorientation transitions
4	**Ramya Narayanan** 20171048	Arijit Bhattacharyay, IISER Pune	Inhomogeneous cosmologies as a dark energy candidate
5	**Anasuya Karmakar** 20171129	Apratim Chatterji, IISER Pune	Search for order in the organization of intrinsically disordered confined polymeric chains
6	**Rajat Sharma** 20181017	Diptimoy Ghosh, IISER Pune	Constraining the space of low energy EFTs
7	**Prajnadipt Ghosh** 20181021	Andrea Ferrara, Scuola Normale Superiore, Pisa, Italy	Dust obscuration in the most massive galaxies of epoch of reionization
8	**Yuv Agarwal** 20181025	Dario Benedetti, CPHT, Ecole Polytechnique, France	Renormalization group analysis of models of symplectic fermions
9	**T.N. Suhal Siva Ratan** 20181035	Apratim Chatterji, IISER Pune	GPU-based multiscale simulation to model active matter hydrodynamics in fluid medium
10	**Aviral Aggarwal** 20181040	Alok Laddha, Chennai Mathematical Institute, Chennai	Classical observables from Feynman amplitude
11	**Anantha S. Rao** 20181044	L. Venkata Subramaniam, IBM Research, Gurugram	Learning distributions with quantum-enhanced variational autoencoders
12	**Varun Shah** 20181046	Sandro Mereghetti, Institute of Space Astrophysics and Cosmic Physics Milan, Italy	Asymmetries in surface temperature distribution of thermally emitting neutron stars
13	**Doke Anushka Kailas** 20181052	Elena Cuoco, Scuola Normale Superiore, Pisa, Italy	Detection and reconstruction of gravitational waves from core-collapse supernovae
14	**Rhuthwik S.** 20181053	Vijayakumar Chikkadi, IISER Pune	Defect dynamics in amorphous colloidal monolayers under shear
15	**Arun Ravi** 20181074	Yogesh Wadadekar, NCRA-TIFR, Pune	Searching for Red Geyser Galaxies with machine learning
16	**Kunal Paul** 20181075	Sanved Kolekar, Indian Institute of Astrophysics, Bengaluru	Asymptotic symmetries of spacetime and memory effect

Sr. No.	Student	Supervisor	Project Title
17	**Aditya Chincholi** 20181085	Rajdeep Sensarma, TIFR Mumbai	Spin and charge memory retention in localized spin-orbit coupled systems
18	**Chandana Rao A.S.** 20181086	Umakanth D. Rapol, IISER Pune	Generation and characterization of entangled photons source through spontaneous parametric down conversion
19	**Saptarshi Pal** 20181089	Nishita Dattatray Desai, TIFR Mumbai	Complementary signatures for strongly interacting dark matter
20	**Abhishek Ravishankar** 20181095	Sumati Surya, Raman Research Institute, Bengaluru	Towards a discrete induced spatial curvature in causal sets
21	**Prem Agarwal** 20181098	V. Ravindran, Institute of Mathematical Sciences, Chennai	Evaluation of multi-loop Feynman integrals using modern methods
22	**Arjun Murlidhar** 20181101	Somak Raychaudhury, IUCAA, Pune	Searching for quadruply lensed quasars in large imaging surveys
23	**Nitish Kumar K.V.** 20181102	Seema Sharma, IISER Pune	Semiparametric graph neural networks for energy regression of hadron showers in the CMS High Granularity Calorimeter
24	**Devjyoti Tripathy** 20181103	Sebastian Deffner, University of Maryland, Baltimore, U.S.A.	Quantum information scrambling in graphene flakes
25	**Ritu Dhaulakhandi** 20181111	Prasanta K. Panigrahi, IISER Kolkata	Quantum neural network architecture to perform machine learning tasks on NISQ computers
26	**Kakade Kartik Nanasaheb** 20181113	Tejinder Pal Singh, TIFR Mumbai	Spontaneous collapse models from a coarse-grained deterministic and non-unitary dynamics
27	**Vishal Ravishankar** 20181114	Firoza K. Sutaria, Indian Institute of Astrophysics, Bengaluru	Theoretical modelling and observational study of supernovae model with self-consistent solutions to radiative transfer equations in an expanding shell
28	**Aparna Jayaraj** 20181118	Sourabh Dube, IISER Pune	Simulating collision events using neural networks
29	**Ashutosh Misra** 20181120	Rejish Nath, IISER Pune	Dynamical trapping of matter-wave bright solitons in optical lattices
30	**Raikhik Das** 20181123	Alok Laddha, Chennai Mathematical Institute, Chennai	Soft gravitons and structure of null infinity in logarithmically asymptotic flat spacetime
31	**Shah Neel Atul** 20181132	L. Sriramkumar, IIT Madras	Constraining primordial perturbations on small scales
32	**Bishal Kumar Ghosh** 20181137	Bijay Kumar Agarwalla, IISER Pune	Impact of dephasing probes on various incommensurate lattice models
33	**Kushan Ashvin Panchal** 20181141	Diptimoy Ghosh, IISER Pune	Bootstrapping cosmological correlators
34	**Batra Pavitra Shailendra** 20181155	Manlio De Domenico, University of Padua, Italy	Analysis of information dynamics in protein interaction networks across the tree of life

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35	**Pranav Sood** 20181160	Shivsai Ajit Dixit, IITM Pune	Experimental probing of the turbulent non-turbulent interface in wall jets
36	**Gurram Lalith Kumar** 20181166	Surjeet Singh, IISER Pune	Effect of doping on the Nb 0.8 CoSb defective half-heusler
37	**Shashwat Singh Tomar** 20181171	Ashna Bajpai, IISER Pune	Probing ultra-slow magnetisation relaxation in transition metal fluorides through DC and AC magnetometry
38	**Pawan Ramprasad Bhure** 20181177	M.S. Santhanam, IISER Pune	Machine learning-based interaction network recovery in dynamical systems
39	**Kartik Sharma** 20181186	Shiraz Minwalla, TIFR Mumbai	Topics in large-N Chern-Simons matter theories
40	**Shaswat Suresh Nair** 20181187	Sudip Bhattacharyya, TIFR Mumbai	A study of the transitional millisecond pulsar PSR J1023+0038 using X-ray satellite data
41	**Deepesh Mohan Khushwani** 20181192	T.S. Mahesh, IISER Pune	Quantum dynamics in wigner phase space
42	**P.B. Harita** 20181195	Suneeta Vardarajan, IISER Pune	Near extremal black hole entropy
43	**Varna Shenoy K.** 20181206	Rejish Nath, IISER Pune	Excitation and correlation dynamics of a Rydberg quantum simulator using numerical methods
44	**Sowkhya Shanbhog** 20181208	Mousumi Das, Indian Institute of Astrophysics, Bengaluru	Radio Observations of Ultraluminous Infrared Galaxies (ULIRGs)
45	**Saikat Majumder** 20181212	Prasad Subramanian, IISER Pune	Thermal conduction and electron heating in solar coronal mass ejections
46	**Vishal Lal** 20181220	Umakanth D. Rapol, IISER Pune	Compact 2D-MOT and 3D-MOT systems for portable quantum gravimeter and quantum simulator
47	**Sukrit Jaiswal** 20181223	Miltos Tsiantis, Max Planck Institute for Plant Breeding Research, Germany	A continuum mechanical approach to model leaf growth

ACADEMIC ACHIEVEMENTS OF BS-MS STUDENTS

Institute Prizes related to academic excellence (CNR Rao Education Foundation Prize and Prizes for Academic Excellence) are given every year to BS-MS and Integrated PhD students.

CNR Rao Education Foundation Prize was awarded to the following students. This prize is given to first year BS-MS students who have secured the highest CGPA in the first two semesters.

Dheeraj Deshpande (Batch 2022, Semester 1)
Jagadish Parameswaran (Batch 2022, Semester 1)
Shuban Ramesh Gupta (Batch 2022, Semester 1)
Vivek Rajesh Joshi (Batch 2022, Semester 1)
Komban Subhas Christopher (Batch 2021, Semester 1)
Mugdha Ashirwad Thatte (Batch 2021, Semester 2)

Prizes for Academic Excellence were awarded to the following BS-MS students. These prizes are given to the BS-MS students who attained the highest CGPA in Semesters 3 to 8.

Sujitha Suresh (Batch 2021, Semester 3)
Mugdha Ashirwad Thatte (Batch 2021, Semester 3)
Rik Sarkar (Batch 2020, Semester 4)
Srivathsa S. Kurpad (Batch 2020, Semester 4)
Valanju Atharva Abhijit (Batch 2020, Semester 4)
Shah Varun Kaushal (Batch 2019, Semester 5 & 6)
Mihir Neve (Batch 2018, Semester 7 & 8)

During the 9th Convocation of the Institute held on May 26, 2022, 162 students graduated with BS-MS dual degrees, and 3 students received BS degree.

Aditya Milind Kolhatkar who secured a CGPA of 9.9 was awarded the Institute Gold Medal.

The following 34 students passed with Distinction (CGPA>9.0):

Writam Sinha Roy Choudhuri	Samarendra Pani
Sarathchandran J.	Nagananda K.K.
Sabarenath J.P.	Shraddha Sunil Pathak
Chetan Pandey	Madabhushi Abhinava Jagan
Yashi Jain	Satavisha De
Ritwick Kumar Ghosh	Ghugal Shreeja Gajanan
Abhinav Masih	Pranav S.R.
Aditya Milind Kolhatkar	Sougata Chowdhury
Akash Trivedi	Vaibhav Chhaya
Dipankar Maity	Chrisil Ouseph
Nikhil Phaniraj	Gautam Jagadish Hegde
Fernandes Johann Milton	Bihan Chatterjee
Shivam Sachin Chitnis	Prabhav Jain
Shruthi Ravindra Bharadwaj	Abhishek Koparde
Advait Ashirwad Thatte	Devesh Maurya
Arijit Paul	Patil Rushikesh Anil
Pratyush M.R.	Vishnupriya S.

LIST OF COURSES

August 2022 Semester 1

BS-MS/ iPhD Course Code	BS-MS/ iPhD Credits	Course Title	Semester	Coordinator / Instructor
BI1113	3	Introductory Biology - I	1	Nagaraj Balasubramanian, Girish Ratnaparkhi
BI1123	3	Experimental Biology (Aug 2022)	1	Krishanpal Karmodiya, Kundan Sengupta, Richa Rikhy, Nixon M. Abraham, Anjan Banerjee
CH1113	3	Principles of Organic Chemistry	1	Amrita Hazra, B. Gnanaprakasam
EC1213	3	Evolution of Earth and Life	1	Devapriya Chattopadhyay
TD1123	3	Academic Communication Skills	1	Pooja Sancheti
MT1113	3	Calculus - I	1	Krishna Kaipa, Manish Mishra
TD1113	3	Introduction to Computing	1	Vivek Mohan Mallick, Baskar Balasubramanyam
PH1113	3	Introductory Mechanics	1	Arka Banerjee, Sudarshan Ananth
PH1123	3	Physics Lab-I	1	Aparna Deshpande, Umakant D. Rapol, Apratim Chatterji, T.S. Mahesh

August 2022 Semester 3

BS-MS/ iPhD Course Code	BS-MS/ iPhD Credits	Course Title	Semester	Coordinator / Instructor
BA1123	3	Experimental Biology (Aug 2021)	3	Nishad Matange, Sagar Pandit, Sunish Kumar Radhakrishnan, Mridula Nambiar, Kalika Prasad
BI2113	3	Ecology and Evolution	3	Sutirth Dey
BI2123	3	Introduction to Biological Systems (Elective)	3	Aurnab Ghose, Collins Assisi
CH2113	3	Principles of Inorganic Chemistry	3	R. Boomi Shankar
CH2243	3	General Chemistry Practicals II (Elective)	3	Harinath Chakrapani, Ramakrishna G. Bhat, Aloke Das, Arun Venkatnathan, Sujit Ghosh, Ramanathan Vaidhyanathan

BS-MS/ iPhD Course Code	BS-MS/ iPhD Credits	Course Title	Semester	Coordinator / Instructor
EC2113	3	Introduction to Climate Science	3	Neena Joseph Mani
EC2123	3	Landscapes and Their Evolution (Elective)	3	Argha Banerjee
HS2123	3	Introduction to HSS	3	Pooja Sancheti, Bejoy K. Thomas, Chaitra Redkar, Shalini Sharma, Sara Ahmed, Pushkar Sohoni
MT2113	3	Introduction to Probability	3	Anup Biswas, Mainak Poddar
MT2123	3	Advanced Linear Algebra (Elective)	3	Anisa Chorwadwala, Chandrasheel Bhagwat
PH2113	3	Introductory Quantum Physics	3	Sourabh Dube, Bhas Bapat
PH2123	3	Mathematical Methods for Physics (Elective)	3	Sachin Jain, Susmita Adhikari

August 2022 Semesters

Semesters 5 and 7 refer to BS-MS; 11 and 13 refer to iPhD; 31 refers to MSc; and 21 and 22 refer to PhD

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	PhD Course Code	PhD Credits	Course Title	Semester	Coordinator / Instructor
BI3124	4	**BI6114**	4	Advanced Molecular Biology	5,11,21	Gayathri Pananghat, Mayurika Lahiri
BI3134/ DS3114	4	**BI6124/ DS6114**	4	Bioinformatics	5,7,11,13,21	M.S. Madhusudhan
BI3144	4	**BI6134**	4	Cellular Biophysics I	5,7,11,13,21	Chaitanya Athale
BI3154	4	**BI6144**	4	Neurobiology - I	5,7,11,13,21	Nixon M. Abraham, Suhita Nadkarni
BI3164	4	**BI6154**	4	Plant Biology - I	5,7,11,13,21	Anjan Banerjee, Kalika Prasad
BI4113	3	**BI6163**	3	Animal Physiology - II	7,13,21	Raghav Rajan, Nishikant Subhedar
BI4123	3	**BI6173**	3	Advanced Immunology	7,13,21	Satyajit Rath, Vineeta Bal
BI3174	4	**BI6184**	4	Advanced Biochemistry - I	5,7,11,13,21	Siddhesh S. Kamat, Sudha Rajamani
BI3184	4	**BI6194**	4	Ecology - I	5,7,11,13,21	Deepak Barua
BI3194	4	**BI6314**	4	Developmental Biology	5,7,11,13,21	Girish Ratnaparkhi, Richa Rikhy
BI3323	3	**BI6333**	3	Structural Biology	5,7,11,13,21	Saikrishnan Kayarat, Gayathri Pananghat
BI4143	3			Literature review	7	Thomas Pucadyil
BI3313	3			Semester Project	5	Sagar Pandit
BI4313	3			Semester Project	7	Sagar Pandit
BI5713	3			Lab Training	13	Deepak Barua
BI5723	3			Lab Training	13	Deepak Barua

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	PhD Course Code	PhD Credits	Course Title	Semester	Coordinator / Instructor
BI5513	3			Lab Training	11	Deepak Barua
BI5733	3			Lab Training	13	Deepak Barua
BI5114	4	**BI6344**	4	Biostatistics	11,13,21	Ramana Athreya
BI3333/ HS3173	3	**BI6363**	3	Disease and Discourse	5,7,11,13,21	Nishad Matange, Pooja Sancheti
BI3344	4	**BI6374**	4	Microbial Genetics	5,7,11,13,21	Sunish Kumar Radhakrishnan, Mridula Nambiar
		BI6382	2	Physical Biology - Concepts and Experiments	13,21	Thomas Pucadyil
		BI6392	2	Immunotherapy	13,21	Satyajit Rath
		BI6512	2	Practical Programming	13,21	Raghav Rajan
		BI6522	2	Mechanobiology and Disease	13,21	Kundan Sengupta
CH3114	4	**CH6114**	4	Physical Organic Chemistry	5,7,11,13,21,31	Hosahudya N. Gopi
CH3124	4	**CH6124**	4	Main Group Chemistry	5,7,11,13,21,31	Moumita Majumdar
CH3134	4	**CH6134**	4	Symmetry and Group Theory	5,7,11,13,21,31	Jeetender Chugh
CH3143	3	**CH6144**	4	Self-Assembly in Chemistry (NKN)	5,7,11,13,21,31	S. Sandanaraj Britto
CH3163	3			Advanced Organic Chemistry Laboratory	5,7,11,31	Pinaki Talukdar
CH3154	4	**CH6154**	4	Chemical Equilibrium and Kinetics	5,7,11,13,21,31	Arnab Mukherjee
CH4114	4	**CH6164**	4	Organic Synthesis - II	7,13,21	Srinivas Hotha
CH4124	4	**CH6174**	4	Bioinorganic Chemistry	7,13,21	V.G. Anand
CH4134	4	**CH6184**	4	Polymer Chemistry	7,13,21,31	M. Jayakannan
CH4144	4	**CH6194**	4	Statistical Thermodynamics	7,13,21,31	Anirban Hazra, Srabanti Chaudhury
CH4153	3			Advanced Physical Chemistry Laboratory	7,13	Pramod Pillai, Pankaj Mandal, Muhammed Musthafa O.T.
CH4164	4	**CH6314**	4	Bioorganic Chemistry and Chemical Biology	7,13,21,31	S.G. Srivatsan
CH4173	3	**CH6324**	4	Solid State Chemistry	7,13,21,31	Partha Hazra
CH4184	4	**CH6334**	4	Electrochemistry	7,13,21,31	Nirmalya Ballav
CH4194	4	**CH6344**	4	Fundamentals of Solution-State NMR Spectroscopy: Principles and Applications (NKN)	7,13,21,31	Jeetender Chugh
CH3313	3			Semester Project	5	Raghavendra Kikkeri
CH4313	3			Semester Project	7	Raghavendra Kikkeri
CH5712	2			Lab training	13	Jeetender Chugh
CH5722	2			Lab training	13	Jeetender Chugh

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	PhD Course Code	PhD Credits	Course Title	Semester	Coordinator / Instructor
		CH6352	2	Reaction Mechanism	13,21,31	Hosahudya N. Gopi, Ramakrishna G. Bhat
DS3313	3			Semester Project	5	Leelavati Narlikar
DS4313	3			Semester Project	7	Leelavati Narlikar
EC3114	4	**EC6114**	4	Numerical Computation	5,21	Suhas Ettammal
EC3124	4	**EC6124**	4	Physics of the Atmosphere	5,7,21	Neena Joseph Mani
EC4114	4	**EC6134**	4	Atmosphere and Ocean Dynamics	7,21	Suhas Ettammal
EC3134	4	**EC6144**	4	Applied Mathematical Methods	5,21	Joy Merwin Monteiro
EC3144	4	**EC6154**	4	Introduction to Geophysics	5,7,21	Arjun Datta
EC3154	4	**EC6164**	4	Sedimentology and Stratigraphy	5,11,21,31	Sudipta Sarkar
EC3164	4	**EC6174**	4	Earth and Planetary Materials	5,7,11,21,31	Shreyas Managave
EC4134	4	**EC6184**	4	Exploration Seismology	7,21	Rahul Dehiya
EC4144	4	**EC6194**	4	Tropical Meteorology	7,21	Suhas Ettammal, Sibin T.P. (IITM Pune)
EC4153	3	**EC6314**	4	Sequence Stratigraphy	7,21	Alok Dave
EC3174	4	**EC6324**	4	Structural Geology and Tectonics	5,7,11,21,31	Shreyas Managave, Durga Mohanty (SPPU Pune)
EC3183/ DS3143	3	**EC6334/ DS6124**	4	Parameter Estimation and Inverse Theory	5,7,21	Rahul Dehiya
EC4164	4	**EC6344**	4	Igneous and Metamorphic Petrology	7,21	Shreyas Managave, Raymond Duraiswamy (SPPU Pune)
EC4173	3	**EC6383**	3	Igneous and Metamorphic Petrology Lab	7,21	Shreyas Managave, Raymond Duraiswamy (SPPU Pune)
EC3194	4	**EC6354**	4	Paleobiology	5,7,11,21,31	Devapriya Chattopadhyay
EC4123	3	**EC6364**	4	Sedimentology and Paleobiology Lab	7,11,21,31	Alok Dave
EC3323	3	**EC6374**	4	Hydrology	5,7,21	Argha Banerjee
EC3334	4	**EC6534**	4	Introduction to Interactive Spheres	5,7,11,13,21,31	Rahul Dahiya, Arjun Datta, Neena Joseph Mani, Argha Banerjee,
EC3313	3			Semester Project	5	Shreyas Managave
EC4313	3			Semester Project	7	Shreyas Managave
		EC6382	2	Fundamentals of Climate Science	21	Neena Joseph Mani
		EC6392	2	Fundamentals of Geology	21	Devapriya Chattopadhyay
		EC6512	2	Fundamentals of Geophysics	21	Arjun Datta, Argha Banerjee, Rahul Dehiya

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	PhD Course Code	PhD Credits	Course Title	Semester	Coordinator / Instructor
		EC6522	2	Classic papers in Earth and Climate Science	21	Argha Banerjee
		HS6114	4	PhD Reading Course	21	Pooja Sancheti
HS3114	4	**HS6124**	4	Disasters and Society	5,7,11,13,21	Shalini Sharma
HS3153	3	**HS6164**	4	Economics and Public Policy	5,7,11,13,21	Bejoy K. Thomas
HS3144	4	**HS6154**	4	Select Key Political Concepts	5,7,11,13,21	Chaitra Redkar
HS3313	3			Semester Project	5	Pushkar Sohoni
HS4313	3			Semester Project	7	Pushkar Sohoni
HS3173/ BI3333	3	**HS6183**	3	Disease and Discourse	5,7,11,13,21	Pooja Sancheti, Nishad Matange
HS3183	3	**HS6194**	4	History of India through 75 objects: Culture and Society	5,7,11,13,21	Pushkar Sohoni
HS3193	3	**HS6314**	4	Curating Film History	5,7,11,13,21	Monia Acciari (De Montfort University); Pushkar Sohoni
MT3114	4			Rings and Modules	5,7,11,31	Prashant Arote, Manish Mishra
MT3124	4			Real Analysis II	5,7,11,31	Ayan Mahalanobis
MT3134	4			Point Set Topology	5,7,11,31	Amit Hogadi
MT3144	4			Ordinary Differential Equations	5,7,11,13,31	Steven Spallone
MT3154	4			Graph Theory	5,7,11,31	Soumen Maity
MT3194/ DS3124	4			Statistical Inference	5,7,11,13,31	Moumanti Podder
MT3174	4			Fields and Galois theory	5,7,11,13,31	Debargha Banerjee
MT4114	4			Algebraic Topology	7,13,31	Diganta Borah
MT4124	4			Functional Analysis	7,13,31	Haripada Sau
MT4134	4	**MT6124**	4	Probability	7,13,21,31	Anindya Goswami
MT3184	4			Differential geometry and Lie groups	7,13,31	Praphulla Koushik
MT4144	4			Representation theory of finite groups	7,13,31	Anupam Kumar Singh
MT3313	3			Semester Project	5	Baskar Balasubramanyam
MT4313	3			Semester Project	7	Baskar Balasubramanyam
MT5723	3			Semester Project	13,31	Kaneenika Sinha
MT5730	14			Research Project	13	Kaneenika Sinha
	4	**MT6134**	4	Algebra - I	13,21	Supriya Pisolkar
	4	**MT6144**	4	Analysis - I	13,21	Kaneenika Sinha
	4	**MT6154**	4	Topology - I	13,21	Rama Mishra

