ANNUAL REPORT
2020-21







Indian Institute of Science Education and Research Mohali

~ in pursuit of knowledge ~

Gazebo under the painted evening sky

Bird's eye view of the campus

Campus pond

Cover & inner cover art : **The Exquisite IISER, an abode with a perfect blend of science and nature**

Cover page middle photo : ***Bacillus subtilis*** **colony showing concentric circles of calcite precipitation**

Photo credits & compilation : **Deeptodeep Roy**

Annual Report
2020-21

Indian Institute of Science Education and Research Mohali

Contents

Preface

I am delighted to present the Annual report of IISER Mohali for the year 2020-21, which lists the various activities of the Institute during this reporting period. In the paragraphs below, I have attempted to provide a bird's eye view of our achievements this year.

Research from the Department of Biological Sciences has elucidated the neural circuitry through which dopamine affects locomotion of a free-living nematode C. elegans in presence of ethanol. Another study established a role for post-synaptic scaffolding protein tamalin in trafficking of specific proteins in cells of the brain. An intricate interconnection was revealed between metabolism of long-chain fatty acids and oxidative protein folding in Gram-negative bacteria. It was shown that a bacterial DNA-binding, nucleoid-associated protein, HU, also binds to bacterial outer membrane lipopolysaccharide such as to release extracellular DNA upon bacterial cell lysis. In the fruit fly Drosophila, researchers demonstrated that fatty acid oxidation is essential for differentiation of blood cell progenitors, and separately that males can plastically vary their reproductive investment based on their perception of both numbers and quality of their competitors. How environmental temperature shapes life-history traits, development and sexual communication in crickets has been determined. Studies have also shown that genome architecture influenced by the protein CTCF may exert widespread allele-specific transcriptional effects in mammals. Research findings from the department also revisited the role of the Hofmeister effect in protein misfolding and aggregation associated with biological functions and disease.

In work from the Department of Chemical Sciences, the molecular design of luminescent discotic liquid crystals with desired properties of solid-state emission, mechanochromism and selective bio-imaging of HeLa cells was achieved. A general strategy for distinguishing conformationally distinct oligomers of Alzheimer's amyloid β-peptide using liquid crystals was also demonstrated. Two experimental set-ups, both as the first of their kinds in India, of ultrafast two- dimensional electronic spectroscopy and optical trapping with multimodal detection, have been designed and developed. Multichromophoric triads with appreciable electron mobilities, ratiometric temperature and multiple cation sensing through a redox mediated FRET turn-off mechanism were developed. Molecular rotors with Stokes' shifts > 200 nm were developed for temperature and viscosity sensing and their excited state dynamics deciphered through transient spectroscopy. A promiscuous proton transfer reaction property of cytochrome c, specifically in membrane-mimetic media, to exemplify the differential behavior of biomolecules in response to their surroundings was established. Liposome-bound alkaline phosphatase activity has been explored towards understanding of enzymatic behavior in complex crowded environments (mimicking cytoplasm-like environment) having a dampening effect in regular diffusive transport. Anisotropy in mechanical unfolding of protein upon partner-assisted pulling and handle-assisted pulling as a response to mechanical cues (to convey the signal for a plethora of biological processes in living organisms) has been investigated. It was shown that biomimetic cofactor (such as quinone) under a photochemical condition can be used as catalyst via one-electron pathway as opposed to traditional two-electron chemistry. A zinc-photocatalyst having long excited-state lifetime has been developed that can steer atom transfer radical addition reactions by single electron transfer to substrate molecules.