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	PhD Course Code	PhD Credits	Course Title	Semester	Coordinator / Instructor
		MT5214	4	Algebra - II	22	Rabeya Basu
		MT5224	4	Analysis - II	22	Divyang Bhimani
		MT5234	4	Topology - II	22	Tejas Kalelkar
PH3114	4	**PH6114**	4	Electrodynamics-I	5,11,21	Ashish Arora
PH3124	4			Quantum Mechanics – I	5,11	Arijit Bhattacharyay
PH3134	4			Optics	5,11	Pavan Kumar G.V.
PH3144	4	**PH6134**	4	Electronics-I with lab	5,11,21	Shouvik Datta
PH3153	3	**PH6144**	4	Methods of Experimental Physics	5,7,11,13,21	Shivprasad Patil
PH3163	3			Mathematical Methods for Physics II (3)	5,7,11,13	Arun M. Thalapillil
PH3173	3			Physics Lab-III	5,11	Sunil Nair, Prasenjit Ghosh
PH3313	3			Semester Project	5	Bijay Kumar Agarwalla
PH5513	3			Semester Project	11	Bijay Kumar Agarwalla
PH5713	3			Semester Project	13	Bijay Kumar Agarwalla
PH5113	3	**PH6353**	3	Advanced Classical Mechanics	7,11,13,21	Deepak Dhar
PH4113	3	**PH6363**	3	Condensed Matter Physics – II	7,13,21	Mukul Kabir
PH4123	3	**PH6163**	3	Statistical Mechanics – II	7,13,21	Sreejith G.J.
PH4133	3	**PH6373**	3	Quantum Field Theory-I (NKN)	7,13,21	Diptimoy Ghosh
PH4144	4			Physics Lab-V	7,13	Surjeet Singh, Ashna Bajpai
PH4154	4	**PH6384**	4	Nuclear and Particle Physics	7,13,21	Seema Sharma
PH4163	3	**PH6393**	3	Astronomy and Astrophysics	7,13,21	Ramana Athreya
PH4173	3	**PH6513**	3	Fluid Dynamics	7,13,21	Prasad Subramanian
PH4183	3	**PH6523**	3	Gravitation	7,13,21	Suneeta Vardarajan
PH4193	3	**PH6533**	3	Physics at Nanoscales	7,13,21	Atikur Rahman
PH4323	3	**PH6543**	3	Quantum Information	7,13,21	M.S. Santhanam
PH4313	3			Semester Project	7	Bijay Kumar Agarwalla
		PH6552	2	Materials for Energy Harvest and Storage	13,21	Satishchandra Ogale
		PH6562	2	Ultracold Quantum Gases	13,21	Rejish Nath
SE4113	3	**SE6113**	3	The Cognitive Basis of Science	7,11,13,21	Nagarjuna G., Aparna Deshpande
SE4123	3	**SE6123**	3	Science and the world	7,11,13,21	Anirban Hazra, Bhas Bapat, Joy Merwin Monteiro

January 2023 Semester 2

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	Course Title	Open to Semester	Course Coordinator
BI1213	3	Introduction to Biomolecules	2	M.S. Madhusudhan, Sudha Rajamani, Nagaraj Balasubramanian, Girish Ratnaparkhi, Gayathri Pananghat
CH1213	3	Principles of Physical Chemistry	2	Pramod Pillai, Angshuman Nag
CH1223	3	General Chemistry Practicals I	2	Moumita Majumdar, R. Boomi Shankar, Shabana Khan, Debangsu Sil, Pramod Pillai, Partha Hazra, S. Sandanaraj Britto, Srinivas Hotha
EC1223	3	The Solid Earth	2	Arjun Datta
HS1223	3	Science and Society	2	Pushkar Sohoni
MT1213	3	Calculus II	2	Manish Mishra, Tejas Kalelkar
MT1223	3	Linear Algebra	2	Rabeya Basu, Ayan Mahalanobis
PH1213	3	Introductory Electricity and Magnetism	2	Arka Banerjee, Arijit Bhattacharyay

January 2023 Semester 4

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	Course Title	Open to Semester	Course Coordinator
BI2213	3	Cell Biology (E)	4	Richa Rikhy, Thomas Pucadyil
BI2223	3	Physiology (E)	4	Nishad Matange, Satyajit Rath, Nishikant Subhedar
BI2233	3	Genetics (E)	4	Kalika Prasad, Mridula Nambiar
CH2213	3	Analytical Chemistry (E)	4	M. Jayakannan
CH2223	3	Principles of Organic Chemistry II (E)	4	Harinath Chakrapani
CH2233	3	Fundamentals of Molecular Spectroscopy (E)	4	Pankaj Mandal
TD2213	3	Thermodynamics	4	Srabanti Chaudhury, Muhammed Musthafa O.T.
TD2223	3	Data Analysis	4	Amit Apte
EC2213	3	Principles of Planetary Climate (E)	4	Joy Merwin Monteiro
EC2253	3	Introductory Seismology (E)	4	Arjun Datta
EC2243	3	Atmosphere and Ocean Chemistry (E)	4	Gyana Ranjan Tripathy
MT2213	3	Group Theory (E)	4	Supriya Pisolkar
MT2223	3	Real Analysis I (E)	4	Chandranandan Gangopadhyay
MT2233	3	Discrete Structures (E)	4	Moumanti Podder
PH2213	3	Classical mechanics (E)	4	Bijay Kumar Agarwalla

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	Course Title	Open to Semester	Course Coordinator
PH2223	3	Thermal & Statistical Physics (E)	4	Rejish Nath, Seema Sharma
PH2233	3	Physics Lab – II (E)	4	Surjeet Singh, Aparna Deshpande, Satishchandra Ogale, Mukul Kabir

January 2023 Semesters

Note: Semesters 6 and 8 refer to BS-MS semesters; 32 refers to MSc Semester 2; 12 and 14 refer to iPhD Semesters 2 and 4 respectively; and 22 refers to PhD Semester 2

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	PhD Course Code	PhD Credits	Course Title	Open to Semester	Coordinator/ Instructor
BI3214	4	**BI6214**	4	Animal Physiology I	6,8,12,14,22,32	Nixon M. Abraham, Nishikant Subhedar
BI3224	4	**BI6224**	4	Introductory Immunology	6,8,12,14,22,32	Satyajit Rath, Vineeta Bal
BI3234	4	**BI6234**	4	Animal Behaviour	6,8,12,14,22,32	Raghav Rajan
BI3254	4	**BI6254**	4	Microbiology	6,8,12,14,22,32	Sunish Kumar Radhakrishnan, Gayathri Pananghat
BI3264	4	**BI6264**	4	Mathematical & Computational Biology	6,8,12,14,22,32	Collins Assisi, Suhita Nadkarni
BI3274	4	**BI6274**	4	Chemical Ecology	6,8,12,14,22,32	Sagar Pandit
BI3284	4	**BI6284**	4	Advanced Biochemistry II	6,8,12,14,22,32	Thomas Pucadyil, Amrita B. Hazra
BI4213	3	**BI6613**	3	Applied Plant Biology	6,8,12,14,22,32	Anjan Banerjee
BI3413	3	**BI6413**	3	Physical Biochemistry	6,8,12,14,22,32	Jayant B. Udgaonkar
BI3423	3	**BI6423**	3	Data Science	6,8,12,14,22,32	Pranay Goel
BI3433	3	**BI6433**	3	Evolution	6,8,12,14,22,32	Sutirth Dey
BI3444	4	**BI6444**	4	Genome Biology & Epigenetics	6,8,12,14,22,32	Krishanpal Karmodiya, Kundan Sengupta
BI4254	4	**BI6454**	4	Biology and Disease	8,12,14,22,32	Mayurika Lahiri, Siddhesh S. Kamat
BI5214	4	**BI6464**	4	Literature Review	14,22	Deepak Barua, Mayurika Lahiri, Aurnab Ghose, Chaitanya Athale, Nagaraj Balasubramanian
BI4223	3	**BI6633**	3	Neurobiology II	6,8,12,14,22,32	Suhita Nadkarni, Nixon M. Abraham
BI4233	3	**BI6623**	3	Cellular Biophysics II	6,8,12,14,22,32	Chaitanya Athale
BI3613	3			Lab/Theory Project	6	Saikrishnan Kayarat
BI4613	3			Lab/Theory Project	8	Saikrishnan Kayarat
BI5223	3			Lab Training	12	Raghav Rajan

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	PhD Course Code	PhD Credits	Course Title	Open to Semester	Coordinator/ Instructor
BI5236	6			Research Project	14	Raghav Rajan
BI5245	5			Research Seminar	14	Raghav Rajan
	2	**BI6472**	2	Design of nervous systems	12,14,22	Aurnab Ghose
	2	**BI6482**	2	Vaccines	12,14,22	Vineeta Bal
	2	**BI6492**	2	Drosophila Genetics	12,14,22	Girish Ratnaparkhi
CH3214	4	**CH6214**	4	Quantum Chemistry	6,8,14,22,32	Arun Venkatnathan
CH3224	4	**CH6224**	4	Organic Synthesis-I	6,8,14,22,32	Boopathy Gnanaprakasam
CH3234	4	**CH6234**	4	Transition metal Chemistry	6,8,14,22,32	Sujit Kumar Ghosh, Debangsu Sil
CH4254	4	**CH6244**	4	Structural Methods and Analysis	8,14,22,32	Pinaki Talukdar, Seergazhi Srivatsan
CH4264	4	**CH6254**	4	Advanced Molecular Spectroscopy	8,14,22,32	Aloke Das
CH4274	4	**CH6264**	4	Medicinal Chemistry	8,14,22,32	Harinath Chakrapani
CH4224	4	**CH6284**	4	Advanced Material Science	8,14,22,32	Ramanathan Vaidhyanathan
CH4243	3	**CH6294**	4	Organometallic Chemistry	8,14,22,32	Ramakrishna G. Bhat
CH3613	3			Semester Project	6	Pinaki Talukdar
CH4613	3			Lab Training/Theory Project	8	Pinaki Talukdar
CH5212	2			Lab Training	12	Arnab Mukherjee
CH5225	5			Research Project	14	Jeetender Chugh
CH5232	2			Research Seminar	14	Jeetender Chugh
CH4284	4	**CH6414**	4	Chemistry for Alternative Energy	8,14,22,32	Angshuman Nag, Muhammed Musthafa O.T.
CH4214	4	**CH6424**	4	Organotransition Metal Catalysis	8,14,22,32	Shabana Khan
CH3253	3			Advanced Inorganic Chemistry Laboratory	6,8,32	Debangsu Sil, Nirmalya Ballav, V.G. Anand
CH4233	3	**CH6454**	4	Thermal Pericyclic and Photochemical Reactions	8,14,22,32	Hosahudya N. Gopi
	2	**CH6432**	2	Introduction to Machine Learning in Chemistry	14,22,32	Arnab Mukherjee
DS3613	3			Semester Project	6	Leelavati Narlikar
DS4613	3			Semester Project	8	Leelavati Narlikar
DS4213	3	**DS6213**	3	Natural Language Processing	8,32	Leelavati Narlikar, Manasi Patwardhan
DS4223	3	**DS6223**	3	Generalized Linear Models and their Applications	8,12,14,22	Leelavati Narlikar, Mousum Datta

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	PhD Course Code	PhD Credits	Course Title	Open to Semester	Coordinator/ Instructor
DS4233	3	**DS6233**	3	Time Series Analysis	8,12,14,22	Leelavati Narlikar, Tulasi Ram Reddy
DS4244	4	**DS6244**	4	Bayesian theory and practice	8,12,14,22,32	Leelavati Narlikar, Chandrasheel Bhagwat, Amit Apte
DS3213	3	**DS6263**	3	Data Science	6,8,12,14,22,32	Pranay Goel
	2	**DS6252**	2	Introduction to Machine Learning in Chemistry	14,22,32	Arnab Mukherjee
EC3214	4	**EC6214**	4	Geo and Cosmochemistry	6,8,22,32	Shreyas Managave
EC3224	4	**EC6224**	4	Geophysical Fluid Dynamics	6,8,22	Suhas Ettammal
EC3414	4	**EC6294**	4	Geodynamics I	6,8,22	Shyam Sundar Rai
EC3243	3			Analytical Geochemistry Lab	6,8,32	Gyana Ranjan Tripathy
EC3253	3			Introduction to Field Techniques	6,8,32	Sudipta Sarkar, Shreyas Managave
EC3264	4	**EC6234**	4	Physical Oceanography	6,8,22	Joy Merwin Monteiro
EC3284	4	**EC6264**	4	Satellite Data Analysis & Image Processing	8,32,22	Sudipta Sarkar
EC3293	3	**EC6274**	4	Isotope Geochemistry	6,8,32,22	Gyana Ranjan Tripathy
EC4243	3	**EC6284**	4	Geological Field Training	8,22	Devapriya Chattopadhyay, Alok Dave
EC4254	4	**EC6414**	4	Indian geology and resources	8,32,22	Alok Dave
EC3613	3			Semester Project	6	Devapriya Chattopadhyay, Neena Joseph Mani, Arjun Datta
EC4613	3			Lab Training/Theory Project	8	Devapriya Chattopadhyay, Neena Joseph Mani, Arjun Datta
EC4262	2			Research-1	32	Devapriya Chattopadhyay, Neena Joseph Mani, Arjun Datta
HS3223	3	**HS6224**	4	Development Studies: Concepts, Applications and Perspectives	6,8,14,22,32	Bejoy K. Thomas
HS3123	3	**HS6134**	4	Evolution of Cinema	6,8,14,22,32	Anil Zankar
HS3613	3			Semester Project	6	Pushkar Sohoni
HS4613	3			Lab Training/Theory Project	8	Pushkar Sohoni
HS3244	4	**HS6244**	4	Political Thought in India: A Study of Select Texts	6,8,14,22,32	Chaitra Redkar

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	PhD Course Code	PhD Credits	Course Title	Open to Semester	Coordinator/ Instructor
HS3253	3	**HS6253**	3	Introduction to Political Ecology: Selected Approaches	6,8,14,22,32	Shalini Sharma
		HS6264	4	Research Methods, Fieldwork, and Ethics	22,32	Chaitra Redkar, Anil Zankar, Bejoy K. Thomas, Shalini Sharma, Pooja Sancheti, Pushkar Sohoni, Venketeswara R. Pai, Sara Ahmed
HS3283	3	**HS6294**	4	Development of Mathematical Astronomy in India	6,8,14,22,32	Venketeswara R. Pai
MT3214	4			Complex Analysis	6,8,32	Diganta Borah
MT3224	4			Algebraic Number Theory	6,8,32,14	Debargha Banerjee
MT3234	4			Measure Theory and Integration	6,8,32	Haripada Sau
MT3244	4			Calculus on Manifolds	6,8,32	Sagar Kalane
MT3254	4	**MT6164**	4	Coding Theory	6,8,32,14,21	Krishna Kaipa
MT3264	4	**MT6214**	4	Algorithms	6,8,21,22,32	Prafullakumar Tale
MT4214	4	**MT6174**	4	Algebraic Geometry	8,21,32	Amit Hogadi
MT4224	4	**MT6184**	4	Fourier Analysis	8,21,32,14	Chandrasheel Bhagwat
MT4234	4	**MT6194**	4	Riemannian Geometry	8,21,32	Baskar Balasubramanyam
MT4244	4	**MT6314**	4	Cryptography	6,8,21,32	Steven Spallone
MT4254	4	**MT6324**	4	Stochastic Processes	8,21,32	Anindya Goswami
MT4264	4	**MT6334**	4	Partial Differential Equations	8,21,32	Mousomi Bhakta
MT4274	4	**MT6344**	4	Topics: Isoperimetric Problems	8,32,14	Anisa Chorwadwala
MT4283	3	**MT6423**	3	Topics: Linear Algebraic Groups	8,14,22,32	Anupam Kumar Singh
MT4294	4	**MT6434**	4	Bayesian theory and practice	8,32,14,22,32	Leelavati Narlikar, Chandrasheel Bhagwat, Amit Apte
MT5214	4	**MT6234**	4	Algebra II	14,21,22	Baskar Balasubramanyam
MT5224	4	**MT6244**	4	Analysis II	14,22	Divyang Bhimani
MT5234	4	**MT6254**	4	Topology II	14,22	Rama Mishra
MT3613	3			Semester Project	6	Diganta Borah
MT4613	3			Theory Project	8	Diganta Borah
MT5614	4			Semester Project	32	Kaneenika Sinha
MT5624	4			Theory Project	14	Kaneenika Sinha
		MT6414	4	Theory Project	22	Soumen Maity
SE4213	3	**SE6213**	3	Pedagogy of Science	8,14,22	Supriya Pisolkar, Shamin Padalkar, TISS

BS-MS/ MSc/ iPhD Course Code	BS-MS/ MSc/ iPhD Credits	PhD Course Code	PhD Credits	Course Title	Open to Semester	Coordinator/ Instructor
SE4223	3	**SE6223**	3	The Role of Media, Models and Experiments in Science Education	8,14,22	Aparna Deshpande, Nagarjuna G.
SE4233	3	**SE6233**	3	Philosophy of Education	6,8,14,22	Pooja Sancheti, K. (Ravi) Subramaniam, HBCSE, TIFR
SE4613	3			BS-MS Semester Project	8	Aparna Deshpande, Nagarjuna G.
PH3214	4	**PH6214**	4	Quantum Mechanics II	6,12,32,22	T.S. Mahesh
PH3244	4			Physics Lab IV	6,12	Atikur Rahman, Ashish Arora
PH3234	4	**PH6264**	4	Statistical Mechanics I	6,12,22,32	Apratim Chatterji
PH3224	4	**PH6274**	4	Condensed Matter Physics I	6,12,22,32	Ashna Bajpai
PH3264	4	**PH6234**	4	Computational Physics	6,8,12,14,22,32	Prasenjit Ghosh, Sourabh Dube
PH3283	3	**PH6222**	3	Electrodynamics II	6,12,22,32	Arun M. Thalapillil
PH3273	3	**PH6243**	3	Electronics & Instrumentation	6,8,12,14,22,32	Umakant D. Rapol
PH3253	3	**PH6223**	3	Group Theory in Physics	6,8,12,14,22,32	Sudarshan Ananth
PH3613	3			BS-MS Semester Project	6	Shivprasad Patil
PH5613	3			iPhD Semester Project	12	Shivprasad Patil
PH4224	4	**PH6254**	4	Atomic and Molecular Physics	8,14,22	Bhas Bapat
PH4233	3			Physics Lab VI	8,14	Pavan Kumar G.V.
PH4243	3	**PH6283**	3	Advanced Gravitation	8,14,22	Suneeta Vardarajan
PH4253	3	**PH6293**	3	Advanced Optics	8,14,22	Shouvik Datta
PH4263	3	**PH6433**	3	Astronomy and Astrophysics II	8,14,22	Prasad Subramanian
PH4213	3	**PH6443**	3	Cosmology	8,14,22	Susmita Adhikari
PH4273	3	**PH6423**	3	Non-linear Dynamics	8,14,22	M.S. Santhanam
PH4283	3	**PH6453**	3	Advanced Particle Physics	8,14,22	Diptimoy Ghosh
PH4293	3	**PH6463**	3	Physics of Soft Matter	8,14,22	Vijayakumar Chikkadi
PH4413	3	**PH6473**	3	Quantum Field Theory II	8,14,22	Sachin Jain
PH4613	3			BS-MS Semester Project	8	Shivprasad Patil
PH5213	3			iPhD Semester Project	14	Shivprasad Patil
	2	**PH6232**	2	Machine Learning for Physics applications	14,22	Sourabh Dube
	2	**PH6242**	2	Mechanics of Single Molecules	14,22	Shivprasad Patil
	2	**PH6252**	2	Self Organized Criticality	14,22	Deepak Dhar

News, Events, and Initiatives

CONFERENCES, SYMPOSIA, AND WORKSHOPS

Conferences and workshops organised by IISER Pune researchers bring together the scientific community from within and outside India. As the COVID-19 pandemic of 2020 and 2021 eased, events began to be conducted in-person during 2022-23.

In addition to the conferences and workshops listed below, research departments organised seminars by researchers from within and outside IISER Pune. The institute also organised several academic outreach events reaching out to external audiences such as students, teachers, and members of the public. These activities are described in the *Outreach Activities* chapter of this report.

SCIENTIFIC CONFERENCES AND WORKSHOPS

Data Science Research Ecosystem: Opportunities and Challenges
August 17, 2022
Organiser Data Science Department, IISER Pune

Low-Dimensional Materials (LDM)-2022
May 19-20, 2022
Organisers Nirmalya Ballav, Angshuman Nag, Pramod Pillai, Partha Hazra, Pankaj Mandal, and Muhammed Musthafa from IISER Pune

Workshop on Retreating Himalayan Glaciers
Part I during May 22-25, 2022; Part-II during December 16-17, 2022
Organiser Argha Banerjee (IISER Pune)

International Asian Chemical Biology Initiative (ACBI) Meeting-2022
September 14-18, 2022
Convenor S.G. Srivatsan (IISER Pune)
International Advisory Committee Motonari Uesugi (Kyoto University, Japan); Sandeep Verma (Secretary DST-SERB and IIT Kanpur); K.N. Ganesh (IISER Tirupati); Govindasamy Mugesh (IISc, Bengaluru)

Indian Zebrafish Investigators Meeting (IZIM) 2022
September 21-23, 2022
Organisers Chinmoy Patra (ARI, Pune) and Aurnab Ghose (IISER Pune)

Conference on Nonlinear Systems and Dynamics (CNSD) 2022
December 15-18, 2022
Local Organising Committee Amit Apte, Pranay Goel, and M.S. Santhanam from IISER Pune

Indian Women and Mathematics (IWM) Annual Conference 2022-2023
December 27-29, 2022
Organising Committee Anisa Chorwadwala (Convener; IISER Pune); Neha Prabhu (SP Pune University); Haripada Sau (IISER Pune); Riddhi Shah (JNU); Vijaylaxmi Trivedi (IWM-EC Chair; TIFR Mumbai)

Workshop on Group Theory 2023
January 13-14, 2023
Organiser Anupam Singh (IISER Pune)

fairSTREAM Stakeholder Workshop
January 17, 2023
Organiser Bejoy Thomas (IISER Pune)

NGN 2023: No-Garland Neuroscience 2023
February 2-5, 2023
Organiser Neuro Interest Group, IISER Pune

42nd Mahabaleshwar Seminars: Mitochondria and Metabolism
February 13-15, 2023
Organisers Sandhya Koushika (TIFR Mumbai); Ullas Kolthur-Seetharam (TIFR Mumbai/ Hyderabad); Richa Rikhy (IISER Pune)

Mini-symposium: Recent Advances in Main-group Chemistry
February 14, 2023
Organiser Moumita Majumdar (IISER Pune)

Physics of Strongly Correlated Electron Systems (PSCES) 2023
March 15-17, 2023
Organisers Sunil Nair and Surjeet Singh from IISER Pune

Chintan Shivir, a Critical Reflection Session on Re-Imagining Education
March 25-26, 2023
Organisers Department of Science Education of IISER Pune and Kishor Bharati

IN-HOUSE DEPARTMENTAL SYMPOSIA

BioConclave 2022: Biology In-house Talks
August 25-26, 2022
Organiser Biology Department of IISER Pune

ChemSymphoria 2022: Chemistry In-house Symposium
December 22-24, 2022
Organisers Chemistry Department and Chemphilic Club, IISER Pune

In-house Math Symposium 2023
March 23-24, 2023
Organiser Mathematics Department of IISER Pune

Sameeksha 2023: Earth and Climate Science In-house Talks
March 25, 2023
Organiser Earth and Climate Science Department of IISER Pune

CAPACITY BUILDING

SERB Karyashala: Hands-on Training and Workshop on High-end Instruments and Advanced Tools in Biology
July 18-26, 2022
Organiser Biology Department of IISER Pune

Wiley-VCH workshop
November 16, 2022
Organiser Moumita Majumdar (IISER Pune)

What makes a campus safe
A session by Nandita Pradhan Bhatt, Director of the Martha Farrell Foundation
December 2, 2022
Organiser Internal Committee of IISER Pune

EMBO Practical Course on CryoElectron Microscopy and 3D Image Processing
December 4-16, 2022
Organiser Gayathri Pananghat (IISER Pune)
Co-Organisers Radha Chauhan (NCCS, Pune); Saikrishnan Kayarat (IISER Pune); Kiran Kulkarni (CSIR-NCL, Pune); Janesh Kumar (NCCS, Pune); Ramanathan Natesh (IISER Thiruvanathapuram)

Molecular Biology Workshop for Underrepresented Groups in Academia
January 25-31, 2023
Organiser Sutirth Dey (IISER Pune)

HFSP Symposium on Opportunities for Frontier Research Collaborations
February 15, 2023
Organisers Mridula Nambiar and Girish Ratnaparkhi from IISER Pune

Training Workshop on Scientific Project Management
February 20-24, 2023
Organisers Vandana Gambhir and Vasundhara Laad from IISER Pune, in partnership with the Department of Science and Technology (DST)

International Women's Day 2023: Interactions with Women in Grassroots Governance
March 16, 2023
Organiser Women in Science Committee of IISER Pune

NAMED LECTURES

KS Krishnan Memorial Lecture 2022
November 4, 2022
Speaker Prof. Aditya Murthy, IISc, Bengaluru
Title The cognitive neuroscience of eye movements
Organiser Biology Department of IISER Pune

Ninth Annual Homi Bhabha Memorial Public Lecture
November 21, 2022
Speaker Prof. Umesh V. Waghmare, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru
Title Instabilities of crystals and their functional behaviour
Organiser Physics Department of IISER Pune

DAE - C V Raman Lecture
February 11, 2023
Speaker Priyadarshini Karve, Samuchit Enviro Tech & Cleaner Cooking Coalition (CCC)
Title Cleaner cooking for a carbon neutral world
Organiser Indian Physics Association, hosted by IISER Pune

INSTITUTE COLLOQUIA

What will happen to Y if we do A? Some perspectives from causal inference
by Prof. Devavrat Shah, MIT, U.S.A.
February 15, 2023

Deep learning for drug design
by Rajgopal Srinivasan, Distinguished Chief Scientist, TCS Research
February 20, 2023

New innovations and progress in antimalarial drug discovery
by Dr. Jeremy N. Burrows, Medicines for Malaria Venture, Switzerland
March 2, 2023

Timing the onset of life's origins on Earth
by Dr. Ramon Brasser, Research Centre for Astronomy and Earth Sciences, Budapest, Hungary
March 9, 2023

Universal stress correlations in crystalline and amorphous packings
by Prof. Kabir Ramola, TIFR Hyderabad
March 20, 2023

DFT an indispensable tool to design materials for energy storage and conversion
by Prof. Gour Prasad Das, Research Institute for Sustainable Energy (RISE) TCG Centres for Research & Education in Science & Technology
March 27, 2023

NEWS AND EVENTS

TWELFTH FOUNDATION DAY

April 9, 2022

The 12th Foundation Day of IISER Pune was celebrated with a report by the Director acknowledging the efforts of all institute members during the pandemic and sharing recent updates and achievements from the institute with the IISER Pune community. Foundation Day Lecture was delivered by Prof. Deepak Dhar on the topic of geometric phase transitions. Foundation Day awards were presented to students, faculty, and staff in recognition of their work.

NINTH CONVOCATION OF IISER PUNE

May 26, 2022

In the 9th convocation of IISER Pune held in the evening of May 26, 2022, a total of 197 students received their degrees. This included 21 PhD students, 11 Integrated PhD, and 165 BS-MS students. Prof. P. Balaram, DST-YOS Chair Professor at the NCBS, Bengaluru and former director of Indian Institute of Science delivered the convocation address.

Thirty four BS-MS students received their degrees with Distinction (CGPA >9). BS-MS student Aditya Kolhatkar received the institute gold medal.

PhD students Prasun Roychowdhury (Mathematics) and Ajith V.J. (Physics) received Xytel Best PhD Best Thesis Awards; and BS-MS students Yashi Jain (Mathematics); Writam Sinha Roy Choudhuri (Chemistry); Rushikesh Anil Patil (Physics); Rohit Sahasrabuddhe (Inter-Disciplinary); Aditya Milind Kolhatkar; Vaibhav Chhaya (Biology); Ishwari Mulkalwar (Earth and Climate Science); and Viraj Dsouza (Humanities and Social Sciences) received the Xytel Best MS thesis awards. Some of the students, who graduated in the previous years' valedictory session held online due to the pandemic received their degrees in person during the convocation.

VISIT OF HONOURABLE MINISTER OF EDUCATION SHRI DHARMENDRA PRADHAN TO IISER PUNE

May 27, 2022

Honourable Minister of Education and Minister of Skill Development and Entrepreneurship Shri Dharmendra Pradhan visited IISER Pune on May 27, 2022. Shri Pradhan laid the Foundation Stone towards the construction of the research and office space for the Department of Data Science, which has been newly established at IISER Pune. He then inaugurated the National Facility for Gene Function in Health and Disease, which had been set up earlier with funding from the Department of Biotechnology for animal model maintenance and development for research purposes.

As part of the visit, Shri Pradhan interacted with various faculty members at the institute, who gave an overview of the research and academic activities at the institute. The meeting was also attended by Ministry of Education's Additional Secretary (TE) Shri Rakesh Ranjan, IISER Pune Board of Governors Chairperson Shri Sudhir Mehta, Director Prof. Jayant Udgaonkar, and Registrar Col. Raja Sekhar.

Shri Pradhan also visited the PARAM Brahma Supercomputer facility at the institute. He noted the immense contributions being made by this facility in scaling up research on national priorities and addressing complex scientific problems in diverse fields.

(Left) Inauguration of National Facility for Gene Function in Health and Disease; (Right) Laying of Foundation Stone for Data Science Department

HINDI FORTNIGHT CELEBRATIONS

September 14-29, 2022

As part of the Hindi Fortnight, several competitions were organised for the institute members. These included Hindi essay writing (Topic: *Challenges and solutions for the use of Hindi in official work*), poetry writing, singing, and knowledge of Hindi words and translation. Winners of the competitions were given prizes and certificates.

MoA WITH TATA INSTITUTE OF SOCIAL SCIENCES (TISS), MUMBAI

December 9, 2022

Tata Institute of Social Sciences (TISS), Mumbai and IISER Pune have signed a Memorandum of Agreement (MoA) to develop joint programmes in teacher education in Science and Mathematics. This unique programme, which will be anchored by the TISS-Centre of Excellence in Teacher Education (CETE), will enable students entering into IISER Pune to select and specialise in science teaching. The MoA was signed by Col. G. Raja Sekhar (Retd.) (Registrar, IISER Pune) and Mr. Narendra Mishra (Officiating Registrar, TISS) in the presence of all other dignitaries.

(Left to Right) Col G. Raja Sekhar (Registrar, IISER Pune); Ms. Uma Lal (Head- Partnerships, CETE, TISS); Prof. Padma Sarangapani, (Chairperson, CETE, TISS); Prof. Shalini Bharat (Director, TISS); Prof. Jayant B. Udgaonkar (Director, IISER Pune); Prof. Bhas Bapat (Professor in Physics and Chairperson, Coordination Committee for Department of Science Education, IISER Pune); Prof. Bino Paul (Deputy Director, TISS); and Mr. Narendra Mishra (Officiating Registrar, TISS)

UPDATES FROM SECTION-8 COMPANIES HOSTED ON IISER PUNE CAMPUS

Giving an impetus to innovation-based initiatives, the Institute promotes and hosts two section-8 companies on campus, the I-Hub Quantum Technology Foundation (QTF) and AIC IISER Pune SEED Foundation (Atal Incubation Centre - Society for Entrepreneurship Education and Development, or AIC-SEED).

I-HUB QUANTUM TECHNOLOGY FOUNDATION

I-HUB Quantum Technology Foundation is funded by the Department of Science and Technology and is working on developing quantum technologies and products such as gravimeter, quantum clock, quantum sensors, and spintronic devices for data storage. During the year, the I-Hub ran FriQuant Seminar series with talks by experts and funded Chanakya Fellowships at undergraduate, postgraduate, doctoral, and post-doctoral levels in a number of Indian institutions. In September 2022, the I-Hub team successfully demonstrated India's first portable cold atoms at the Centre-State Conclave held in Ahmedabad.

AIC SEED For Innovation

AIC-SEED, a technology business incubator, is supported by the Atal Innovation Mission, NITI Aayog, Government of India, and aims to nurture the spirit of entrepreneurship in the campus. During 2022-23, AIC-SEED incubated 18 startup companies in domains such as biotech, pharma, healthcare, agritech, AI/ML, clean energy and environment sustainability. Among these, 5 were startups initiated by faculty and students of IISER Pune, namely, Curem Biotech LLP, Materials Magica LLP, S&T Digital LLP, Orbiton Life Sciences Pvt Ltd, and Ushm Pvt Ltd. AIC-SEED Student Entrepreneur-in-residence Program “AIC-SEED StEP”, was launched to encourage student entrepreneurship, with the enabling support of corporate donors. AIC-SEED was selected under the Startup India Seed Fund Scheme (SISFS) by the Department for Promotion of Industry and Internal Trade (DPIIT), Ministry of Commerce and Industry, with a sanction of Rs 4 Crores to provide financial assistance to eligible startups.

GOLD MEDALS TO TWO IISER PUNE TEAMS AT iGEM-2022 SYNTHETIC BIOLOGY COMPETITION

November 2, 2022

Two teams of undergraduate students from IISER Pune participated in the 2022 iGEM synthetic biology competition this year. Both the teams have won gold medals, as announced during iGEM's Grand Jamboree event held during October 26-28, 2022 in Paris. The teams had worked on two separate research projects. Team 1 worked on combatting waterlogging in agricultural fields and Team 2 worked on an antibody based therapy for dengue, both targeting locally relevant issues with the aid of synthetic biology. In addition to a gold medal, Team 2 also made it to the top 10 undergraduate teams - the first time an Indian team has made it to the top 10.

PHARMACY ON CAMPUS

In February 2023, a pharmacy has been opened on campus next to the Wellness Clinic on the Ground floor of Hostel 1. The pharmacy is open every day from 8 am to 10 pm.

NATIONAL SCIENCE DAY 2023

February 28, 2023

National Science Day is celebrated in India every year on February 28th to commemorate the discovery of the Raman Effect by Sir C.V. Raman. It is a day to promote scientific temper and create awareness about the importance of science in our daily lives.

Exhibition of science and math projects made by students during the science day celebration

Smt. Indrani Balan Science Activity Centre organised the events of the day beginning with inaugural remarks by Prof. Kundan Sengupta, Professor and Associate Dean (International Relations and Outreach), Dr. Aparna Deshpande (Faculty in-charge of Science Activity Centre), Mr. Siddharth Yawalkar – (Company Secretary and CSR Head, TATA Technologies) and Ms. Shubhangi Wankhede (Principal Technical Officer (Endowment, Outreach, and R&D)).

In this event various activities, demonstrations and lectures were designed for students from class 5 onwards. Around 4500 school children and members of the public visited the IISER Pune campus on this day.

INTERNATIONAL WOMEN'S DAY 2023

March 2023

On the occasion of International Women's Day (March 8), the following events were organised at IISER Pune.

Smt. Indrani Balan Science Activity Centre organised an interaction session of 110 girl students with IISER Pune women scientists with the aim of celebrating women's achievements, raise awareness about the issues women face, and bring together the community (March 16, 2023).

The Women in Science Committee organised a talk by Prof. Ankona Datta from TIFR Mumbai (March 3, 2023); and Panchayat Mahila Choupal, an interaction session with women in grassroot governance (March 16, 2023).

(Left) Interaction with women scientists from IISER Pune; (Right) Panchayat Mahila Choupal, an interaction session with women in grassroot governance

INAUGURATION OF STEM TINKERING EXPERIENCE CENTRE

March 27, 2023

A STEM Tinkering Experience Centre was inaugurated at IISER Pune Campus on March 27, 2023 by Mr. Vikrant Gandhe (Company Secretary and Head of Corporate Social Responsibility at Tata Technologies). This activity is part of the STEM Ready project being conducted at IISER Pune in collaboration with Tata Technologies under Tata Technologies' CSR initiative. This project aims to promote STEM (Science, Technology, Engineering, and Mathematics) education in schools.

A STEM Tinkering Experience Centre was inaugurated at IISER Pune Campus on March 27, 2023 by Mr. Vikrant Gandhe (Company Secretary and Head of Corporate Social Responsibility at Tata Technologies)

STUDENT-LED ACTIVITIES DURING 2022-23

Through the various student clubs of the institute, IISER Pune hosts a variety of activities and events offering the student community a vibrant campus atmosphere. Some of the student-led activities that take place every year include Mimamsa national quiz programme, Disha outreach programme, and Karavaan cultural festival. Various sports events are conducted through the year by the Sports Club and a large team of players and performers represent the IISER Pune contingent at the annual Inter-IISER Sports Meet and the Inter-IISER Cultural Meet, respectively. Details about these activities are included in the *Student-led Activities* chapter of this report.

THEME-BASED EVENTS

The Institute celebrated the following events during the year: International Day of Yoga (June 21, 2022); Independence Day with Har Ghar Tiranga Initiative (August 15, 2022); Swachhta Pakhwada (September 1-15, 2022); Vigilance Awareness Week (October 31 to November 6, 2022); International Day of Sign Languages (September 23, 2022); Constitution Day (November 26, 2022); Veer Bal Diwas (December 26, 2022); and Republic Day (January 26, 2023). These events were coordinated by the Administration section of the Institute with support from student club members and other members from the institute.

The Department of Mathematics and the student-led Math Club at IISER Pune organised Pi-Day (Math Day) during March 2023 through a myriad of events such as treasure hunt, juggling sessions, panel discussions and stalls for school students. The event also included talks from distinguished mathematicians.

INTERNATIONAL RELATIONS

IISER Pune's international partnerships are centered on the institute's research and teaching mandate to foster the exchange of ideas across the globe. The institute hosts delegations, builds partnerships, and offers international student and scholar services through its International Relations Office.

MEMORANDA OF UNDERSTANDING (MoU) AND AGREEMENTS SIGNED DURING 2022-23

A total of 29 collaborations, 27 ongoing and 2 new, were pursued during 2022-23.

Partner Organisation/s	Purpose
April 8, 2022 Agreement with M/s. Johns Hopkins India Private Limited (JHIPL), an Indian subsidiary company of Johns Hopkins University (JHU), U.S.A.	For establishing a clinical research unit at IISER Pune campus
August 1, 2022 Collaboration with University of Luxembourg/LCSB	Dr. Siddhesh Kamat from IISER Pune and Prof. Carole Linster from the University of Luxembourg/ LCSB are collaborating on a research project named LipoNAXD aiming to develop a lipidomics pipeline to understand the serine-to-lipid pathway connections in a rare pediatric neurometabolic disorder.
August 26, 2022 MoU with University of Notre Dame du Lac, Notre Dame, U.S.A.	MoU renewed to develop academic and research collaborations and exchanges in the fields of shared interest and expertise
January 3, 2023 MoU with Leibniz University Hannover, Germany	MoU renewed to develop an academic exchange and cooperation programme in education and research areas of mutual interest

PARTNERSHIPS AND ENDOWMENTS

Through the Offices of the Dean for Research and Development and the Dean for International Relations and Outreach, the institute engages with the industry partners towards building collaborations, supporting young researchers, and nurturing capacity building programmes.

PARTNERSHIPS WITH INDUSTRIES AND ACADEMIC ORGANISATIONS

IISER Pune signed 13 agreements / amendments / MoU during FY 2022-23 with the following industries and academic organisations (also see page 117 and page 122). One of these was towards consultancy while the others were for the purpose of research collaborations.

The organisations with which agreements/MoU were set up included Indian Institute of Science (Bengaluru), Livguard Energy Technologies, GelsoTech, TCG CREST (Centres for Research and Education in Science and Technology), King Edward Memorial Hospital Research Center, Zumator Biologics Inc, Syngene International Ltd, Unilever Industries Pvt Ltd, Indian Cancer Genome Atlas (ICGA) Foundation, TotalEnergies, and Dentsply Sirona Implants.

ENDOWMENTS

IISER Pune continues to maintain active engagements with our industry partners for a variety of societal and national development initiatives through scientific research and education. During the reporting period, we strengthened our ongoing partnerships as well as forged new ones; over 20 such collaborative activities have been implemented.

1. SUPPORT FOR RESEARCH ACTIVITIES

1.1 Rahul Bajaj endowed Chair Professorships

Dr. Mousomi Bhakta (Associate Professor, Mathematics), Dr. Thomas Pucadyil (Professor, Biology) and Dr. Pinaki Talukdar (Professor, Chemistry) were selected as Chair Professors for a period of 3 years starting June 2021.

During the reporting period, the three Chair Professors continued their ongoing research work as well as embarked on new scientific avenues. Apart from their research efforts, their contributions could be briefed as follows: Dr. Bhakta is credited with 5 publications, delivered invited talks at 4 national and international conferences and conferred with DST Swarnajayanti Fellowship. Dr. Pucadyil is credited with 2 research papers, one review, one editorial and opinion piece. He participated in 4 national and international conferences and secured 2023-28 DBT-Wellcome Trust India Alliance Team Science Grant. Dr. Talukdar has published 7 research papers and visited 6 national and international conferences. He is acknowledged as 'Fellow of the Royal Society of Chemistry (FRSC) through the Leaders in the Field' scheme (Year 2023)'. He also received extramural funding from SERB, Govt. of India for his project 'Development of self-assembled synthetic water channels as biomimetic membranes for water desalination'.

1.2 Developing Proof of Concept for Low-cost Breast Cancer Diagnostics Test using indigenous resources for affordable access across India

Breast cancer is among the most commonly diagnosed cancers. The ERBB2/HER2 FISH diagnostic test cost is prohibitive for most of the Indian sub-population. Furthermore, this test takes at least 7-10 days to report. Since the HER2 gene amplification status is a crucial biomarker for evaluating therapies for breast or gastric cancer, the project aims to create an affordable diagnostic kit for detecting ERBB2 amplifications in cells derived from tissue samples of breast cancer patients. The project is supported by Athenahealth which partners with healthcare organisations across the care continuum to drive clinical and financial results.

1.3 Support for discovery of inhibitors against SARS-CoV-2 proteins involved in replication and transcription: therapeutic targets against COVID-19

The COVID-19 pandemic has amplified the need to invest more in basic science research so that the life cycle of the coronavirus in general and SARS-CoV-2 in particular, could be studied and mechanisms to fight the virus effectively are developed. IISER Pune is implementing a unique research activity supported by Rotary Pune Sports City that aims to discover inhibitors and repurpose existing drugs against CoV-2 proteins of its genome replication machinery involved in the replication and transcription of the SARS-CoV-2 genome. Researchers at IISER Pune have been applying their expertise to learn how the virus proliferates, find ways to arrest its growth, and develop tests to diagnose it along with surveillance through genome sequencing. This research team consisting of IISER faculty along with 4-6 PhD and MSc/MS students from IISER Pune and other neighbouring institutes, would help India lead the way in the worldwide war against Covid and other similar pandemic viruses.

2. INFRASTRUCTURE SUPPORT

2.1 Support to Srinivasa Ramanujan library at IISER Pune

Twenty Twenty Interior Design Software (India) Pvt Ltd supported Srinivasa Ramanujan Library at IISER Pune. Through this grant, the library has subscribed to the online research support tool 'Turnitin Originality Check Enterprise License'. This web tool helps the institute library a 'Plagiarism Checking Service' to the bonafide students, faculty, and staff of IISER Pune.

2.2 Tree plantation to increase the diversity of native species and develop the RET (Rare, Endangered and Threatened species) garden on the IISER Pune campus

Brose India Automotive Systems Pvt Ltd is supporting IISER Pune's efforts since 2021 to increase native tree cover on the campus with an emphasis on boosting plant diversity and developing the Rare, Endangered, and Threatened (RET) plantation areas. Brose employees and the IISER Pune community, came together for two plantation drives in June-July 2022. Plantation efforts have continued since then, and more than 300 trees belonging to native, rare, and endangered species have been planted on campus in 2022-23. The survival and maintenance of the trees have been a priority since then, and we have an overall 98% survival rate, with the trees flourishing with the onset of the monsoon in June 2023. This year, the RET area is being developed by the addition of walkways and informational signage to encourage visitors and educate the community about the importance of local endemic and rare species. Such initiatives on the IISER Pune campus not only benefit the immediate community but also strengthen the flora and fauna of the Pune region.

3. SUPPORT FOR STUDENT WELFARE ACTIVITIES

3.1 IISER Pune - IDeaS Ltd scholarship for meritorious students

During FY 2022-2023, the scholarship is awarded to 6 students pursuing their BS-MS course, 2 students pursuing their Integrated PhD course, and 7 students pursuing PhD course.

3.2 Financial assistance to students belonging to the economically weaker section

Through generous support from Integrated Decisions and Systems (India) Private Limited (IDeaS), Xytel India Pvt Ltd, Shraman Foundation, Datadirect Networks India Private Ltd, Innoplexus Consulting Services Pvt Ltd, and Trimurti Fabricators Ltd, partial financial support was extended to 209 students towards their semester fee.

3.3 Infosys Foundation endowment fund

During the reporting period of 2022-23, tuition free waiver was extended to 28 BS-MS students and 4 Integrated PhD students whereas the travel grant was awarded to 34 PhD and iPhD students.

3.4 IISER Pune - Xytel Ltd Best Thesis award

In the reporting period, 9 of our exceptional students were recognised for their innovative research in various disciplines by the thesis evaluation committees and were declared as the winners of the IISER Pune - Xytel Ltd Best Thesis Award for 2022. The award was given out to the students during the 9th convocation held on May 26, 2022.

4. SUPPORT FOR STUDENT-CENTRIC RESEARCH ACTIVITIES

4.1 Travel grant for research Internship

As part of the 5-year Integrated BS-MS degree at IISER Pune, students are required to carry a year-long dissertation for their 5th year. Innoplexus Consulting Services Pvt Ltd supported international travel of one student for a research internship at the Max Planck Institute of Plant Breeding, Cologne.

5. SUPPORT FOR OUTREACH ACTIVITIES

5.1 IISER Pune - Praj Industries Ltd Mimamsa 2022 and Mimamsa 2023

Mimamsa is a national-level annual science challenge at the undergraduate level organised by the students of IISER Pune. The partnership with Praj Industries Ltd, since the 2020 edition, has helped to scale up Mimamsa and it is now one of the nation's premier science competitions.

Mimamsa 2022 had embraced a hybrid format, combining online preliminaries held on an examination portal. The 2022 edition saw the participation of more than 4000 students from 300 colleges across the country. Amongst 950 teams that appeared for prelims, four teams got shortlisted for the final round: IISc Bengaluru, IISER Kolkata, IIT Madras, and IIT Roorkee. Highlight of this year was that 42% of the participants were girls with more than 200 All-Girls teams. IIT Madras won the 2022 edition held in April 2022.

Mimamsa 2023 followed a comparable similar format, ensuring inclusiveness for participants from all over the country. The 2023 edition saw the participation of 1384 teams represented by more than 4800 students from around 450 colleges across the country. The highlight of this year was the participation of the 332 all girls team, with a rise of 66% as compared to last year. Four teams that made it to finals included IISc Bengaluru, IIT Bombay, IIT Delhi, and IIT Madras. Team IISc Bengaluru emerged as the winners of the Mimamsa 2023.

5.2 Molecular Biology training programmes for everyone

With the support from Praj Industries Ltd and KK Nag Pvt Ltd, the team continued the 'Molecular Biology for Everyone' series of workshops for school, undergraduate and postgraduate students in the year 2022-2023. The team conducted 48 workshops and catered to 551 students, where they learned about an assortment of techniques including isolation of DNA and RNA, PCR, AGE, PAGE, Western Blotting, TA cloning, etc. The team obtained a competitive grant from the Science and Engineering Research Board (SERB), Department of Science and Technology, Government of India, to organise a 7-day long high-end 'Karyashala' workshop catering to about 25 MSc and PhD students from marginalized community (SC/ST/OBC (NCL)/EWS and Women candidates) from non-metro cities of India. Apart from SERB, KK Nag Pvt Ltd, Eppendorf (India) Pvt Ltd and Bartleby Pvt Ltd provided financial support whereas Praj Industries Ltd and Pune Sports City Rotary Trust provided in-kind support.

5.3 STEM Ready

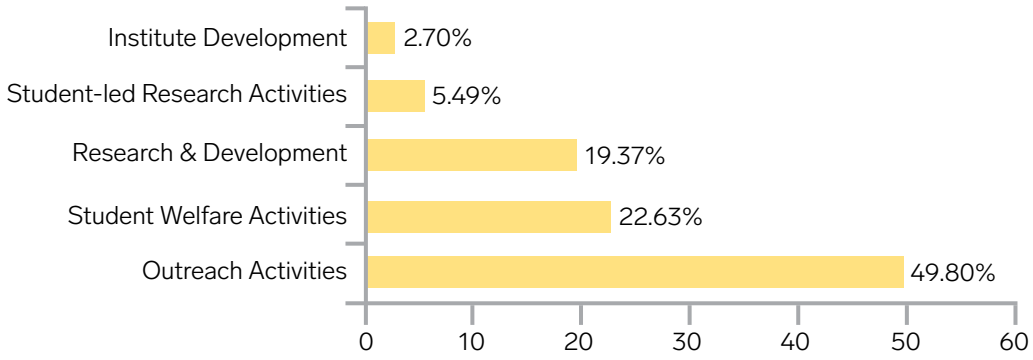
The Science Activity Centre at IISER Pune embarked on an initiative supported by Tata Technologies Ltd, to enhance the STEM tinkering ecosystem in schools. The project kicked off with a series of five-day workshops once a week, for the first cohort of 45 high school teachers. During the reporting period, half-day workshops were conducted for school students, benefiting over 1405 students from more than 35 schools. Furthermore, seven online sessions were held on Sundays, where experts shared their ideas and insights with approximately 48,000 virtual attendees. To provide a unique learning experience to school teachers, students and the general public, a STEM Tinkering Experience Centre was established at the IISER Pune Campus. The centre is equipped with cutting-edge tools and equipment and serves as a hub for students and teachers to engage in a wide range of low-cost STEM based activities and design scientific experiments.

5.4 STEM Workshop: Vigyaan for promoting STEM Education

IISER Pune collaborated with Tata Consulting Engineers (TCE) Ltd to enhance STEM education and train proactive teachers in government schools of six states of Maharashtra, Gujarat, Karnataka, West Bengal, Jharkhand and Uttar Pradesh. The main focus of these workshops was to build knowledge and skills of teachers in using the STEM models providing experiential learnings to students. The customised content was delivered through seven workshops of 3-days duration across the six states wherein a total of 216 teachers participated. STEM learning boxes containing a variety of open-source educational software “Tinkercad” were introduced and made available to 168 schools. These STEM activities were used by teachers in their classroom teaching and reached over 10,000 students.

SUMMARY OF PURPOSES OF ENDOWMENTS RECEIVED DURING FY 2022-2023

Data is shown as percentage of the total funds received



OUTREACH ACTIVITIES

IISER Pune believes that the benefits of high-quality science education and infrastructure should not be restricted to members of the institute. As an attempt to spread the excitement of science and to make the expertise and facilities at IISER Pune available to the science and education community, IISER engages in several outreach activities. These encompass social outreach in the local community, capacity building for teachers, making and popularising simple science toys, and effectively communicating scientific research through various media.

SMT. INDRANI BALAN SCIENCE ACTIVITY CENTRE (SAC)

The Science Activity Centre was established as a part of the centre of excellence in science and mathematics education in August 2017. The Science Activity Centre (SAC) is engaged in developing low-cost interactive science toys and the objective is to strengthen the teaching and learning of science and mathematics. SAC also generates educational resource material for students and teachers, aimed at improving conceptual understanding of topics from the curriculum.
Link: https://www.iiserpune.ac.in/engage/outreach-and-training/science-activity-centre

Sunday Online Session Series
A Sunday live talk and demonstration series with topics from classes V to XII syllabus was initiated by the Science Activity Centre during the COVID-19 pandemic. This series has been continued beyond the pandemic. These live sessions have already completed 12 episodes in this academic year and received more than 90,000 views.
Link: https://youtube.com/playlist?list=PLNsl4FmzN-wka0IRUQsWfOm27IcRqYKMg

Interactive workshop with students during their visit to IISER Pune

Wednesday School Visits
During Wednesday school visits, students are given a presentation on IISER Pune informing them of the ongoing research work, lab facilities, admission procedures, and more. Students are shown the science activity centre's hands-on science and math activities, STEM tinkering-related models, puzzles, exercises, etc. Students are given a campus tour at the end of the

workshop, and they also visit research laboratories. Between April 1, 2022 to March 31, 2023, around 15,145 students and teachers from more than 105 schools, colleges, and institutes will have benefited.

Glimpses of activities conducted for school students

Activities with IISER Pune Student Clubs

IISER Pune has various clubs that are run by students groups. In collaboration with these clubs, the SAC has conducted outreach activities with schools and college students by arranging various lectures, demonstrations, and science model making competitions. During this academic year, over 650 students and 61 teachers have benefited from these activities.

Eminent visitors to SAC

Many eminent personalities visited the Science Activity Centre during this year.

Prof. Dilip Malkhede (Vice-Chancellor of Amravati University), Mr. Rajiv Vartak (Science communicator and head of Adhyayan Santha), Mr. M. Prakash (well-known mathematician), Mr. Vikas Garad (Deputy Director of SCERT Maharashtra), Prof. Prem Agarwal (IIT Kharagpur), Prof. Madhav Gadgil (well-known ecologist and Padma Bhushan awardee), Mr. Rakesh Ranjan (Secretary Ministry of Education Government of India), Mr. Arvind Gupta (well-known science communicator and Padma Shri awardee), Prof. Santosh Gharpure (IIT Bombay), Mr. Vikas Rastogi (Principal Secretary of Government of Maharashtra), Ms. Marja Einig (Deputy Consul General Germany), Prof. R. Ramanujam (former faculty member of IMSc Chennai), Prof. Gareth Edwards (University of East Anglia, U.K.), Mr. Vikrant Gandhe (Company Secretary and CSR Head, TATA Technologies), Ms. Ardhra Nair (Times of the India), Mr. Vipin Sondhi (Confederation of Indian Industry, New Delhi), Dr. Vinay Natu (former MLA of Guhagar), Dr. A.D. Karve (Scientist and founder of Appropriate Rural Technology Institute), Prof. Margreet Zwarteveen from Netherlands (adviser of Living Waters Museum), Dr. Francais Leucier (CNRS France), Prof. Catherine Montgomery, and Prof. Catherine Reading (Durham Centre for Academic Development - Durham University), Prof. Helen Mason(University of Cambridge), Dr. Anil Sadgopal (Indian educationist).

Celebration of National Events

Teacher's Day: Every year on September 5, we appreciate teachers' work and celebrate and honor them for their special contributions to the teaching and learning process. The Science Activity Centre organised a special online talk by the well-known science communicator and Padma Shri awardee, Mr. Arvind Gupta. Over 10,200 viewers have viewed this online session so far.

Link: https://www.youtube.com/live/XUQXRxNJbT4?feature=share

Children's Day: Celebrated every year on November 14, this special day is dedicated to the joys of childhood and the unique qualities that make children special. On the occasion of this day, the Science Activity Centre organised an online lecture and demonstration on the topic “Solving the puzzle of photosynthesis” by Dr. Neeraja Dashaputre and Dr. Asim Auti from IISER Pune. Over

6500 have viewed this online session so far.
Link: https://www.youtube.com/live/BktbHI98pdY?feature=share

National Science Day is celebrated in India every year on February 28 to commemorate the discovery of the Raman Effect by Sir C.V. Raman. It is a day to promote scientific temper and create awareness about the importance of science in our daily lives. IISER Pune's Science Day celebrations included events and activities all through the day including talks, demos, and exhibits. Around 4500 students, educators attended the event.

International Women's Day (March 8) was celebrated on March 16, 2023 by the Science Activity Centre. Through this programme, 110 girl students interacted with IISER Pune scientists who spoke about women's achievements, challenges, and inspiring examples.

IISER Pune faculty members celebrated Women's Day with school students

CURRENT PROJECTS

STEM Ready - Project Activity
STEM Ready is a 3-year STEM Tinkering Project funded by Tata Technologies under its CSR Initiative. As part of the project, a STEM Tinkering Experience Centre was set up on IISER Pune campus. The centre has many experiments that can be created with readily available low-cost materials for a wider reach. Participating teachers and students will be able to explore these activities in this dedicated STEM Tinkering space. Under this project, workshops are being conducted with students and teachers to explore STEM tinkering activities related to the school curriculum.

A series of 5-day workshops that started on 9th January 2023 has teachers visit IISER Pune one day per week in two batches. These workshops were targeted at Government and Government-aided schools. Teachers worked on distinctive ideas such as electronics prototyping, controlling motors and LEDs, setting up small ecosystems for observation, soil-less farming and using mathematical puzzles to explain concepts. These concepts were correlated with the school curriculum and presented as STEM challenges that can be explored with the students in their classrooms.

Selected teachers from these workshops will be offered a seed grant under the project to set up mini-tinkering labs in their respective schools.
Link: https://sites.google.com/acads.iiserpune.ac.in/stemready/home

At the inauguration of STEM Tinkering Experience Centre on March 27, 2023

STEM Workshop – Vigyaan for promoting STEM Education

This programme is in association with TATA Consulting Engineers Limited (TCE). Seven 3-day workshops were conducted for 216 in-service school teachers from 168 schools. The workshops were conducted in-person at 7 different locations of TCE offices - Pune, Airoli, Bangalore, Surat, Kolkata, Jamshedpur and Noida. The focus was on improving the quality of STEM education and enhancing creative and effective STEM learning resources for classroom teaching. As a part of the project each participating school also received a STEM learning box.

Teacher's workshop at Kolkata under the TCE's STEM workshop project

Considering the baseline survey for the participants, a STEM learning resources were designed for schools in collaboration with the participating teachers. As a part of long term engagement process, these participating teachers conducted workshops for their fellow teachers and students in their respective schools. Also, the participation of the TCE volunteers in this project played a vital role in supporting teachers at the respective locations after the workshop.

Thus, this workshop covers all recommended areas of NEP 2020 and aims at the holistic development of teachers participating in this orientation programme.

Through the above events, the Science Activity Centre reached out to a total of 1,47,511 teachers, students, parents, and science enthusiasts during 2022-23.

SCIENCE MEDIA CENTRE

The Science Media Centre at IISER Pune is actively involved in science communication activities with the aim of sharing science through innovative strategies.

During 2022-23, the SMC was involved in the following activities:

Science Communication Workshops and Internships

- A total 6 workshops were conducted on topics ranging from visual designs, art and animations for science communication, 3D Illustrations, videography, editing, mobile film-making and science writing for BS-MS and PhD students.
- These workshops aimed at having a work-integrated learning approach and were outcome based. Students made their own scientific illustrations, designs and short films by the end of each workshop.
- Around 100 students attended these workshops and 6 of them are working at SMC as part of the ongoing science communication projects.

A one day workshop was organised by SMC for 5th-6th graders from ZP Ghore Budruk School in Pune. During this workshop, while the SMC team exposed them to storytelling through different media, the SAC team introduced them to toy-based learning of science. By evening, each group presented their chosen science concepts through radio and TV shows, drawings, songs and articles.

Original Productions

The film "Trials and Triumphs of GN Ramachandran" produced by SMC won the best of festival award at the 6th International Science Film Festival of India. The resources collected during the film production have now been organised into a digital museum on GN Ramachandran for people to engage with as per their interests and academic levels.

Launch of Digital Museum on G N Ramachandran

On the occasion of the 2023 National Science Day, the SMC launched a digital museum on the life and works of eminent scientist G N Ramachandran. The event included screening of a documentary on GNR, tour of the digital museum, and a panel discussion on ‘Lessons from GNR and the history of structural biology in India’.

Link: https://youtu.be/I1Ocg2LcSYk
National Science Day event link: https://youtu.be/GT78wn-wcmk
Digital museum: gnramachandran.org

Supporting Outreach Activities

- Video documentation for ongoing Science Education outreach programmes in IISER Pune including the Science Activity Centre, iRISE and MS-DEED
- 8 videos have been released this year, 6 are under production with many more to come

MOOC Courses

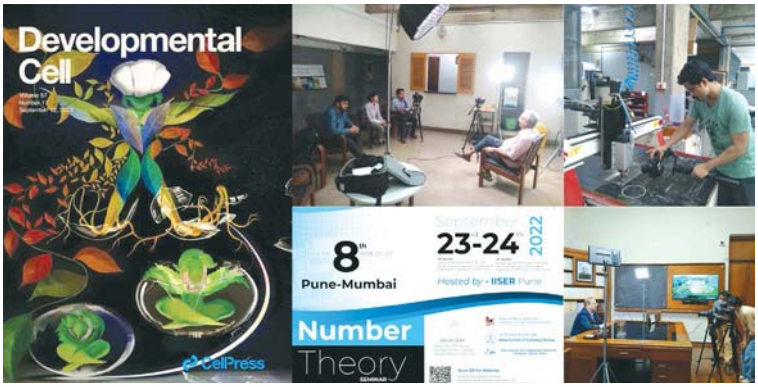
- SMC has produced 25 courses till now for the National Program on Technology Enhanced Learning (NPTEL).
- 3 courses are currently going on: Technology Forecasting for strategic decision making by Bala Ramadurai, IIT Madras
- Evolution of the Earth and Life by Devapriya Chattopadhyay, IISER Pune
- Introduction to Human Physiology by Nishikant Subhedar, IISER Pune

Grants Received and Funded Projects

- British Council Global Partnership Grant to co-develop inclusive science communication courses along with UWE, Bristol, Nature, the Association of British Science Writers and the Science Journalist Association of India (GBP 40000)
- Developing videos for institutes like Raman Research Institute, S & T Digital, National Research Development Organization and others.

Facilitation of Institute Activities

- SMC has documented over 70 events through photography, videography and live broadcasting
- Covering events for organisations like AIC SEED, I-Hub Quantum Technology Foundation
- Over 20 artworks including posters, cover art for journals, brochures
- Supporting faculty members for making video content for publicising their research.
- Script and article writing for these videos



MS-DEED Project

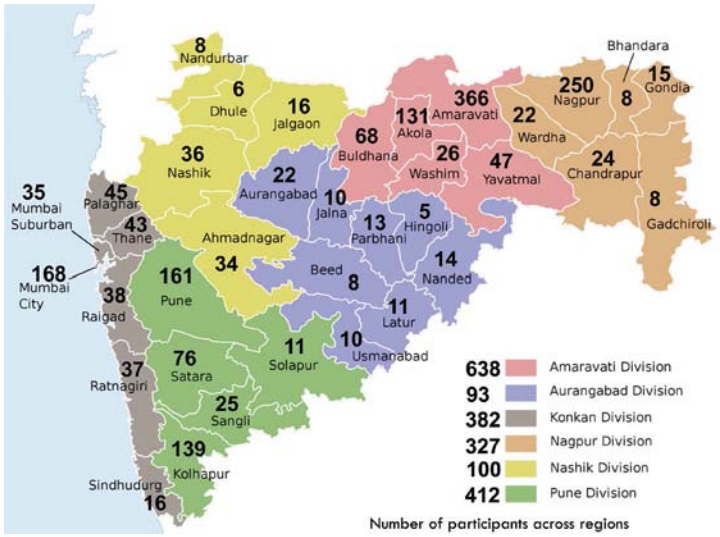
The Maharashtra State Development of Educators and Enhancement in Delivery (MS-DEED) Programme is a close collaboration between IISER Pune and the Maharashtra State Faculty Development Academy (MSFDA) - Centre for Multi-disciplinary Curriculum & Pedagogy under the Department of Higher and Technical Education, Government of Maharashtra.

The programme aims to engage in developing the professional capacity of in-service UG/PG teachers from various government and government-aided universities and colleges across all districts of Maharashtra. The training programme is aligned with NEP 2020. The focus is on integrating classrooms and labs with scientific teaching, active-inquiry-based learning and 'low threshold high ceiling' approaches with emphasis on teaching strategies by and for teachers.

IISER Pune started the MS-DEED programme in December 2021 and has conducted several online and in-person workshops. Several of the IISER faculty members have been contributing to the programme as trainers. The implementation has two main components: (1) Online or In-person short workshop/ Level-1; and (2) In-person intensive training/Level-2 (classroom and lab)

Through the programme, 13 Level-1 workshops were conducted during April 2022 to March 2023. The workshops are predominantly for science and mathematics teachers, out of which 3 were conducted in an online mode, and 10 were conducted in an in-person manner. One short workshop was also carried out for humanities and social sciences teachers, while other workshops had participation from these faculties.

Designed for select participants from the Level-1 workshops, the Level-2 workshops consist of sessions about innovative teaching-learning methods as well as the 'training the trainer' (ToT) module to develop a pool of Master Trainers that would engage nodal centers and train fellow teachers in regional workshops. During 2022-23, three Level-2 workshops were conducted.



Between December 2021 to March 2023, MS-DEED programme has reached 2500+ teachers across 36 districts of Maharashtra. Teacher participants joined from across 350+ colleges across all the 36 districts of the state of Maharashtra.

iRISE Project

Inspiring India in Research Innovation and STEM Education (iRISE) is a three-year collaborative programme between the Department of Science & Technology (DST), IISER Pune, the British Council, the Royal Society of Chemistry, and Tata Technologies. The programme started in October 2021 with four strands: Teachers Development Strand, Early Career Researcher, Thought Leadership Forum and CxO Forum.

The Teachers' Development Strand aims to build a range of skills and competencies at the grassroots level by engaging with teachers and thereby students and introducing experiential learning in the school classrooms, incorporating many of the crucial guidelines from the National Education Policy 2020. The programme also aims at creating new curricula and teaching techniques.

As part of this, the iRISE team developed a resource package which consists of lesson plans, teaching strategies, videos, digital repository, and activities mapped as per syllabus. They also developed a low-cost innovative STEM education kits for teachers with material for 30 inquiry based learning activities.

During 2022-23, the Teachers' Development Strand has seen significant progress in its Phase I and Phase II programmes, with 1213 teachers trained in 12 batches at the regional level and 314 master teachers (Innovation Champions) developed in four batches of Phase II. The programme has also trained over 3000 cascade teachers (Innovation Coaches) in 53 district-level workshops across Maharashtra and Bihar, impacting over 1 lakh students through teachers.

The development workshop focused on three major areas: STEM pedagogical content knowledge, innovation, and training of trainers. The training was conducted for 100 hours and included more than 15 strategies, eight inquiry sessions, and two subject-specific integrated subjects. The development workshop was designed to be engaging and varied, including hands-on activities, games, stories, puzzles, presentations, videos, yoga, sky gazing, science education, arts in science integration, dinner interactions with IISER scientists, tasks, and assignments. In addition, the curricular and co-curricular digital repository was shared with teachers to provide more lesson plans.

During the training period, the programme introduced a new segment called the 7i model of Innovation to help teachers understand the steps involved in ideation that led to innovation. This approach helps teachers develop their own innovative solutions to common problems and encourages them to think critically and creatively.

Through the Early Career Researcher Strand, iRISE team has conducted capacity building workshops for PhD students. The purpose is to build competencies around themes like

leadership and collaboration, science communication, teaching and mentoring of STEM PhD scholars in Indian Universities. During 2022-23 period, the team conducted 7 such workshops in partnership with host institutions including IISER Pune, CSIR-NCL Pune, IIT Gandhinagar, and CSIR-CIMAP, Lucknow.

SOCIAL OUTREACH

Social outreach activities are conducted by voluntary organisations at the institute run primarly by the IISER Pune student community in association with faculty coordinators and volunteers.

Disha is a student run social outreach organisation at IISER Pune. It is a platform for IISER Pune students to work towards the goal of socioeconomic equity. Disha works for making education accessible for children from underprivileged and marginalised communities from nearby localities.

Prutha, a green initiative by IISER Pune students, which works to create awareness about issues related to the environment and to promote a clean campus. The group is involved in organising nature walks, clothes donation drives, and activities around management of waste.

Information on these student-led social outreach activities, along with several other initiatives by the student community, is given in the *Student-led Activities* chapter of this report.

STUDENT-LED ACTIVITIES

The large range of community activities on campus at IISER Pune are directed and driven by our energetic students. These activities engage not only the student community, but also staff, faculty and community members alike, and span the range of art to quizzing to astronomy.

The clubs that conducted activities in the year 2022-23 include Aroha, Art, Astro, Bookworms, Dance, Disha, Drama, Hindi, iPlug, Kaleidoscope, Kalpa, Karavaan, Literary, Marathi, Maths, Mimamsa, Photography, Prutha, Quiz, Satrangi, Science, SPICMACAY, Sports, TEDxIISER Pune, and Yoga clubs. Some of these activities are described below.

ACTIVITIES CONDUCTED THROUGH STUDENT CLUBS

Navarasa, the dance club of IISER Pune brings together the community through vibrant performances for Republic Day, Mimamsa, Karavaan, and many more such events. Through these activities, Navarasa has persevered to build a strong dance community, one that is anticipated to grow over the coming years.

Activities during the year:

- Navarasa Showcase, a 30 min ensemble during the annual student fest Karavaan
- Nupura inter-college dance competition during Karavaan
- Performances for the group dance, synchro, and dance battle events during Inter-IISER Cultural Meet (IICM)
- Spotlight, an open dance floor event
- Tango, Bharathnatyam, and Kathak classes for faculty family members and IISER students

The **Quiz Club**'s main mission is to preserve and share the hobby of quizzing within IISER Pune and with the rest of Pune.

Activities during the year:

- Monday Night Quizzes (MNQs) every Monday at 9 PM during the semester; Fresher's Quiz, the Erdős Quiz as part of Pi Day in collaboration with Maths Club; a leaderboard leading to Quizophrenia final
- Pauling's Memorial Quiz, a science-themed quiz for middle and high school children, as part of National Science Day. Over 100 school children attended this event.

- Informal quizzing sessions in common rooms and midnight MDP, via WhatsApp group, for our community in IISER Pune.
- Kairoi Open Quiz, as part of Karavaan
- General Quiz, as part of IICM hosted in IISER Pune

Aroha is the music club of IISER Pune

Activities during the year:

- Cultural programmes for Independence Day and Republic Day celebrations
- Open Mics as a platform for IISER community to showcase their musical talents
- Aroha Showcase for Karavaan '22: a 28-minute musical performance comprising 36 musicians from the student community incorporating a wide variety of genres including Hindustani, Carnatic, Rock and Pop Music.
- Managing the logistics and conducting musical events for the IICM held at IISER Pune
- Let's Talk Music (LTMs) sessions at introducing the audience to an expansive view of the facets of a particular aspect or type of music

Disha is an independent voluntary social organisation of IISER Pune students. Through its programmes, it is involved in the education of children who belong to socio-economically disadvantaged communities.

Activities during the year:

- All programmes returned to offline during 2022-23
- Spread the Smile programme held in 3 villages Nimgaon, Wafegaon, and Bhawadi with sessions on astronomy, holograms, the solar system and eclipses, microscopes, DNA extraction using household materials, menstrual health, and vaccinations
- Abhyasika volunteers teach students from socio-economically disadvantaged backgrounds living in Lamanvasti. Volunteers spend about an hour about three times a week teaching children

The **Yoga Club** promotes a stress-free ambiance in the campus and organises workshops and talks to with the aim of enabling a joyous learning experience of Yoga.

Activities during the year:

- Events as part of the International Day of Yoga (IDY 2022): 15 day Yoga Workshop, freestyle writing competition, poem writing competition, Yotsi - Asanas Competition, Conquistar Quiz competition, a Samarpan meditation session centered around the theme of 'Mind Detoxification through Meditation'
- One month of regular Yoga sessions sponsored by the institute followed by Vippassana meditation session

Aakashganga, the IISER Pune Astro Club, caters to the astronomy and astrophysics enthusiasts and amateur astronomers at IISER Pune fostering a greater interest and understanding of the wonders of the universe.

Activities during the year:

- Viewing session for the partial solar eclipse
- Overnight sky gazing event called "Path of Stars," and the observation of Comet C/2022 E3 (ZTF) through electronic telescopes
- On National Science Day, the club showcased sunspots and explained their formation.
- Educational session on LIGO India, explaining its working principles through demonstrations and posters for school children
- Talks on topics like astrophotography, solar science, cosmology, and astronomy throughout the year.

The **Science Club** organises events around the latest topics in science, life of scientists, and careers in science. During 2022-23, the club members conducted Alumni talk series, and organised talks by scientists and Nobel Evening talks.

The **Maths Club** aims to promote a deep regard for mathematics through various fun-filled activities.

Activities during the year:

- Integration Bee held in August 2022, with over 50 participants battling for the crown of ‘Grand Integrator’.
- Stalls during events such as National Science Day and Fossil Day, where simple demonstrations and games were used to exhibit elegant and profound ideas in mathematics.
- 'Let’s Talk Math' is a newly introduced event this year, intending to promote engaging discussions on topics ranging from discrete mathematics to geometry to algebra
- 'Merch design contest' was held twice this year, and the winning designs were printed on t-shirts and sold
- On the occasion of National Mathematics Day, the birthday of Srinivasa Ramanujan, talks and competitions commemorating his life and works were held.
- Sudoku competition, held in the last week of December 2022, was extremely well received, with over 150 participants comprising students, faculty and administrative staff participating enthusiastically in the competition, culminating in 18 winners!
- Pi Day included outreach activities for school students, insightful talks by distinguished mathematicians, panel discussion, juggling performance, treasure hunt and many more events.

The **IISER Pune Linux Users Group** (IPLUG) was established with the goal of introducing people to the world of free and open-source softwares.

Activities during the year:

- Conducted weekly teaching sessions to help students level up their tech skills. Sessions from basics of Python to machine learning, from introducing LaTeX to ethically hacking a Windows XP system, introducing Git, MATLAB, and so much more, we received an excellent response from the students for all the sessions.

SPIC MACAY IISER Pune The Society for the Promotion of Indian Classical Music And Culture Amongst Youth (SPIC MACAY) completing 10 years at IISER Pune is committed bringing the best of Indian classical music, dance, and art to the campus. With a significant student engagement, this organisation started in 1977 by Dr. Kiran Seth (IIT Delhi) has created opportunities for students to engage with artists across the country.

Activities during the year:

- Returning from the break due to the pandemic, SPIC MACAY began its return with Hindustani vocal recital by Pandit Raghunandan Panshikar in April 2022.
- Special Monsoon Melody recital by Pandit Partho Sarothy (Sarod) and Paul Livingstone (Sitar), both disciples of Pandit Ravi Shankar
- Parijaat, our unique overnight concert series, hosted extraordinary musicians from across the country: Vid. Dr. S. Sowmya (Carnatic vocal), Vid. A. Kanyakumari (Padma Shri) (Carnatic violin), Debopriya and Suchismita Chatterjee (Bansuri), Sanjeev and Ashwani Shankar (Shehnai) and Manjiri Asanare-Kelkar (Hindustani vocal).
- Hosted AMEERAS as part of the first Pune Kabir Festival, that brought the thoughtful insight of Kabir to the campus. Together, these events made for a wonderful year of music for all on campus.

Prutha is IISER Pune's environmental club that works towards making life off and on campus more sustainable.

Activities during the year:

- Launched IISER Pune Marketplace to promote reusability where people can sell their old stuff to people who can use them.
- Repairment drives and old clothes and book collection drives.
- Talk series to promote Urban Farming in collaboration with Dr. Amrita Hazra: talks by Mr. Samir Bordoloi; one-day workshop on Sustainable Food Systems in Urban Spaces
- Talk by Dr. Meenakshi Bharath on reusable menstrual products
- Campus tree walk
- Birdwatching trip to Bhigwan Wildlife Sanctuary

Sports Club coordinates the Sports activities on the campus.

Activities during the year:

- IISER Basketball League, Tennis League, Football League, Volleyball League, and cricket through the IISER Premiere League through the month of April 2022
- Competitions as part of the 2022 Fit India Movement (September 15-16, 2022) and a 5k “Run for Unity and Vigilance" (October 31, 2022)
- Initiated Kreedajung 2023 in January 2023, an Intra-IISER Pune Sports fest
- A large team of players from IISER Pune participated at the 9th Inter-IISER Sports Meet (IISM) hosted by IISER Bhopal during December 21-26, 2022. The IISER Pune contingent secured 2nd position overall.

Mimamsa Science Quiz

Mimamsa 2022 Mains, April 23-24, 2022; Mimamsa 2023 Mains, April 6-9, 2023

Mimamsa is a national-level annual science challenge at the undergraduate level organised by the students of IISER Pune. The partnership with Praj Industries Ltd, since the 2020 edition, has helped to scale up Mimamsa and it is now one of the nation's premier science competitions.

Mimamsa 2022 had embraced a hybrid format, combining online preliminaries held on an examination portal. The 2022 edition saw the participation of more than 4000 students from 300 colleges across the country. Amongst 950 teams that appeared for prelims, four teams got shortlisted for the final round: IISc Bengaluru, IISER Kolkata, IIT Madras, and IIT Roorkee. The highlight of this year was that 42% of the participants were girls with more than 200 All-Girls teams. IIT Madras won the 2022 edition held in April 2022.

Mimamsa 2023 followed a comparable similar format, ensuring inclusiveness for participants from all over the country. The 2023 edition saw the participation of 1384 teams represented by more than 4800 students from around 450 colleges across the country. The highlight of this year was the participation of the 332 all girls team, with a rise of 66% as compared to last year. Four teams that made it to finals included IISc Bengaluru, IIT Bombay, IIT Delhi, and IIT Madras. Team IISc Bengaluru emerged as the winners of the Mimamsa 2023.

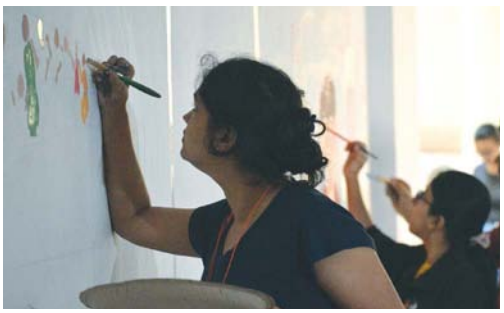
Inter-IISER Cultural Meet 2022

December 28-30, 2022

In December 2022, IISER Pune had the privilege of hosting the third edition of the Inter IISER Cultural Meet (IICM) for all sister institutions, including CEBS Mumbai, IISc Bengaluru, NISER Bhubaneswar, and all the IISERs. This edition of the IICM witnessed participation from all ten institutions, with a record-breaking number of over 650 participants competing in 19

competitive events. The IICM endeavour highlights the cultural dimensions in the lives of young academicians across these STEM institutions.

Organising the IICM after a two-year hiatus and amidst a student body predominantly accustomed to online campus life posed numerous challenges. A dedicated team of senior students spearheaded the initiative, collaborating closely with the IISER Pune clubs, undertaking tasks ranging from formulating event rules, arranging hospitality accommodations, and managing logistics.



In this edition of the IICM, the hosts introduced the concept of conducting non-competitive events that fostered knowledge sharing and collaboration across and within institutions, aiming to make more meaningful artistic and cultural contributions to society. This idea was warmly embraced by the participants, leading to the inclusion of events that highlighted various socio-cultural aspects.

Each year, the host institution introduces new events to the cultural meet. This time, IISER Pune presented five new additions: Mehfil, a classical concert; wall painting; Editor's Spree; Dance Battle Championship; and stand-up comedy. Aligning with the organisers' vision, the logo design and wall painting events focused on exploring sustainable cultural values. Over a period of 3 days, students participated in dance and music performances and drama and literary competitions. A fashion show by students and performance by Pineapple Express, a popular band known for its playful covers of Hindi songs, were the other highlights.

IISER Kolkata claimed the overall trophy with the highest score, IISER Thiruvananthapuram secured the runner-up position by a narrow margin. The competition was fierce, yet everyone demonstrated great sportsmanship and celebrated genuine talent and efforts.

Karavaan Annual Festival
November 4-6, 2022

Karavaan is the annual festival that celebrates the scientific, social, and cultural diversity of IISER Pune. Karavaan 2022 was eagerly awaited after a prolonged hiatus due to the pandemic and successfully brought the campus community together, fostering unity, creativity, and joy. The festival kicked off with Halloween night called "Whispers," setting the stage for a series of remarkable performances by renowned artists like SABALI: The Band, Joel D' Souza, MR Jammer, IQQANVE who added their unique flair to the festivities.

Over the course of three months, the various clubs on campus dedicated themselves to showcasing their flagship events for Karavaan 2022. Students showcased their talents through events such as Open Cube challenge, Freshers 2022, Crime Scene Investigation, Antakshari, Street Play, Art Bazaar, Painting Competition, and Showcase.

Karavaan 2022 also encompassed impactful social and outreach events aimed at promoting inclusivity, awareness, and environmental stewardship within the community. Events addressing matters such as human-animal conflict and mental health were conducted.

Collaborating with the Jeevitnadi Foundation, the Karavaan team organised a river cleaning drive and conducted science outreach activities for school students.

IISER Pune's second Pride Parade was held during Karavaan 2022 to raise awareness about HIV/AIDS and advocate for the rights of the LGBTQ+ community in Pune.

Karavaan presents a great opportunity for students to enhance their communication skills and expand their networks beyond the confines of IISER Pune. Through collaboration and active participation, students explore new avenues and discover innovative ways to make a positive impact in their communities.

Support Structure

SUPPORT STRUCTURE AND FACILITIES

ISER Pune has set up institutional policies and procedures to facilitate smooth functioning of the institute and to coordinate activities on the campus.

Matters related to general administration, finance, human resource management, IT requirements, procurement of equipment and consumables, civil, electrical and other engineering infrastructure are all handled by qualified staff members in consultation with institutional committees. The institutional committees are comprised of teaching and non-teaching staff members with a dual purpose: to oversee all support systems and to develop and implement plans to support future needs of the institute.

The **Administration** section takes care of recruitment to regular positions and of personnel under various research projects; maintains personal records, service books, and Annual Performance Appraisal Reports; and facilitates security, housekeeping, and transport services.

The **Finance and Accounts** section handles preparation of budget estimates, monitoring of expenses under various account heads, internal audit of payments and disbursements, preparation of the Annual Accounts, and interaction with the audit team of CAG (Comptroller and Auditor General of India).

The **Purchase** section of the institute looks after the indigenous and import procurement required for the entire institute. The purchase section finalises the service contracts and maintenance contracts. The procurement process is managed through the Government eMarket (GeM) and Central Public Procurement Portal (CPPP).

The offices of the Dean Graduate Studies and Dean Doctoral Studies constitute the **Academic** section that handles all aspects pertaining to the student admission process, timetable and classroom requirements, conducting of exams, and maintaining of student records.

The campus is connected through a dedicated internet leased line of 10 Gbps National Knowledge Network and a 1 Gbps BSNL line for uninterrupted internet access. The institute has a centrally managed indoor and outdoor dual band campus wide Wi-Fi access network along with IT security perimeter protection. The **Information Technology (IT)** section manages setting up, upgradation and operations of these facilities along with hosting critical infrastructure services such as IT security, email, website, DNS, Eduroam, iisERP, computer laboratories, virtual reality laboratory, dining management system, facial recognition based attendance system, and recruitment as well as admissions software. The team also manages institute machines, local area network, voice over internet phones (VoIP), audio-video equipment during on campus events, supports the IT related operations of campus facilities such as the auditorium, convention centre, classrooms, seminar halls, lecture halls and e-classrooms.

During the year, the IT section successfully steered the operations and provided scientific applications support of the National Supercomputing Mission funded PARAM Brahma

supercomputing facility of peak computing power 1.7 PF at the Institute on a 24x7 basis with 99.99% uptime, which is oversubscribed at any point in time. This has helped many researchers of the institute as well as other institutes to successfully carry out their compute-intensive research in the areas of High Performance computing, Artificial Intelligence, Deep Learning, Machine Learning, and Big Data from a location of their choice. IT section has facilitated procurement (installation to commence soon) of a state of the art Artificial Intelligence facility of 1 PF along with 3 PB storage, especially for applications related to Data Science, AI, ML etc. Additionally, the IT team provides system as well as application level support for the high performance computing clusters and parallel file system based storage hosted in multiple data centres aggregating 450 TF and 1 PB for various scientific and research applications in the areas of computational biology, particle physics, astrophysics, computation chemistry, materials modelling, molecular dynamics, nanoparticles, cryptography, seismology, climate science, etc.

The IISER Pune campus has world-class infrastructure for teaching, research, housing and recreational facilities for students and employees. IISER Pune campus is GRIHA 4 star rated green and energy efficient campus. The physical infrastructure consists of Main Laboratory Building, Lecture Hall Complex, Animal House Facility, Guest House-cum-Convention Centre, students' hostels with central dining facility and on-campus housing for employees. Further common amenities include outdoor sports facilities, an indoor sports complex, shopping facility, daycare, wellness clinic and pharmacy. The **Engineering** section handles all construction activities on the campus along with maintenance and upkeep.

Working at the interface of research and administration, the **Research Administration and Development Integration Office (RADIO)** is envisaged to further the research progress of IISER Pune through support in the following areas: garnering research funding; forging national and international partnerships; bringing in endowments; engagement through research communications via print and online media including annual report, institute website and social media portals; and actively engaging with various stakeholders in government and private bodies, alumni, and members of the public.

Srinivasa Ramanujan Library is an integral part of academic and research work on campus. It supports the teaching, learning, research, and other scholarly activities of the institute with over 30000 print documents, 4000 online journals, 5 online databases, over 6000 e-books and 2000 theses and dissertations in its collection. Library facilitates access to electronic, print, and multimedia resources and provides essential online information and research support services. Library has added 1007 purchased books and 387 gratis books to its collection during 2022-23. A large part of the journals and online resources' subscription is through e-ShodhSindhu – a national consortium for higher education e-resources formed by the Ministry of Education (MoE), Govt. of India, and 'IISER Library Consortium'. Library services are completely automated with all the required software tools and the circulation kiosk is integrated with RFID technology and a biometric user authentication system.

The library provides various research support services such as Faculty Research Profiles, Assistance to Open Access Publishing, Bibliometrics and Scientometrics Analysis, Plagiarism Checking Service, Current Awareness Service, Document Delivery Service, Inter Library Loan, Author Workshops, Orientation, Training, and Digital Literacy Programmes. The library also provides access to various essential research tools such as Web of Science, Scifinder Scholar, MathScinet, Derwent Innovation, Grammarly, Turnitin, Cambridge Structural Database, and ChemDraw. The Library has been actively engaged in designing and delivering need-based information services. During the COVID-19 pandemic, library continued to stay connected with the user community and support their academics by providing off-campus access to e-resources through 'Remote Access Portal'.

Digital Repository (DR) (http://dr.iiserpune.ac.in:8080/xmlui/) has been set up to preserve and provide instant access to the scholarly output of IISER Pune faculty, students, staff, and others associated with the institute. It serves as a platform for the IISER Pune community to share their research work with the wider community. Metadata of the PhD records available in the repository is also integrated with the National Digital Library of India. Library also deposits full-texts of PhD theses to Shodhganga national repository in addition to hosting them on DR. There are 2000 theses and dissertations, 5000 scholarly publications and over 500 other scholarly resources are available in DR. 200 full-text MS theses, 67 full-text PhD theses, metadata of 500 scholarly publications have been added to DR during the year.

Library enrolled as an institutional member of Jaykar Knowledge Resource Centre, Savitribai Phule Pune University to benefit our users with access to wider collections learning resources. Library has good number of braille books in its collection and also enrolled as an institutional member of Sugamya Pustakalaya, DAISY Forum of India, New Delhi to provide access to over 6 lacs audio books to people with print disabilities. The library has been actively promoting reference and information services both in person and over the campus network using the library website and institute email. The total number of documents issued to our users during the year was 16091. Library has been taking an active part in availing benefit of resource sharing with other major libraries throughout India through Inter Library Loan and Document Delivery Services. Library receives a number of requests from faculty and students for getting books and non-subscribed research papers from other libraries. To meet these requests, library has managed to get 288 publications and 6 books from other libraries and delivered 297 papers to other libraries in reciprocation.

Library has organised a display of 75 highly used books, treasure hunt, and open book quiz for users as part of the celebration of Azadi Ka Amrit Mahotsav and on the occasion of National Librarians' Day on August 12, 2022 to commemorate the birth anniversary of Padmashri Dr. S.R. Ranganathan – father of library science in India. Users have actively participated in the events and won prizes.

Library celebrated Azadi Ka Amrit Mahotsav and National Librarians' Day on August 12, 2022

Living on campus: Along with on-campus accommodation for students and employees, the IISER Pune campus houses a wellness clinic with a 24x7 ambulance service, a daycare facility, dining hall, gym, and indoor and outdoor sports facilities including basketball court and football and cricket fields. The campus is green with increasing tree cover each year. Student clubs such as *Disha, Prutha*, and SPICMACAY@IISER offer volunteering opportunities for engaging with the community within and beyond the campus through educational, cultural, and environment awareness programmes.

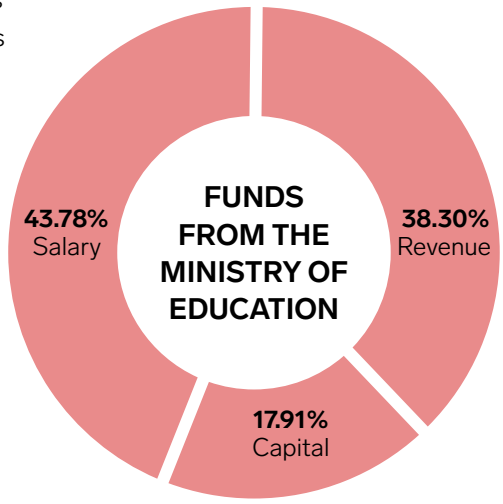
The infrastructure and facilities on the campus cater to 137 regular faculty members; 18 visiting, emeritus and guest faculty; 7 fellows and project scientists, 53 post-doctoral research associates; 134 non-teaching staff members; 1814 students (471 PhD, 189 Integrated PhD, 28 MSc, and 1126 BS-MS); and 116 research and management staff recruited through extramural projects. The numbers are as of March 31, 2023.

Accounts at a Glance

ACCOUNTS AT A GLANCE

The Annual Accounts of the Institute were approved by the Finance Committee and the Board of Governors during its meeting held on May 19, 2023. The annual audit for the Financial Year 2022-23 was carried out during June 7-27, 2023. The balance sheet and the income and expenditure statement for the Financial Year 2022-23 are given in the following pages.

Revenue ₹55.02 crores
Capital ₹25.73 crores
Salary ₹62.89 crores



FUNDS RECEIVED FROM THE MINISTRY OF EDUCATION

During the Financial Year 2022-23, IISER Pune received an amount of ₹143.64 crores from the Ministry of Education under the budget heads revenue, capital, and salary. The break-up across the three budget heads is as above.

CORPUS

The cumulative corpus fund as on March 31, 2023 from the Internal Revenue generated is ₹99.58 crores. The Institute generated an amount of ₹13.94 crores during the Financial Year 2022-23 from internal receipts.

EXTRAMURAL GRANTS

A number of research projects receive support from extramural grants through individual competitive research grants that faculty members have secured. During the Financial Year 2022-23, a total of ₹38.82 crores have been received by / assigned to the Institute via extramural grants. New grants initiated during the Financial Year 2022-23 are listed in the *Appendix* section of this report.

ENDOWMENTS

Some of the activities at IISER Pune are supported through endowments from corporate organisations. During the financial year 2022-23, ₹2.73 crores was received via endowments. Details are given in the *Partnerships and Endowments* chapter of this report.

BALANCE SHEET

as on March 31, 2023

Amount in ₹

Sources of Funds	Schedule	Current Year 2022-23	Previous Year 2021-22
Corpus/Capital Fund	1	710,22,27,165	691,55,68,605
Designated/Earmarked/Endowment Funds	2	38,32,01,453	37,94,34,902
Current Liabilities & Provisions	3	64,01,41,204	87,70,68,151
Secured Loans - HEFA Loan	3 D	12,43,57,909	5,96,44,670
Total		**824,99,27,730**	**823,17,16,328**

Application of Funds	Schedule	Current Year 2022-23	Previous Year 2021-22
Fixed Assets	4		
Tangible Assets		590,23,43,277	597,43,35,187
Intangible Assets		6,33,64,256	6,03,54,748
Capital Works-In-Progress		13,26,89,924	1,49,03,882
Investments From Earmarked / Endowment Funds	5		
Long Term		-	-
Short Term		35,69,78,446	34,78,65,190
Investments - Others	6	149,66,11,494	147,32,82,998
Current Assets	7	159,332,692	21,96,64,587
Loans, Advances & Deposits	8	13,86,07,636	14,13,09,732
Total		**824,99,27,730**	**823,17,16,328**
		1	**(0)**
Significant Accounting Policies	23		
Contingent Liabilities and Notes to Accounts	24		

For and on behalf of IISER Pune

sd/-	**sd/-**	**sd/-**
CA. Vasundhara Laad	**Col. G. Raja Sekhar (Retd.)**	**Prof. Sunil S. Bhagwat**
Jt. Registrar (F & A)	Registrar	Director

Place: Pune | **Date:** May 8, 2023

INCOME AND EXPENDITURE STATEMENT

For the year ended March 31, 2023

Amount in ₹

Particulars	Schedule	Current Year 2022-23	Previous Year 2021-22
INCOME			
Academic Receipts	9	10,36,01,182	8,36,71,320
Grants/Subsidies	10	120,81,78,000	115,62,55,823
Income from Investments	11	1,13,45,630	-
Interest Earned	12	-	-
Other Income	13	9,41,41,125	5,43,02,970
Prior Period Income	14	4,98,16,451	10,85,851
Total (A)		**146,70,82,388**	**129,53,15,964**
EXPENDITURE			
Staff Payments & Benefits *(Establishment Expenses)*	15	63,29,20,952	56,14,10,159
Academic Expenses	16	17,46,31,781	14,21,02,657
Administrative and General Expenses	17	31,67,69,759	23,72,13,221
Transportation Expenses	18	56,03,853	50,88,103
Repairs & Maintenance	19	12,36,99,445	10,97,20,874
Finance Costs	20	40,82,656	13,42,782
Depreciation	4	44,49,17,243	34,62,77,325
Other Expenses	21	5,23,446	8,96,62,509
Prior Period Expenses	22	20,53,798	11,95,129
Total (B)		**170,52,02,934**	**149,40,12,759**
Balance being excess of Income over Expenditure (A-B)		**(23,81,20,546)**	**(19,86,96,795)**
Transfer to Corpus Fund (9+11+13)		(20,90,87,938)	(13,79,74,290)
Transfer to Capital Fund (Depreciation)		44,49,17,243	34,62,77,325
Transfer to Capital Fund (Loss on Asset disposal)		(7,33,938)	-
Over Utilization of Grant in Aid for Revenue Exps (Schedule 3C)		-	-
Under Utilization of Grant in Aid for Revenue Exps (Schedule 3C)		-	-
Balance being surplus/deficit carried to Institute Corpus Fund		**(15,57,303)**	**96,06,240**
Significant Accounting Policies	23		
Contingent Liabilities and Notes to Accounts	24		

For and on behalf of IISER Pune

sd/-	**sd/-**	**sd/-**
CA. Vasundhara Laad	**Col. G. Raja Sekhar (Retd.)**	**Prof. Sunil S. Bhagwat**
Jt. Registrar (F & A)	Registrar	Director

Place: Pune | **Date:** May 8, 2023

Appendix

PUBLICATIONS IN 2022

The list has been generated from the information shared by institute members with our campus Library and, additionally, includes papers sourced from the Web of Science database with authors having IISER Pune as their primary affiliation. The names of authors with IISER Pune affiliation are in all-caps.

BIOLOGY

1. ANUJAN, KRISHNA; Ratnam, Jayashree; Sankaran, Mahesh, 2022, Chronic browsing by an introduced mammalian herbivore in a tropical island alters species composition and functional traits of forest understory plant communities. Biotropica, 54(5), 1248-1258.

2. KALE, TANVI; CHITNIS, SHIVAM S.; ATHALE, CHAITANYA A., 2022, Scaling of cell growth and macromolecules. Resonance, 27(3), 325-337.

3. KHATRI, DHRUV; Brugière, Thibault; ATHALE, CHAITANYA A.; Delattre, Marie, 2022, Evolutionary divergence of anaphase spindle mechanics in nematode embryos constrained by antagonistic pulling and viscous forces. Molecular Biology of the Cell, 33(6).

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CHEMISTRY

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BOOKS

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BOOK CHAPTERS

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CONFERENCE PAPERS

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INVITED LECTURES

At conferences/workshops and at colleges/universities/institutes/outreach

Nixon Abraham
Title: Multimodal olfaction, at Indian Institute of Technology (IIT) Madras, Chennai, July 22, 2022 • Title: Olfaction as a tool to study the brain in health and disease, at Indian Academy of Neuroscience Meeting on Neuroscience Research: Current Trends and Future Needs, December 8, 2022 • Title: Sense of smell in health and disease; at Firmenich, New York, U.S.A., January 19, 2023

Bijay Kumar Agarwalla
Title: Universal bounds on fluctuations in thermal machines and its connection to thermodynamic uncertainty relations, at the Department of Physics, Indian Institute of Technology (IIT) Bombay, April 2022 • Title: Understanding quantum transport in quasi-periodic lattice systems, at the conference on Trapped Atoms, Molecules and Ions (TAMIONs-2), International Centre for Theoretical Sciences (ICTS), Bengaluru, May 9-13, 2022 • Title: Universal bounds on fluctuations in continuous and discrete thermal machines, at the Department of Physics, Satyendra Nath Bose National Centre for Basic Sciences, November 2022 • Title: Anomalous transport at band edges, at the Physics Department of IIT Gandhinagar, February 2023 • Title: Non-equilibrium physics of quantum systems: Transport, fluctuations, and quantum devices, at the Raman Memorial Conference at the Department of Physics, Savitribai Phule Pune University, March 17-18, 2023

Sudarshan Ananth
Title: Teaching physics to undergraduates, at MS-DEED programme for college teachers, IISER Pune, May 24, 2022 • Title: Aspects of N=8 Supergravity, Plenary Lecture at the Max Planck Institute for Gravitational Physics, Potsdam, Germany (Hermann-fest), September 14, 2022 • Title: Careers in Science and Technology, at CST 2022, organised by S & T Digital, a start-up incubated at the Atal Incubation Centre (AIC-SEED), November 6, 2022

Amit Apte
Title: Data science: making sense of uncertainty, at Shree Santkrupa Institute of Engineering & Technology, Karad (online) April 2022 • Title: Machine learning methods in data assimilation, at Conference on PDE and numerical analysis, TIFR-CAM, Bengaluru (online) April 2022 • Title: Data literacy, Or how to teach students to read the newspaper, at MS-DEED Level 2 Programme, IISER Pune, May 2022 • Title: Statistical modelling of Indian monsoon rainfall, at Workshop on Prediction and Variability of Air-Sea Interactions: the South Asian Monsoon, ICERM Brown University (online) June 2022 • Title: Role of statistical reasoning in understanding climate, at Digital Pedagogy & Climate Change Education Workshop, IISER Pune, August 2022 • Title: Dynamical and statistical models of Indian monsoon rainfall, at Tipping Points in Complex Systems, ICTS-TIFR Bengaluru, September 2022 • Title: Data science: learning to live and love uncertainty, at Workshop on

Careers in Science and Technology, IISER Pune, November 2022 • Title: Stability of particle filters for chaotic, deterministic dynamical systems, at International Indian Statistical Association Annual Conference, IISc, Bengaluru, December 2022 • Title: Data assimilation for chaotic dynamics: stability and asymptotic behaviour, at Online Lecture Series in Nonlinear Dynamics, Bharathidasan University, February 2023

Debargha Banerjee
Title: Local Galois representations and cohomology, Colloquium at IIT Gandhinagar, April 4, 2022 • Title: Ramanujan congruences and its generalization, at IIT Tirupati, September 2, 2022 • Title: Some properties of modular curves, at IISER Tirupati; March 17, 2023

Arka Banerjee
Title: Cosmology with nonlinear structure formation: Simulations and Statistics, as Colloquium at IUCAA, Pune, May 15, 2022; at IISER Pune Physics Colloquium, Pune, August 22, 2022; at HRI Physics Colloquium, HRI, Prayagraj, September 20, 2022; and at Presidency University School of Astrophysics Colloquium, Kolkata, December 12, 2022 • Title: Nearest Neighbor distributions: a new approach to cosmological clustering: at Vipolze Berkeley Workshop on Large Scale Structure, Slovenia, July 22, 2022; at Advances in Astrophysics, Particles and Cosmology, SINP, Kolkata, January 27, 2023; and at Frontiers of Cosmology, RRI, Bengaluru

Rabeya Basu
Title: On K_1- Stabilization of Classical Groups, at IISER-NISER Math Meet (IINMM) 2022, June 2, 2022 • Title: Linear algebra and K-theory, at RKMVERI, Belur, West Bengal • Title: On the completion of unimodular rows and its applications in commutative algebra and classical K-theory, at Commutative Algebra Seminar, Purdue University, October 12, 2022

Mousomi Bhakta
Gave a one month course (32 hours of lectures) on differential equations in mathematical physics in the Summer School of Scuola Matematica Interuniversitaria (SMI), Perugia, Italy, July-August, 2022, at the Dept of Mathematics, Jadavpur University, January, 2023

Anup Biswas
Title: Ergodic Hamilton-Jacobi equation with fractional Laplacian, at Inter IISER-NISER Mathematics Meeting, IISER-Kolkata, May 31, 2022 • Title: Existence-Uniqueness results for nonlinear integro-differential equations, at Stochastic Control and its Applications, IISc Bengaluru, July 25, 2022

Gnanaprakasam Boopathy
Title: Exploring continuous-flow for the peroxidation and azidation reactions, at Contemporary Facets in Organic Synthesis-2022, IIT Roorkee, Roorkee, December 1-4, 2022 • Title: Acceptorless dehydrogenation catalysis for the heterocycles and macrocycles, at Syngenta Biosciences Private Limited, Goa, November 18, 2022 • Title: Continuous Flow Technology in organic synthesis and pharmaceutical applications, at national level one-day workshop on Hands-on training in Sustainable and Continuous Flow Synthesis, Dnyanprassarak Mandal College and Research Centre-Syngenta Biosciences Private Limited, Goa, April 23, 2022

Apratim Chatterji
Title: Organized by Entropy: Lessons from bacterial chromosomes, at the Dept. of Physics, Presidency University, Kolkata, July 25, 2022; Current Directions in Statistical Phys., JNCASR, Bengaluru, August 5, 2022 • Title: DNA-polymer topology orchestrates the segregation and spatial organization of bacterial chromosomes during replication, as Colloquium at the Dept of Physics, IISER Kolkata, July 27, 2022; J.C. Bose Institute, Div. of Molecular Medicine, Kolkata, August 3, 2022; at Physics department, Colloquium, IISER Pune, August 29, 2022; at EMBO workshop on Bacterial cell biophysics: DNA replication, growth, division, size and shape, Ein Gedi, Israel, December 12, 2022; at Symposium on Polymers in Physics and Biology, IIT Bombay, February 9, 2023

Devapriya Chattopadhyay
Title: Evolution of Oligo-Miocene Tethyan seaway and its impact on the marine molluscan biodiversity of western India, at Department of Earth Sciences, University of Cambridge, U.K., September 7, 2022 • Title: Looking back to see the future, at the Department of Geology, Savitribai Phule Pune University, Pune, October 11, 2022 • Title: Live, dead and the very dead: Tracing evolution in deep time, at Fossil day celebration at IISER Pune, October 15, 2022 • Title: What do the clams tell us? A molluscan perspective on Paleoecology, at Rhetor 3.0 symposium organised by the Biology Club of the IISER Thiruvananthapuram, November 18, 2022 • Title: The fascinating world of fossils: how do we know what we know?", at the Celebration of International Women's Day at IISER Pune; March 16, 2023

Srabanti Chaudhury
Title: Stochastic approaches to understand reaction dynamics on catalysts, at CRSI meeting, IISER Mohali, July 8, 2022 • Title: Theoretical investigations of the microscopic mechanisms of heterogeneity and catalytic communication within single nanocatalysts, at Interdisciplinary Initiative in Chemical Sciences (IICS), Agra, July 30, 2022 • Title: Dynamics of the protein search for targets on DNA in quorum-sensing cells, at DAE-BRNS Symposium on Current Trends in Theoretical Chemistry, Mumbai, October 23, 2022 • Title: Microscopic mechanisms of catalytic communication within single nanocatalysts, at Designing Catalysts on Computers, IACS, Kolkata, December 2, 2022 • Title: An insight into protein-DNA interactions using discrete state stochastic models, at Frontiers in Chemical Sciences - FICS, IIT Guwahati, December 4, 2022 • Title: A simple stochastic approach to probe reaction dynamics on individual nanocatalysts, at APATCC, Vietnam, February 21, 2023 • Title: Mechanism of protein search for targets on DNA: Discrete and continuum approaches, at Statistical Mechanics, Soft & Living Matter, IIT Bombay, March 10, 2023 • Title: Understanding the molecular mechanism and the role of heterogeneity in cooperative communications within single nanocatalysts, at (Chemistry) Meet 2023: Kindling in Kaziranga, March 18, 2023

Anisa Chorwadwala
Title: A glimpse of shape optimisation problems, as Colloquium at the Department of Mathematics, IIT (BHU), Varanasi, July 27, 2022 • Title: On the optimal shapes for the first Dirichlet eigenvalue of the laplacian and dihedral symmetry, as Colloquium at DST CIMS Banaras Hindu University (BHU), July 29, 2022 • Guest speaker at the Dr. APJ Abdul Kalam popular lecture series, an activity under GoI DBT-STAR status scheme organised by the NES Ratnam College, Bhandup, Mumbai, September 12, 2022 • Title: An application of SCP to the p-Laplacian, as Colloquium at the Departmento De Mathematica, Universidad de Concepcion, Chile, October 27, 2022 • Invited to give three lectures on "Calculus on variations" at the Refresher Course in Maths, Statistics and Computer Science organised by University of Lucknow, January 10-23, 2023 • Plenary speaker at the Hypatian Voices: A Gynocentric National Seminar on Mathematical Sciences University of North Bengal, March 16-17, 2023, jointly organised by IWM (Indian Women in Mathematics) and NBU (University of North Bengal)

Aloke Das
Session Chair, Low Dimensional Materials (LDM-2022), IISER Pune, May 19-20, 2022 • Session Chair, 18th Discussion Meeting on Spectroscopy and Dynamics of Molecules and Clusters (SDMC), Malpe, Karnataka, November 10-13, 2022 • Title: Sequence dependent folding motifs of the secondary structures of oligopeptides, at the Annual In-house Chemistry Symposium Chemsymphoria 2022, IISER Pune, December 22-24, 2022 • Title: Understanding folding motifs of peptides from solution, solid and gas phase studies, at the "Let there be Light", a discussion meeting in Spectroscopy and Microscopy, Khawasa, Madhya Pradesh, February 19-22, 2023

Shouvik Datta
Title: Tailoring quantum oscillations of excitonic Schrodingers Cats as qubits, at IISER Kolkata, November 16, 2022; and at Saha Institute of Nuclear Physics, Kolkata, December 20, 2022 • Title: Critical aspects of the basics in semiconductor physics, at the University Teachers Training Workshop at Savitribai Phule Pune University, Pune, February 10, 2023

Sutirth Dey

Title: What cost dispersal evolution? Lessons from the humble fruitfly, Bielefeld University, Faculty of Biology, Behaviour and Evolution seminar series (online) April 19, 2022; and at Hindu College, Delhi University, Evolutionis, National Meeting on Evolutionary Biology, March 17, 2023 • Title: Matter of size: How population size affects bacterial adaptation, at NCBS, Bengaluru (Online), November 21, 2022, SMBE Everywhere (Global Symposia): Genetics of Adaptation; and at Maharshi Dayanand University, Rohtak, International Conference on Microbial Technologies for Sustainable Biosphere, February 3-5, 2023

Deepak Dhar

Title: Geometrical phase transitions, at Institute Foundation Day lecture, IISER Pune, April 9, 2022; at Research Scholars' Days, IIT Madras, Chennai, April 18, 2022; at SP University of Pune, April 21, 2022; and at Frontiers in Physics Seminar, Fergusson College, Pune, May 12, 2022 • Title: Phase transition in hard rods, at XVth Madan Lal Mehta Memorial Lecture, Tata Institute of Fundamental Research, Mumbai, April 11, 2022 • Title: My random walk in statistical physics, at NSF Wednesday Colloquium, Tata Institute of Fundamental Research, Mumbai, April 13, 2022 • Title: The nematic to high-density disordered phase transition in a system of hard rods on a lattice, at IAMP One World seminar (webinar), April 23, 2022; on Boltzmann Day, at IMSc, June 28, 2022 • Title: States of matter, at Science Activity Center, IISER Pune, June 26, 2022 • Title: Phase transitions in spaces of non-integer dimensions: Fractals, at Pune Knowledge Cluster, May 28, 2022 • Title: The relationship of Mathematics to the real world, seminar for Maths Club, IISER Pune, August 10, 2022 • On the use of partial differential equations in Physics, at the workshop on Partial Differential Equations, at Center for Excellence in Theoretical and Computational Studies, Mumbai University, August 22, 2022 • Title: 200 years of studies of phase transitions, as Foundation Day Lecture, IISER Mohali, September 27, 2022 • Title: Phase transitions in a system of hard rods, at the Physics department, IIT Kanpur, November 2, 2022 • Title: Introductory remarks on careers in science and technology (Why I like being a scientist), as Inaugural talk in the meeting "Careers in Science and Technology 2022", at IISER Pune, November 5, 2022 • Title: Interacting hard rigid rods on a d-dimensional lattice, at the Annual General Meeting of INSA, National Institute of Oceanography, Vishakhapattanam, December 4, 2022 • Title: Multiple phase transitions in a system of hard core rotors on a lattice, as part of Chandrasekhar Memorial lectures, International Center for Theoretical Sciences, TIFR, Bengaluru, December 14-16, 2022 • Title: 200 years of studies of phase transitions, for NIUS students, Homi Bhabha Centre for Science Education, January 4, 2023 • Title: Hard rotors on a lattice, Web seminar, Rutgers University, January 11, 2023 • Title: River networks, for school students on National Science Day, IISER Pune, February 28, 2023 • Title: States of matter, as popular lecture on National science Day, High Energy Materials Research Laboratory, Defence Research and Development Organization, Pune, February 28, 2023 • Title: Modelling physical systems with cellular automata, Second Asian Symposium on Cellular Automata Technology 2023, Indian Institute of Engineering, Science and Technology, Shibpur, Howrah, March 3, 2023

Sourabh Dube

Title: Multidisciplinary curriculum at an institutional level, Faculty Induction Programme, MSFDA, Pune, May 2, 2022 • Title: Experimental methods for Physics at the LHC, as part of lecture series at the Vietnam School of Physics, Quy Nhon, Vietnam, July 24-August 5, 2022 • Title: Machine learning in particle physics, at Data Science Symposium at IISER Pune, August 17, 2022 • Title: Analogies, visualizations, and humor in the class, at MSDEED Level2 workshop, Pune, August 22 and December 24, 2022 • Title: Introduction to particle physics, at Te-Searchers Faculty Development Program, GH Raisoni College of Engineering, Nagpur, October 12, 2022 • Title: Detectors in high energy physics, at 1st National Workshop on GEANT4, IUCAA, Pune, December 12, 2022

Sreejith Ganesh Jaya

Title: Exact calculations of loop probabilities in a double dimer model, at Laboratory of theoretical physics, CNRS Toulouse, France, May 15, 2022 • Title: An exactly solvable problem motivated by variational states, as FQHE, Seminar, Laboratory of theoretical physics, CNRS Toulouse, France, May 27, 2022 • Title: Exact calculations of loop probabilities in a double dimer model, Penn State University, U.S.A., July 2022 • Title: Composite fermions: wave functions, numerical strategies, and some results on inverse problems, at Correlations in Topological Quantum Matter conference, Alto University, Lammi, Helsinki, Finland, October 2022 • Title: Real space entanglement spectra of parton states in fractional quantum Hall effect, at QMAT Conference, IIT Kanpur, October 2022 • Title: A quantum Monte Carlo study of the critical phase in the square lattice quantum dimer model, at Frustrated Metals and Insulators, ICTS Bengaluru, October 2022; and at Young Investigator Meet on Quantum Condensed Matter Physics, October 2022

Sujit K. Ghosh

At the following universities / institutes: Department of Chemistry, Savitribai Phule Pune University, Pune, August 6, 2022 • Centre for Water Research (CWR), IISER Pune, September 21, 2022 • Department of Chemistry, School of Advanced Sciences, Vellore Institute of Technology, Vellore, August 25, 2022 • Centre for Clean Environment (CCE), Vellore Institute of Technology, Vellore, August 26, 2022 • Nanjing University of Sciences and Technology, Nanjing, China, Webinar, November 9, 2022 • Institute of Chemical Technology, Mumbai, India, November 22-26, 2022 • Department of Chemistry, IISER Pune, Chemsymphoria 2022, December 24, 2022 • Water Innovation Centre (WICTRE) at IIT Bombay, India, December 1-2, 2022 • Department of Chemistry and Chemical Biology, IIT-ISM, Dhanbad, India (organised by Indian Chemical Society), December 16-18, 2022 • Convergence of Chemistry & Materials (CCM-2023), BITS Pilani, Hyderabad Campus, January 6-7, 2023 • 2nd International Conference on Nanomaterials and Sustainable Applications (NANO-SA-2023), Aurangabad, Maharashtra, India, Organised by Institute of Chemical Technology, Mumbai-Marathwada Campus, Jalna, January 10-11, 2023 • ChemSci2023: Leaders in the Field Symposium January 23-25, 2023, JNCASR Bengaluru • 30th CRSI National Symposium in Chemistry (CRSI-NSC-30), Jawaharlal Nehru University, New Delhi, February 2-5, 2023 • Conference on Crystal Engineering and Solid-state Chemistry, IISER Thiruvananthapuram, February 22, 2023 • Emergent Materials for Energy and Environment (EMEE-2023), Department of Chemistry, IIT Roorkee, March 4-5, 2023 • Colloquium, Radiochemistry Division, Bhabha Atomic Research Centre, Mumbai, March 17, 2023 • The 103rd Chemical Society of Japan (CSJ) Annual Meeting (2023), Noda Campus, Tokyo University of Science (Webinar), March 23, 2023

Rejish Nath

Title: Excitation and correlation dynamics of Rydberg atoms coupled to a photonic crystal waveguide, at National symposium on QUEST, IIIT Hyderabad, April 13, 2022 • Title: Overlapping bright solitons in spinor Bose-Einstein condensates, at conference on Physics with Trapped Atoms, Molecules and Ions, ICTS Bengaluru, May 12, 2022 • Title: Doubly dipolar Bose-Einstein condensates, at ICTP, Trieste, Italy, November 24, 2022; and at Institute of Fundamental Physics, Spanish National Research Council, Spain (CSIC), December 13, 2022

Anindya Goswami

Title: On merging of stochastic flow of semi-markov dynamics, at IINMM Inter IISER–NISER Mathematics Meet, IISER Kolkata, June 1, 2022 • Title: Data-driven option pricing using single and multi-asset supervised learning, at 88th Annual Conference of IMS at BIT Mesra, Speaker and invited organizer of the symposium on Mathematical Finance, December 30, 2022 • Title: Pi-Day Talk on Financial Mathematics and Machine Learning, Dept. of Mathematics & Statistics in MIT-WPU, as Chief Guest in the Pi Day Celebration, March 14, 2023

Partha Hazra

Title: Exploring multi-functionality and RTP in novel organic luminogens & optical properties, at "Tunability and Triplet Harvesting of Novel Copper Clusters and Complexes" Kyoto University, Japan, June 14, 2022 • Title: Spectroscopic ventures in the multi-domain materials world, at University of Tokyo, Japan, August 4, 2022; at Kyushu University, Japan, July 12, 2022; and at "Soft Matter, Metal Nano-clusters and Organic Emissive Functional Materials" VIT Chennai, September 13, 2022

Tejas Kalelkar
Title: An algorithm to identify hyperbolic manifolds from their geometric triangulations, at the 39th Annual workshop in Geometric Topology (Online), Texas Christian University, June 8, 2022 • Title: Bounds on Pachner moves in cusped hyperbolic 3-manifolds, International Conference on Knot Theory and Applications, at a satellite conference to the ICM (Online), Tomsk State University, Russia, July 2, 2022; and at Knots and Representation Theory, as part of Moscow-Beijing Topology Seminar series (Online), August 22, 2022 • Title: Techniques to recognise knots, Research seminar at IIT Kharagpur, October 25, 2022 • Title: An algorithm to identify hyperbolic manifolds using their geometric triangulations, at the 37th Annual Conference of the Ramanujan Mathematical Society at SSN College of Engineering, December 7, 2022 • Title: An algorithm for hyperbolic knot recognition, at Topology '22 conference by Prof. B.L. Sharma Higher Mathematics Trust at Banaras Hindu University (Online), December 23, 2022 • Title: An algorithm to recognise cusped hyperbolic 3-manifolds, Research seminar at University of Regensburg, Germany, January 23, 2023

Siddhesh Kamat
At the 10th International Singapore Lipid Symposium (ISLS), National University of Singapore, Singapore, 2022 • At Guha Research Conference, Bhimtal-Nainital, Uttarakhand, 2022 • At EMBO Young Investigators' Annual Meeting, Heidelberg, Germany, 2022 • At EMBO-India Investigators Network (IIN), 2022 • At Cell Biology Lecture Series, NCCS Pune, 2022 • At Asian Chemical Biology Initiative (ABCI) Annual Meeting, IISER Pune, 2022 • FEBS Advanced Course: 360o Lysosome Meeting, Kusadasi-Izmir, Turkey, 2022 • At NII Seminar Series, NII, New Delhi, 2022 • At Annual Meeting, Society of Biological Chemists of India, Kolkata, 2022 • At MBU50 Meeting, IISc Bengaluru, 2023 • At Mitometab Meeting, 42nd Mahabaleshwar seminar series, IISER Pune, Pune, 2023 • At ARUMDA Annual Meeting, TIFR-Hyderabad, 2023

Krishanpal Karmodiya
Title: Transcriptional heterogeneity as a means to diversify gene expression in *Plasmodium falciparum*, at Computational Workshop on Genomics, Proteomics and Metagenomics 2022 (CWGPM-2022), IGIB, New Delhi, July 20-23, 2022 • Title: An introduction to NGS and personalized genomics, SERB Karyashala workshop, IISER Pune, January 25-31, 2023 • Title: Dissecting transcriptional heterogeneity in *Plasmodium falciparum*, Institute of Bioinformatics and Applied Biotechnology (IBAB), Bengaluru, January 30, 2023 • Title: Chronobiology of mosquitoes olfaction: Understanding the differential molecular rhythm and peri-receptor events of diurnal and nocturnal mosquitoes, at the 15th Conference on Vectors and Vector Borne Diseases (COV-15), Goa, February 15-17, 2023

Shabana Khan
Title: Ligand effect in homogeous catalysis, at Empowering S&T with women- A step towards a new era, IIT Jodhpur, April 19-20, 2022 • Title: Chemistry of N-a heterocyclic silylene ligated coinage metal complexes, at Trends in Organometallic Chemistry by ACS, November 28, 2022 • Title: Sizzling chemistry of silylene supported metal complexes, at CNRS, Toulouse, France, September 15, 2022 • Title: Cationic Sb(III) and Bi(III) compounds as catalysts in cyanosilylation reaction, at International Conference on Main Group Synthesis and Catalysis 2023, IISER Thiruvananthapuram, February 9-12, 2023 • Title: Silylene metal complexes: From bonding to catalysis, at International Symposium on Emerging Trends in Chemical Sciences, (ETCS-2023), NEHU, Shillong, March 2-4, 2023

Mukul Kabir
Title: Magnetism in ultrathin proximate quantum spin liquid Na_2IrO_3, at Q-MAT, IIT Kanpur, September 18-22, 2022 • Title: Magnetism in quantum spin liquids, at International Conference on Advanced Materials Synthesis, Characterization and Applications, Savitribai Phule Pune University, October 18-20, 2022

Raghavendra Kikkeri
Title: Deciphering structure-function relationships of heparan sulfate using synthetic glycans, at International Carbohydrate Conference (CARBO-XXXVI) on Emerging Trends in Glycochemistry, Glycobiology & Technology, IIT Bombay, December 5-7, 2022

G.V. Pavan Kumar
Title: Structured-light scattering: Implication in momentum space, structured light and spin-orbit photonics, ICTS, Bengaluru, December 1, 2022 • Title: Hot Brownian colloids in structured optical tweezers, at Frontiers in Non-Equilibrium Physics (FNEP), IMSc, Chennai, January 19, 2023 • Title: Hot Brownian colloids and structured light, at Physics Colloquium, Dept of Physics, IIT Madras, February 8, 2023

Moumita Majumdar
Title: Battery anode materials syntheses and electron-rich cationic ligands designs using the main-group concepts, at RSC-IISER TVM Desktop Seminar with Dalton Transactions "Main group compounds in synthesis and catalysis", May 11-12, 2022 • Title: Organometallic approach for the preparation of multi-functionalized carbon materials as battery anode, at Conference on Low-Dimensional Materials, IISER Pune, May 19-20, 2022 • Title: Designing cationic main-group compounds: new feats in the field of lewis acid catalysis, at Workshop on New achievements in Molecular Main-group Element Chemistry, University of Bonn, Germany, July 15, 2022 • Title: Heavier low-valent group 14 and group 15 ring systems: the electronically extraordinary cases, at 16th International Symposium on Inorganic Ring Systems, at Graz, Austria, July 24-29, 2022 • Title: Coordination chemistry of the cationic donor ligands, at 8th Asian Conference on Coordination Chemistry, August 7-11, 2022 • Title: Designing cationic main-group compounds: New feats in the field of lewis acid catalysis, at DFG-SERB Young Researchers Meeting, November 7-10, 2022; and at Chemsymphoria, IISER Pune, December 22, 2022 • Title: The electron-rich main group cations, at Trends in Organometallic Chemistry, Organometallics, ACS, December 15, 2022 • Title: Cationic Main-Group compounds as ligands and transition metal mimics, American Chemical Society Spring Meeting, Indianapolis, U.S.A., March 26-30, 2023

Vivek Mohan Mallick
Title: Some spaces associated to (multi-)graded rings, at Ramanujan Mathematical Society Conference, SSN College of Engineering, Chennai, December 8, 2022 • Title: Noncommutative tt-categories and coherent frames, at Conference on Algebraic Geometry, HRI Allahabad, December 15, 2022

Pankaj Mandal
Title: Optical Kerr effect spectroscopy to probe exciton-phonon coupling in lead-halide perovskite, at Let There Be Light 2023, Pench, Madhya Pradesh, February 13-16, 2023 • Title: Charge carrier dynamics in lead-halide perovskites, at Chemistry Meet 2023: Kindling in Kaziranga, Assam, March 16-19, 2023

Neena Mani
Title: Boreal summer intraseasonal oscillation in S2S reforecasts, in the session A35G: Subseasonal to Seasonal Climate Prediction, Processes, and Applications, at the American Geophysical Union Fall Meeting, Chicago, IL, U.S.A., December 12-16, 2022 (Virtual) • Title: Investigating the Atlantic-Indian summer monsoon multidecadal teleconnections in the PMIP3 last millennial simulations, in the session AS03 - The Asian Monsoon: Past, Present and the Future, at the 19th Annual Meeting of Asia Oceania Geosciences Society (Virtual)

Joy Monteiro
Title: Using climate and environmental challenges to develop systems thinking, at Digital Pedagogy and Climate Change Education Workshop for All Disciplines, IISER Pune, August 5, 2022 • Title: Solar system planets and earth's weather and climate, at Exoplanets Online Course, Pune Knowledge Cluster, February 16, 2023

Mridula Nambiar
Title: Cohesins at centromeres - roles in recombination and chromosomal segregation: at Bioconclave, IISER Pune, August 26, 2022; and at Yeast India Meeting, IISER Mohali, March 12, 2023 • Title: Mechanisms of genomic instability in human diseases, at MASIF, Gargi College, Delhi University, November 4, 2022 (online) • Title: Diversity among cohesin complexes: roles in recombination and chromosomal segregation, at Chromosome Stability Meeting, IISER Trivandrum, December 15, 2022

Muhammed Musthafa O.T.

Title: Electrochemical neutralization: concepts to devices, at National Conference on Recent Trends in Green Energy Technologies (NCRTGET-2022), Dept. of Green Energy Technology, Pondicherry University, December 8-9, 2022 • Title: Electrified interface: Challenges and opportunities, at DST-STUTI workshop (sophisticated instrumental techniques used in research), Department of Chemistry, MSU Baroda, December 11-17, 2022 • Hydrogen economy: Coupling of hydrogen storage and hydrogen utilization in the same energy device, at International Conference, CONIAPS-2022, VSK University, Ballari, December 21-23, 2022 • Title: Ligand geometry-directed energy storage and conversion, at International Conference on Energy Conversion and Storage (IECS-2023), Centre of Excellence on Centre for Energy Storage and Conversion of the Energy Consortium of IIT Madras, Chennai, January 18-20, 2023 • Title: Electrochemical neutralization: concepts to devices, at DAE-BRNS 2nd International Conference on EIHE-2023 Electrochemistry for Industry, Health and Environment, DAE Convention Centre, Anushaktinagar, Mumbai, February 7-11, 2023 • Title: Electrochemical neutralization: concepts to devices, at Indo-French Workshop on Clean and Sustainable Energy Technologies (INFINITE)' at CSIR - National Physical Laboratory (NPL), New Delhi, February 21-24, 2023 • Title: Structural isomerism at electrified interfaces: Molecular insights to contrive efficient electrocatalysts and high energy supercapacitors, at International Conference on Nanomaterials for Electro-Catalytic Technologies (I-CONECT- 2023), Department of Chemistry, IIT Delhi, March 20-22, 2023

Pramod P. Pillai

Title: Hot carriers and hot surfaces: the two faces of plasmons in chemical transformations; at Conference on Advances in Catalysis for Energy and Environment (CACEE -2022), TIFR Mumbai, October 31, November 4, 2022 • Title: Light-matter interactions with surface engineered nanomaterial, in Innovations in Materials and Processing for Energy, Environment and Electronics (IMPEEE 2023), Marathwada Mitra Mandal's College of Engineering, Karvenagar, Pune, February 8, 2023 • Title: Thermoplasmonics: Taking the heat out from plasmonic nanostructures with sunlight, in Advances in Heat Generation by Direct and Indirect Methods for Aerosol Production, ITC Life Science and Technology Centre, Bengaluru, March 20, 2023

Gayathri Pananghat

Title: Sculpting of *Spiroplasma*, a helical, cell wall less bacterium, at the Contemporary Webinar Series, organized by Rajiv Gandhi Centre for Biotechnology, Faridabad, May 13, 2022 (online webinar) • Title: Cytoskeletal filaments that sculpt a bacterial cell, at the International Conference on Integrative Biology and Applied Genetics (ICIBAG), Osmania University, Hyderabad, from July 20-22, 2022 • Title: Helical structures in biology (Public online lecture) organised by Kerala Sastra Sahitya Parishad LUCA Science online portal under the seminar series on GNR@100 • Title: Cytoskeletal filaments that sculpt a helical bacterial cell, organized by Proteus, the Biology Students Club of IISER Thiruvanathapuram, November 12, 2022 (Online lecture) • Title: Membrane remodeling dynamics of the bacterial actin MreB from a cell wall less helical bacterium, at the symposium titled Microbe Matters, Indian Institute of Science, Bengaluru, November 28-29, 2022 • Title: Cytoskeletal filaments that sculpt a bacterial cell, at the symposium on Frontiers in Modern Biology, held at IISER Kolkata, January 20-22, 2023 • Title: Membrane remodeling by a bacterial actin MreB, at the conference titled Microtubules, Motors, Transport and Trafficking 2023, held at IISER Bhopal, January 27-29, 2023 • Title: Cytoskeletal filaments that sculpt a bacterial cell, at the CEMBIO symposium, held at NISER Bhubaneswar, February 12-14, 2023 • Title: Structural basis for kinetic polarity of the bacterial tubulin FtsZ, at the Frontiers Symposium in Biology, held at IISER Thiruvananthapuram, March 17-19, 2023

Supriya Pisolkar

Title: Fontaine-Mazur conjecture and analytic pro-p groups, at IISER Symposium, March 2022 • Title: Towards Fontaine-MAzur conjecture for bi-quadratic extensions- an example, at Pune-Mumbai Number Theory Seminar, IISER Pune, September 2022 • Title: Mysterious Galois groups in number theory - IWM regional workshop at IIT Patna, December 2022 • Title: Polynomials and groups, at MS-DEED workshop, IISER Pune, December 2022

Mainak Poddar

Title: Equivariant splitting of toric principal bundles over projective spaces, at Conference on Algebraic Geometry and Commutative Algebra, SRM University, Amravati, July 22, 2022 • Title: Generalized complex geometry of certain principal torus bundles, at Geometry and Topology Symposium, Annual conference of the Ramanujan Mathematical Society, Chennai, December 8, 2022 • Title: Logarithmic connections and symmetries of bundles, at Algebra-Combinatorics-Geometry seminar, University of Pittsburgh, U.S.A., February 2, 2023 • Title: Logarithmic connections on principal bundles, at Vector bundles in Chennai, IIT Madras, February 11, 2023

Thomas Pucadyil

Title: Membrane fission: Insights from reconstituting organelle form and chemistry, at Biologically Speaking Webinar Series, April 11, 2022 • Title: Insights into mechanisms regulating T-tubule biogenesis from in vitro reconstitution, University of Nebraska, Department of Biochemistry and Molecular Biology, Nebraska, U.S.A., April 11, 2022 • Title: Fission for the masses: High throughput screens for membrane fission proteins, EMBO Conference on Birth and Fission of Cellular Compartments, Bilbao, Spain, July 26, 2022 • Title: Reconstituting membrane biology and consolidating a career in science, at Young Investigators Meeting, IIT-Gandhinagar, Gandhinagar, February 13, 2023

Boomi Shankar R.

Title: Organic and hybrid ferroelectrics for piezoelectric energy harvesting applications, at the Department of Chemistry, IIT-Bombay, April 19, 2022 • Organizing Committee Member and Session chair and Coordinator, Future-Oriented Research Conferences and Exhibitions (FORCE) under the theme Interdisciplinary Initiative in Chemical Sciences (IICS), Agra, July 28-31, 2022 • Title: Organic and organic-inorganic ferroelectric materials for piezoelectric energy harvesting and storage, at International Conference on Emerging Advanced Nanomaterials 2022 (ICEAN-2022), Newcastle Exhibition and Convention Center, Newcastle, NSW, Australia, October 17-21, 2022 • Title: Ferroelectrics crystals and their composites for piezoelectric energy harvesting applications, at 49th National Seminar on Crystallography, University of Jammu, November 28-30, 2022 • Title: Organic and hybrid ferroelectrics for piezoelectric energy harvesting applications, as Colloquium talk at the School of Natural Sciences, Shiv Nadar Institute of Eminence University, December 1, 2022 • Title: Synthesis and host-guest studies of neutral Pd(II) cages supported by imido-P(V) trianions, at ChemSymphoria-2022, IISER-Pune, December 22-24, 2022 • Title: Hybrid ferro- and piezoelectric materials supported by phosphonium cations, at Symposium on Materials Science Towards New Horizons-2023, Royal Society of Chemistry and IIT-Indore, January 19-20, 2023 • Title: Ferro- and piezoelectric materials derived from amino-P(V) scaffolds, at Mini-symposium on the Recent Advances in Main Group Chemistry, IISER Pune, February 14, 2023 • Title: Hybrid ferro- and piezoelectric materials supported by phosphonium cations, at One-day Conference on Crystal Engineering and Solid-state chemistry, IISER Thiruvananthapuram, February 22, 2023

Sudha Rajamani

Title: How prebiotic selection pressures influenced the emergence of life on Earth, as part of the 2nd Annual Meeting of the Chemical Biology Unit (Nano@ChemBio 2022), INST Mohali, September 16-17, 2022 • Title: Compositional heterogeneity and its implications for life's origins and evolution, a discussion session led as part of Nano-to-Cosmic Studies of Complex Systems, a NASA PCE3 Virtual Workshop, October 19-20, 2022 • Title: Delineating life's origins at the COoL Lab: the story thus far, at Life Webinar, Early Career Researchers in Origin of Life, organized as part of Special Issue highlight by guest editors Dr. Tony Z. Jia and Dr. Kuhan Chandru, January 12, 2023 • Title: The story of how life originated on Earth, as part of ˜Biowaves-2023: Life Beyond Earth, an event organized by Department of Life Science and Biochemistry, St. Xavier's College, Mumbai, January 21, 2023 • Title: Biosignatures: In-situ, as an expert for the Exoplanets Course organized by Pune Knowledge Cluster, February 23, 2023 • Title: Tale of two protocellular systems, as part of CCMB Guest Lecture Series, February 27, 2023 • Title: Delineating the chemical origins of life on the early Earth, at Mumbai-Pune Bio-Network meeting organized by the Department of Biological Sciences, TIFR, March 11-12, 2023

Raghav Rajan
Title: Intro notes: a feature or a bug or a distraction, Virtual Song Satellite meeting, May 20, 2022 • Title: Using the songbird to understand how the brain initiates and produces complex movements, Guest lecture, Sophia College, September 15, 2022

Girish Ratnaparkhi
Title: The VAPB social network: At the crossroads of ER stress, proteostasis, and inflammation, at the University College London, IHA-Virtual symposium on neurodegeneration in flies, August 4, 2022 • Title: Circadian dysfunction in a *Drosophila* model of Amyotrophic Lateral Sclerosis, at the Indian Neurobehavior Conference in MAHE, Manipal, December 21, 2022

Chaitra Redkar
Title: In search of space for dialogue between Gandhi and Ambedkar, at Rajyashastra Vichar Manch of the SRTM University, Nanded, April 13, 2022 • Title: Gandhi's economic idea, at Gandhi Study Centre, Shivaji University, Kolhapur, April 29, 2022 • Title: Changing dynamics of political parties and its impact on local politics, in the ISHAD local democracy lecture series organised by International Society for Human Awakening (ISHAD), Association for Democratic Reforms (ADR) & Research & Support Centre for Development (RSCD) , August 28, 2022 • Title: Movements for social justice, at Sambodhi Pratishthan, Satara, December 1, 2022 • 2 sessions in ICSSR Research Methodology Course on Paradigms and Philosophy of Social Science Research organised by Raja Shripatrao Bhagwantrao Mahavidyalaya, Aundh (Dist-Satara), December 2, 2022 • Title: S M Joshi's idea of Maharashtra, in the Maharashtra Lecture Series at the Dept. of Civics & Politics, University of Mumbai, December 16, 2022 • Title: Is political science a gender-sensitive discipline? some reflections, in the Gender and Political Theory Lecture Series organised by Dept. of Civics & Politics, University of Mumbai, December 17, 2022

M. S. Santhanam
Title: Chaos and quantum correlations: Lessons from chaotic models, at Indo-Russian Workshop on Quantum Technologies, IISER Pune, August 21, 2022 • Title: Spectral statistics of complex quantum systems, International Conference on Complex Systems, BM Munjal University, Gurgaon, November 21, 2022 • Higher order spectral statistics in complex quantum systems, Frontiers in Physics, Hyderabad Central University, Hyderabad, March 4, 2023

Sudipta Sarkar
Title: Gas hydrates and sill intrusions in the Central Gulf of California, departmental Seminar, University of Hyderabad, Hyderabad, February 22, 2023

Haripada Sau
Title: A constrained Ando Dilation Problem, at 37th RMS Annual Conference, at Sri Sivasubraminya Nadar College of Engineering, Chennai, December 6-8, 2022; and at Conference on Functional Analysis and Related Topics-2023, IIT Bombay, February 21-25, 2023 • Multivariable Operator Theory: rational dilation problem, realization formula, and distinguished varieties, outreach activity at IIT Bombay, March 9, 2023

Kundan Sengupta
Title: Single cell analyses in tissue microenvironment, as Webinar organized by Tissuegnostics, May 2, 2022 • Title: Chromosomal instability and DNA damage accompany Epithelial to Mesenchymal Transitions (EMT) in colorectal cancer cells, at Bhabha Atomic Research Center (BARC), Bioscience Group, Applied Genomics Section, May 11, 2022 • Title: Techniques in molecular cytogenetics and cancer, at Synergistic Training Program Utilizing Scientific and Technological Infrastructure (STUTI)' program of the R&D infrastructure Division, BHU Varanasi, June 2, 2022 • Title: Lamins - Mechanoprotector of the nucleus, at 12th India-Japan Science and Technology Conclave - International Conference on Frontier Areas of Science and Technology (ICFAST-2022), School of Physics, University of Hyderabad, September 9, 2022 • Title: Aneuploidy & Cancer, at Inaugural ceremony of Zoology association, Dept of Zoology, Fergusson College, Pune, October 12, 2022 • Title: The diverse roles of lamins in the maintenance of chromosomal stability in cancer cells, at Center for Cellular and Molecular Biology (CCMB), Hyderabad, December 12, 2022 • Title: To CIN or not to CIN? - role of lamins in modulating chromosomal instability (CIN) in cancers, at 42nd Indian Association of Cancer Research (IACR) Conference, ACTREC, Mumbai, January 12, 2023

Seema Sharma
Title: Detectors for HL-LHC & Future Colliders, at Horizons in Accelerators, Particle/Nuclear Physics and Laboratory-based Quantum Sensors for HEP/NP, Bengaluru, November 14-18, 2022 • Title: Searches for BSM Higgses and Electroweakinos at the CMS Experiment, Frontiers in Particle Physics 2023, IISc Bengaluru, March 10-12, 2023

Surjeet Singh
Title: Frustrated systems - "the materials landscape", at Frustrated Metals and Insulators held at ICTS Bengaluru, September 15, 2022 • Title: Topological phases in the pyrochlore iridates, at Conference on Novel Phases of Matter in Frustrated Magnets, Bordeaux, France, October 18, 2022 • Title: Quantum magnetism in low-dimensional systems, at Forschungs-Neutronenquelle Heinz Maier-Leibnitz (FRM II), Technical University of Munich, Germany, October 27, 2022 • Title: Weyl phase and quantum criticality in pyrochlore iridates, at the 66th DAE Solid State Physics Symposium held at Birla Institute of Technology, Ranchi, Jharkhand, December 18, 2022 • Invited lecture at the Indo-Swedish Meeting on the Divergent Quantum Materials, Methods and Applications (DQMMA2023), Goa, February 3, 2023 • Title: Low-dimensional systems with spins on chains, ladders and honeycomb structures, at The Frontier Symposium Physics 2023, IISER TVM, February 26, 2023 • Title: Crystal growth of quantum materials - techniques and new materials, at International Materials Conclave (IMC-2023) & 33rd Annual Foundation Day held at CMET Pune, March 9, 2023

Kaneenika Sinha
Title: Distribution and spacing statistics of Sato-Tate sequences in short intervals, Indian Institute of Science Number Theory Seminar, IISc, Bengaluru, May 6, 2022 • Title: Central limit theorems in number theory, Special functions number theory seminar (online, co-organized by Ashoka University, IIT Gandhinagar and JNU), two talks delivered on September 22 and October 6, 2022 • Title: Questions about error terms in Sato-Tate distributions, at Around Frobenius distributions and related topics (online, co-organised by University of Illinois at Chicago, U.S.A., Universitat de Bordeaux, France and University of Neuchâtel, Switzerland & University of Rennes, France, October 5, 2022 • Title: Moments of the pair correlation function for Sato-Tate sequences, at Annual Meeting of the Ramanujan Mathematical Society, SSN College of Engineering, Chennai, December 6, 2022 • Title: Reflections on the prime omega function, Indian Women and Mathematics, Regional Workshop on Research and Opportunities, December 9, 2022 • Title: Central limit theorems in number theory, Workshop on number theory, National Institute of Science Education and Research, Bhubaneswar, four talks in a lecture series delivered on February 20-22, 2023

Pushkar Sohoni
Public book launch of Sultanate Ahmadabad and its Monuments: The City of the Muzaffarids (Ahmad Shahis), organized by Arthshila, Ahmedabad, March 25, 2023 • Public lecture with Riyaz Latif: Ornaments in Stone: Monuments of Sultanate Ahmadabad, at Jnanapravaha, Mumbai, March 17, 2023 • Virtual book launch of Sultanate Ahmadabad and its Monuments: The City of the Muzaffarids (Ahmad Shahis), organized by Primus Books, and with co-panelists Parul Pandya-Dhar and Samira Sheikh, March 10, 2023 • Invited talk in the series Authors on Architecture at BRICK School of Architecture, Pune, March 3, 2023 • Title: Reading beyond the writing: the materiality of texts, at the School of Humanities and Social Sciences (SHSS), Indian Institute of Technology (IIT) Mandi, February 23, 2023 • Workshop on numismatics for the School of Humanities and Social Sciences (SHSS), Indian Institute of Technology (IIT) Mandi, February 24, 2023 • Title: Translating science into the vernacular, at the Workshop Colonial Science and Education: India and Taiwan, sponsored by the Ministry of Science and Technology (MOST), Taiwan, and the Indian Council for Social Science Research (ICSSR), and at Academia Sinica, Taipei, February 13, 2023 • Title: Material

sources of history: Reading beyond texts, at the Refresher Course in History organised by the HRDC, Maulana Azad National Urdu University, Hyderabad in collaboration with the Department of History, MANUU, January 25, 2023 • Discussant at the launch of the book Golconda-Hyderabad 1975/1996/2012: A Photographic Essay organized by Goethe-Zentrum Hyderabad, November 24, 2022 • Title: Missing 300 years: Politics and public perception of temples in Maharashtra, at the Seminar Religious Structures and Regional Traditions in India: New Directions in Architectural, Social, and Cultural History, Centre for Studies in Social Sciences, Kolkata, November 19, 2022 • Title: Jewish Deccan, talk organised by INTACH Bengaluru at Max Mueller Bhavan, Bengaluru, November 5, 2022 • Title: Changing paradigms of defence: Gunpowder and fortification in the Deccan, at the Department of History, Maulana Azad National Urdu University, Hyderabad, September 28, 2022. • Discussant on the panel for the exhibition March to Freedom organised by DAG at the Indian Museum, Kolkata, August 13, 2022 • Title: Taziâahs and Temples in the Western Deccan at the roundtable discussion Revisiting Muharram, at Centre for Asian and Transcultural Studies, South Asia Institute, Universität Heidelberg, July 27, 2022 • Participant and presenter at the workshop Revisiting Muharram, Centre for Asian and Transcultural Studies, South Asia Institute, Universität Heidelberg, July 27, 2022 • The Impact of Railways on Market Halls in India for the workshop The Time and Space of Railways: Markets, Work, and Circulation in South Asia at Georg-August Universtitatt, Goettingen, June 16, 2022 • Title: Temples in Maharashtra, organised by the Rotary Club of Pune, Shivajinagar, May 23, 2022 • Title: The fort of Janjira, the tombs at Khokri, and the Ahmadganj palace for African Rulers and Generals in India: Afro-South Asia in the Global African Diaspora, Bangalore International Centre, Bengaluru, conducted online. https://www.youtube.com/watch?v=5wRfxkggAR8 April 21, 2022 • Participant at the workshop Courts of North India and the Deccan (c. 1347-1562), Department of South Asia Studies, University of Pennsylvania, Philadelphia, April 16, 2022. • Title: Creating an Ecumene: Cultural boundaries of the Deccan, at the conference Fielding the Deccan: Landscape, Architecture, and Space in Southern India, Department of History, Pomona College, CA, April 8, 2022

Pinaki Talukdar

Title: Artificial ion transport as a tool to target cancer, at Asian Chemical Biology Initiative (ACBI) Meeting 2022, IISER Pune, September 14, 2022 • Title: Synthetic ion transport systems to target cancer, as Expert talk, Chemistry Discipline Seminar Series, IIT Gandhinagar. March 23, 2023 • Title: Ion-templated reversible conversion of bis(indole) double helix to supramolecular polymer: An application in transmembrane ion transport, at National Conference on Macrocycles and Nanotechnology. L. J. University, Ahmedabad, March 24-25, 2023

Arun Thalapillil

Title: Hidden Objects & Hidden Physics, at Less Travelled Path to the Dark Universe conference; ICTS, Bengaluru, 1 March 13-24, 2023

Bejoy Thomas

Title: Linking water, trees and people, at Maharashtra State Biodiversity Board, India, World Biodiversity Day 2022 event, May 22, 2022 • Title: Rethinking water management: a river basin perspective, at Agharkar Research Institute, Pune, Azadi Ka Amrit Mahotsav and ARI Platinum Jubilee lecture, August 17, 2022 • Title: Rethinking urban water management: an integrated, river basin perspective, at Indian Institute of Forest Management, Bhopal (online), September 12, 2022 • Title: Environment-development trade-offs at different scales, at IIT Kanpur, Workshop on Developing an Actionable Approach to Carbon Neutrality, October 11, 2022 • Title: Imagining sustainability: insights from COVID-19 lockdown in India, at Institute for Global Environmental Strategies, Tokyo, Japan, Workshop on Understanding and Addressing Systemic Risks Behind the Socioeconomic Impacts of COVID-19 in India and Japan, November 21-22, 2022 • Title: The city and its water: how our cities manage their water and waste water?, at Christ College, Pune, December 2, 2022 • Moderator for the panel on 'Integration in Water Education', Tata Institute of Social Sciences Hyderabad, India, Wednesdays for Water Foundation's Water Festival, January 12, 2023 • Title: Climate change and development', The Divecha Centre for Climate Change, Indian Institute of Science, Bengaluru, India (online); ITEC training course in climate change and environment, February 10, 2023 • Title: Budget 2023-24 and the environmental challenge, Cochin University of Science and Technology, Kochi (online), February 10, 2023 • Panel on 'Natural Resources Governance and Regulation: Towards Sustainability and Equity', Tata Institute of Social Sciences, Mumbai, India, Crystal Jubilee Celebration 2023 - 15 years of School of Habitat Studies, March 9, 2023

Gyana Tripathy

Title: Re-Os geochronology of black shales, at Cambridge University, UK, September 7, 2022

Ramanathan Vaidhyanathan

Title: COF- A candidate for lightweight and fast charging storage, at Division of Energy and Fuels, Battery Materials & Interfaces: Anodes, Cathodes & Novel Electrolytes, ACS Fall 2022, August 21-25, 2022, Chicago, USA • Title: Covalent Organic Frameworks as platform for charge-storage, at Future Oriented Research Conferences and Exhibitions (FORCE), Interdisciplinary Initiatives in Chemical Sciences (IICS) FORCE-IICS 2022, July 28-31, 2022, Agra • Title: Covalent Organic Frameworks and Metal Organic Frameworks- demand, promise and challenges, at the International Winter School, December 5-9, 2022, in JNCASR, Bengaluru • Title: Framework solids for energy and environment, Royal Society of Chemistry and IIT Indore, Symposium on Materials Science Towards New Horizons-2023, January 19-20, 2023 • Title: COF a solution when space and flexibility matters, ChemSci2023: Leaders in the Field Symposium organized by the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru in association with the Chemical Science Journal, January 23-25, 2023 • Title: COF - A candidate for fast-charging lightweight energy storage, at National Conference on Chalcogenide Compounds and Applied Chemistry, March 16-17, 2023 (NC3-2023), Organized by Department of Applied Chemistry Defence Institute of Advanced Technology, Girinagar, Pune

Suneeta Vardarajan

Title: Non-extremal black holes and the Schwarzian at workshop on observables in quantum gravity, IISER Mohali, March 25, 2023

Arun Venkatnathan

Title: Molecular simulations of structure and ion mobility in a diglyme-based sodium-ion battery electrolyte, at Current Trends in Theoretical Chemistry (CTTC-2022), BARC, Mumbai, September 22-24, 2022

ACADEMIC EVENTS ORGANISED

Amit Apte
Co-organiser (with Pranay Goel, M.S. Santhanam), Conference on Nonlinear Systems and Dynamics, IISER Pune, 100+ participants, December 15-18, 2022

Nirmalya Ballav
Co-organiser (with Angshuman Nag, Pramod Pillai, Partha Hazra, Pankaj Mandal, Muhammed Musthafa), Low-Dimensional Materials (LDM)-2022, IISER Pune, 150 participants, May 19-20, 2022

Argha Banerjee
1st IISER Pune Glacier Retreat, IISER Pune, 4 participants, May 22-25, 2022; and 10 participants, December 16-17, 2022

Arka Banerjee
Co-organiser (with Subinoy Das, Koushik Dutta, Raghavan Rangarajan and Vikram Rentala), Workshop: Less Traveled Path to the Dark Universe, ICTS Bengaluru, 80 participants, March 13-24, 2023

Debargha Banerjee
8th edition of Pune-Mumbai Number Theory Seminar 2023, IISER Pune, September 23-24, 2022

Mousomi Bhakta
Organiser, special session PDE in the Annual Conference of Ramanujan Mathematical Society, Chennai, ~40 participants, December 6-8, 2022

Apratim Chatterji
Organiser, ICTP-IITB workshop: Stochastic Thermodynamics in Biology, IIT Bombay, 70 participants, November 28-December 2, 2022

Devapriya Chattopadhyay
Co-organiser, National Training workshop - Paleoclimate- archives, proxies and analysis/measurement techniques, 50 participants, IITM, Pune, January 16-20, 2023 • Instructor, NPTEL course "The evolution of the Earth and life", participants 1567, Jan-April, 2023 (https://onlinecourses.nptel.ac.in/noc23_ce54/preview)

Anisa Chorwadwala
Co-organiser (with Anupam Kumar Singh, Supriya Pisolkar, Manish Mishra and Debargha Banerjee), In-House Math Symposium, IISER Pune, March 23-24, 2023 • Co-organiser, Mathematics Day (Week-long Celebration around March 14, 2023) • Convener, Scientific Committee Member and an Organiser of The Indian Women and Mathematics (IWM) Annual Conference 2022-2023, IISER Pune, 113 participants, December 27-29, 2022. Co-organisers: Vijaylaxmi Trivedi (TIFR Mumbai), Riddhi Shah (JNU), Sachi Shrivastava (DU), Neha Prabhu (SPPU), Haripada Sau (IISER Pune)

Anindya Goswami
Organiser, Symposium on Mathematical Finance, 88th Annual Conference of IMS, BIT Mesra, December 30, 2022

Siddhesh Kamat
Organiser, EMBO India Delegation, March 2023

Soumen Maity
Organiser, Fourth conference on Computational Thinking in Schools (CTiS2022), IISER Pune, 200 participants, July 8-9, 2022

Moumita Majumdar
Organiser, Wiley-VCH workshop in hybrid mode, IISER Pune, November 16, 2022 • Organiser, Mini-symposium on 'Recent Advances in Main-group Chemistry', IISER Pune, February 14, 2023, IISER Pune

Vivek Mohan Mallick
Co-organiser (with Sanjay Amrutiya (IITGn), Umesh V. Dubey (HRI)), Conference on Algebraic Geometry, HRI, Allahabad, 36 participants, December 12-16, 2022

Joy Monteiro
Co-organiser (with Chhavi Mathur and Peeyush Sekhsaria), Citizen Science Meeting, IISER Pune, February 27, 2023

Angshuman Nag
Co-organiser (with Nirmalya Ballav, Pramod Pillai, Partha Hazra, Muhammed Musthafa and Pankaj Mandal), Low-Dimensional Materials (LDM) - 2022, IISER Pune, May 19-20, 2022

Mridula Nambiar
Co-organsier (with Girish Ratnaparkhi), Symposium on "Opportunities for Frontier Research Collaborations" by Human Frontier Science Program (HFSP), IISER Pune, ~50 participants, February 15, 2023

Muhammed Musthafa O.T.
Co-organiser (with Nirmalya Ballav, Angshuman Nag, Pramod Pillai, Partha Hazra, and Pankaj Mandal), Low-Dimensional Materials (LDM) - 2022, IISER Pune, May 19-20, 2022

Pramod P. Pillai
Co-organiser (with Nirmalya Ballav, Angshuman Nag, Partha Hazra, Muhammed Musthafa, and Pankaj Mandal), Low-Dimensional Materials (LDM) - 2022, IISER Pune, ~100 participants, May 19-20, 2022 • ChemSymphoria 2022, IISER Pune, ~250 participants, December 22-24, 2023

Gayathri Pananghat
Co-organiser (with Saikrishnan Kayarat, Kiran Kulkarni, Radha Chauhan, Janesh Kumar and Ramanathan Natesh), EMBO Practical Course on Cryo Electron Microscopy and 3D Image Processing (CEM3DIP), IISER Pune, December 4-16, 2022 • 3rd Annual Symposium on Single Particle CryoEM and Cellular Tomography, Names of organisers: Gayathri Pananghat, Saikrishnan Kayarat, and Ramanathan Natesh, December 17, 2022

Supriya Pisolkar
Co-organiser, Triangle Groups, Belyi Uniformization, and Modularity, Bhaskaracharya Pratishthana (BP) Pune. It was an online international event for three trimesters, August 2021 to December 2022

Boomi Shankar R.
Co-organiser, Mini-symposium on the Recent Advances in Main Group Chemistry, IISER Pune, February 14, 2023

Sunish Radhakrishnan
EMBO Workshop: Bacterial morphogenesis, survival and virulence: Dynamic genomes & envelopes; Co-organisers: Anjana Badrinarayanan (NCBS, Bengaluru), Patrick Viollier (University of Geneva, Switzerland) and Bavesh Kana (University of Witwatersrand, South Africa); Location: Goa; 142 Participants; February 6-10, 2023

M.S. Santhanam
Co-organiser (with Pranay Goel, Amit Apte), Conference on Nonlinear Systems and Dynamics, IISER Pune, 100+ participants, December 15-18, 2022

Haripada Sau
Co-organiser, Indian Women and Mathematics (IWM) Annual Conference 2022-2023, ~100 participants, December 27-29, 2022, IISER Pune

Surjeet Singh
Co-organiser (with Sunil Nair), Physics of Strongly Correlated Electron Systems (PSCES) 2023, IISER Pune, 120 participants, March 15-17, 2023

Bejoy Thomas
Workshop on 'Identifying water, food, and biodiversity nexus challenges in the Upper Bhima Basin'; Collaborators: SOPPECOM, Pune and IIASA, Austria; Location: IISER Pune, 45 participants from government agencies, NGOs, academic institutions and local communities, January 17, 2023

Gyana Tripathy
International Fossil Day (in association with the Paleontological Society of India: Pune-Mumbai student chapter), IISER Pune, October 15, 2022

NEW EXTRAMURAL GRANTS GARNERED

Funds shown in the last column represent the amount either received by or assigned to the project

Amount in ₹

Sr. No.	Name of the Project and Project Leader	Project Code	Funding Agency	Period From-To	Total Funds Sanctioned	Funds during the Year
1	Viability and scope of oxazole and thiazole based ionic liquids as CO_2 capture systems a theoretical study PI: Dr. Uttama Mukherjee	GAP/DST/WOS-A/CHE-22-595	DST (WOS-A)	02.04.2022 01.04.2025	35,87,340	15,76,400
2	NASI Senior Scientist Platinum Jubilee Fellowship to Prof Deepak Dhar PI: Prof. Deepak Dhar	GAP/NASI/PHY-22-596	NASI	03.01.2022 02.01.2023	4,60,000	4,60,000
3	Investigating novel mitochondrial fission pathways in organelle quality control PI: Prof. Thomas Pucadyil	GAP/SERB/BIO-22-597	SERB	24.05.2022 23.05.2025	82,68,080	57,66,980
4	Going Global Partnerships 2021-22: Collaboration between IISER Pune, India and University of Glasgow, U.K. PI: Dr. Aparna Deshpande	GAP/BC/PHY-22/598	British Council	25.05.2022 24.05.2025	1,69,044	1,69,044
5	VAJRA Faculty Scheme - Dr. Geeta Narlikar, University of California, San Francisco U.S.A. PI: Prof. Sanjeev Galande	GAP/SERB/BIO-22-599	SERB	17.07.2022 16.07.2023	14,87,000	14,87,000
6	VAJRA Faculty Scheme - Dr. Dieter Suter, Technical University of Dortmund, Germany PI: Prof. T.S. Mahesh	GAP/SERB/PHY-22-600	SERB	16.05.2022 15.05.2023	15,57,200	15,57,200
7	Co-ordination between stem cell activation, cell division and transdifferentiation guiding the reunion of disconnected tissues: Dissecting the fundamental principles of a phenomenon previously unknown in plant. PI: Dr. Kalika Prasad & Prof. Anjan Kumar Banerjee	GAP/SERB/BIO-22-601	SERB	28.06.2022 27.06.2025	86,90,586	43,34,977
8	Rapid, low-diagnostics and deployable surge capacity for COVID-19 PI: Prof. Chaitanya Athale	GAP/IDRC/BIO-22-602	University of Toronto	05.03.2021 05.06.2023	14,59,972	14,59,972

Amount in ₹

Sr. No.	Name of the Project and Project Leader	Project Code	Funding Agency	Period From-To	Total Funds Sanctioned	Funds during the Year
9	Raja Ramanna Fellowship to Prof. Srinivasan Ramakrishnan PI: Prof. Srinivasan Ramakrishnan	GAP/DAE/PHY-22-603	DAE-Others	13.07.2022 12.07.2025	13,50,000	13,50,000
10	J C Bose Fellowship for Prof. Jayant B. Udgaonkar PI: Prof. Jayant B. Udgaonkar	GAP/SERB/CHE-22-604	SERB	01.06.2022 31.07.2025	60,16,666	15,82,603
11	The role of Api5 during breast morphogenesis PI: Dr. Mayurika Lahiri	GAP/SERB/BIO-22-605	SERB	17.08.2022 16.08.2025	58,22,696	25,47,000
12	Soft-colloids on plasmonic surfaces: Optothermal trapping and assembly PI: Prof. Pavan Kumar G.V.	GAP/AOARD/PHY-22-606	Asian Office of Aerospace R & D (AOARD)	28.04.2022 27.07.2023	23,93,539	23,93,539
13	Mechanisms controlling the positional memory of stem cell regeneration using *Arabidopsis* root tip resection as a model PI: Dr. Kalika Prasad	GAP/DBT/BIO-22-607	DBT	20.09.2022 19.09.2025	89,97,000	49,14,680
14	The role of DNA damage on cytoskeleton dynamics PI: Dr. Mayurika Lahiri Co-PI: Prof. Aurnab Ghose	GAP/DBT/BIO-22-608	DBT	26.10.2022 25.10.2025	77,33,360	32,91,280
15	SERB-POWER Fellowship to Dr. Moumita Majumdar PI: Dr. Moumita Majumdar	GAP/SERB/CHE-22-609	SERB	09.11.2022 08.11.2025	38,10,000	12,70,000
16	Harnessing the potential of global regulator SATB1 as a novel molecular target for cancer therapy using statins PI: Prof. Sanjeev Galande	GAP/DBT/BIO-22-610	DBT	05.12.2022 04.12.2024	1,19,98,600	1,05,00,400
17	Teachers Associateship for Research Excellence (TARE) PI: Dr. Smita Chaturvedi (Mentor – Prof. Surjeet Singh)	GAP/SERB/PHY-22-611	SERB	10.10.2022 09.10.2025	10,05,000	3,35,000
18	National Network Project of CSIR-National Chemical Laboratory PI: Prof. Girish Ratnaparkhi	GAP/DBT/BIO-22-612	DBT	29.08.2022 28.08.2027	22,53,360	3,00,000
19	Probing structural polymorphism and recognition of non-canonical nucleic acid motifs of human and viral genomes PI: Prof. S.G. Srivatsan	GAP/SERB/CHE-22-613	SERB	26.12.2022 25.12.2025	79,39,888	45,26,700
20	Development of self-assembled synthetic water channels as biomimetic membranes for water desalination PI: Prof. Pinaki Talukdar	GAP/SERB/CHE-22-614	SERB	27.12.2022 26.12.2025	54,59,696	23,66,565
21	Chiral hybrid perovskite semiconductor PI: Dr. Angshuman Nag	GAP/SERB/CHE-22-615	SERB	27.12.2022 26.12.2025	62,59,324	49,59,995
22	Mechanism of chromosome mis-segregation due to meiotic recombination at centromeres PI: Dr. Mridula Nambiar	GAP/DBT/BIO-22-616	DBT	26.12.2022 25.12.2025	71,43,840	32,71,280

Amount in ₹

Sr. No.	Name of the Project and Project Leader	Project Code	Funding Agency	Period From-To	Total Funds Sanctioned	Funds during the Year
23	Design and synthesis of functional ionic MOFs (iMOFs) for industrially relevant light hydrocarbons separation PI: Prof. Sujit Kumar Ghosh	GAP/SERB/CHE-22-617	SERB	30.12.2022 29.12.2025	75,83,543	55,23,930
24	Doubly dipolar Bose-Einstein Condensates-Matrix PI: Dr. Rejish Nath	GAP/SERB/PHY-22-618	SERB-Matrix	04.01.2023 03.01.2026	6,60,000	2,20,000
25	Exploratory single crystal growth of new topological materials PI: Dr. Luminita Harnagea	GAP/DST/PHY-22-619	DST (WOS-A) Kiran Division	02.01.2023 01.01.2026	27,32,400	9,28,800
26	Structural and biochemical characterization of protein complexes in *Myxococcus xanthus* polarity regulation PI: Dr. Gayathri Pananghat	GAP/IGSTC/BIO-22-620	IGSTC	20.01.2023 19.01.2026	39,00,000	13,00,000
27	INSPIRE Faculty Award - Dr. Prafullkumar Tale PI: Dr. Prafullkumar Tale	GAP/DST-INSPIRE-22-621	DST-INSPIRE	19.09.2022 18.09.2027	1,12,40,000	22,00,000
28	INSPIRE Faculty Award - Dr. Chandranandan Gangopadhyay PI: Dr. Chandranandan Gangopadhyay	GAP/DST-INSPIRE-22-622	DST-INSPIRE	15.09.2022 14.09.2027	1,12,40,000	22,00,000
29	Teachers Associateship for Research Excellence (TARE) PI: Dr. Smita Vishal Deore (Mentor-Dr. Sudha Rajamani)	GAP/SERB/BIO-22-623	SERB	01.11.2022 31.10.2025	18,30,000	3,35,000
30	Understanding correlated electronic phases in vanadium based kagome systems PI: Dr. Aparna Deshpande	GAP/SERB/PHY-22-624	SERB	24.01.2023 23.01.2026	24,78,696	8,33,000
31	Valley-contrasting resonances and Fermi-edge singularities in gated 2D semiconductors using high-precision magneto-optical spectroscopy PI: Dr. Ashish Arora	GAP/SERB/PHY-22-625	SERB	03.02.2023 02.02.2026	53,73,520	44,48,000
32	Understanding the genesis mechanisms of monsoon low pressure systems PI: Dr. Suhas Ettammal	GAP/MoES/ECS-22-626	MoES	09.11.2022 08.11.2025	10,11,280	3,50,000
33	The Rufford Foundation Grant for Akashdeep Roy - 38166-1 / To support understanding the construction of human-wildlife conflict through a political ecology framework in the North Bengal Region, India PI: Akashdeep Roy (student of Dr. Pushkar Sohoni)	GAP/RUFFORD/HSS-22-627	The Rufford Foundation	13.01.2023 30.03.2024	5,85,208	5,85,208
34	Interferometer based atomic force microscope for viscoelasticity of single folded macromolecules PI: Dr. Shivprasad Patil	GAP/SERB/PHY-22-628	SERB	08.02.2023 07.02.2026	72,26,206	52,26,000
35	Acoustic spin pumping in quantum materials PI: Dr. Sunil Nair	GAP/SERB/PHY-22-629	SERB	08.02.2023 07.02.2026	30,28,696	10,16,500

Amount in ₹

Sr. No.	Name of the Project and Project Leader	Project Code	Funding Agency	Period From-To	Total Funds Sanctioned	Funds during the Year
36	Indian participation in the CMS experiment at CERN: Maintenance, operation and upgradation PI: Dr. Seema Sharma	GAP/DST/PHY-22-630	DST	17.06.2022 30.06.2027	3,23,10,000	13,65,500
37	Reconstructing past variability in monsoon and westerlies using the isotopic records of tree rings from the Himalayas PI: Dr. Shreyas Managave	GAP/SERB/ECS-22-631	SERB	24.02.2023 23.02.2026	32,12,000	18,50,000
38	Wellcome Trust / DBT India Alliance - Dr. Vandana Gambhir PI: Dr. Vandana Gambhir	GAP/Wellcome Trust/ Admin-22-632	Wellcome Trust - DBT India Alliance	01.01.2023 31.12.2023	10,00,000	2,50,000
39	Response of shallow marine community to seaway closure: Insights from Oligo-Miocene WIP (Western Indian Province) fauna using comparative paleobiogeography and paleocommunity analyses. PI: Dr. Devapriya Chattopadhyay	GAP/SERB/ECS-22-633	SERB	07.03.2023 06.03.2026	18,13,560	2,50,000
40	Orbital-controlled design of the heavier group 15 and group 14 main group cations in their low-oxidation states for catalysis PI: Dr. Moumita Majumdar	GAP/SERB/CHE-22-634	SERB	07.03.2023 06.03.2026	52,90,000	26,00,000
41	Consortium for collective and engineered phenomena in topology concept PI: Dr. Pankaj Mandal	GAP/DST/CHE-22-635	DST	10.03.2023 09.03.2028	81,29,839	40,84,759
42	Insight into structural deformation, fluid migration patterns, and gas hydrate accumulation within deep water fold-and-thrust belts from 3Dseismic data offshore Krishna-Godavari Basin PI: Dr. Sudipta Sarkar	GAP/SERB/ECS-22-636	SERB	10.03.2023 09.03.2026	33,48,360	1,00,000
43	Wellcome Trust / DBT India Alliance - Dr. Richa Rikhy PI: Prof. Richa Rikhy	GAP/Wellcome Trust/ BIO-22-637	Wellcome Trust - DBT India Alliance	01.02.2023 31.01.2028	4,41,04,500	1,17,26,550
44	Genomic surveillance for SARS-CoV-2 in India: Indian SARS-CoV-2 genomics consortium (INSACOG)-Phase II PI: Dr. Krishanpal Karmodiya Co-PI: Prof. Sanjeev Galande & Prof. Aurnab Ghose	GAP/DBT-INSACOG/ BIO-22-638	DBT - INSACOG	29.12.2022 28.12.2023	14,41,600	2,60,400

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