In the Department of Earth and Environmental Sciences, direct utilization of unpurified industrial CO2 for acetic acid production via microbial electrosynthesis has been demonstrated, a new process with immense potential. Considerable progress has also been achieved in developing low-cost technology based on integrated biological and bioelectrochemical processes for wastewater management at the household level. The occurrence, distribution, characterization and quantification of microplastics and phthalates from fresh water aquatic environment in the Indian Himalayas has been worked out, which provides an important baseline for the future investigations on their hazardous impact. A new emission inventory has been compiled for paddy stubble fire emissions and roadside transport exhaust emissions over India for all categories of air pollutants and more than 70 trace gases. That ozone production over

northwest India is sensitive to both volatile organic compounds (VOCs) and nitrogen oxides (NOx) has been established, which corrects an existing paradigm ozone production is only NOx-limited. It was shown that low-cost particulate matter sensors could be promising, but that they cannot be used without proper field calibration. Research on cloud resolving scale simulations to investigate the physical mechanism for generation of heavy to extremely heavy rainfall events in August 2018 over Kerala (during the southwest monsoon) has shown that suitable cloud microphysical schemes and realistic cloud-aerosol interactions are essential to predict such extreme rainfall events.

In the Department of Humanities and Social Sciences, a doctoral researcher in the archaeology and paleoanthropology lab discovered numerous fossilized ostrich eggshells (OES) for the first time in the Indian Siwalik Hills zone, which may be the oldest-known Pleistocene OES evidence in India.

Work at the Department of Mathematical Sciences has contributed to proof of Morel's conjecture on the A^1-invariance of the sheaf of A^1-connected components. A conjecture of Dochtermann on the spherical parking functions of certain graphs has been proved. The Alexander and Markov theorems for stable isotopy classes of immersed circles on surfaces have been established. Further, structural aspects of groups in this Alexander--Markov correspondence have been investigated, which include some very interesting families of Artin and Coxeter groups. In a related direction, link quandles have been shown to be residually finite, which implies that the word problem is solvable in these algebraic systems. A contribution has been made to generalization of an important result of Scott and Swarup on quasiconvexity of a subgroup of a hyperbolic 3-manifold group that fibers over a circle. Conjugation orbits of generic loxodromic isometries of the quaternionic hyperbolic space have been classified. Important progress has been made to understanding of the stability and local minimizing properties of various Riemannian functionals defined by L2-norms of several curvatures. Interesting connections between the abelianization of the group of units of the group ring and the underlying finite group have been established.

At the Department of Physical Sciences, a theoretically predicted microscopic non-linear analog of an Akhiezer damping mechanism was discovered in nano-beams of hydrogenated palladium. A quantum heat engine with two atoms was shown to yield maximum heat-to-work conversion efficiency (Carnot efficiency) beating quantum fluctuations. It was demonstrated that the spontaneous emission rate of a rapidly revolving atom in vacuum can be significantly amplified inside an electromagnetic cavity, to be readily observable with the technologies available, potentially testing one of the most fundamental prediction of modern physics that particles may not have independent existence free of their observers. In work focusing on a type of neural network that incorporates the symmetries and conserved quantities of Hamiltonian dynamics, it was shown that a successful prediction of motion even in nonlinear systems that are chaotic, is possible. Another work has shown that the expected number of exotic image forms in gravitational lensing to a set of clusters of galaxies has been vastly under-estimated in earlier calculations. Further, a new dilution fridge was installed which will be used for measurements of various quantum effects at temperatures down to 10 mKelvin.

The Technology Business Incubator (TBI) at IISER Mohali is working within the NISP initiative of MoE to transform and build deep impact across the start-up ecosystem through innovation knowledge and technology adoption, with support from the Department of Science and Technology. Currently seven technology-based startups are located in the incubation facility, whose work is on different innovative concepts ranging from algae-based air purification to bio-fermentation to AI based virtual platform.

In the following sections, I touch upon the awards and honours received by the faculty and students, as well as activities undertaken by the different Departments, during the reporting period.

With reference to the Department of Biological Sciences, the institute was ranked 4th in the Nature Index ranking among all the academic institutions in India in the field of Life Sciences in the year 2021. Prof. Prasad and Dr. Lolitika Mandal were elected to fellowship of the Indian Academy of Sciences and National Academy of Sciences (India), respectively. Prestigious research fellowships and awards this year have included the Ramalingaswami fellowship to Dr. Jogender Singh; Wellcome Trust/DBT-India Alliance Intermediate Fellowship to Dr. Indrajit Lahiri; POWER grant and SUPRA grant of SERB to Dr.

Lolitika Mandal and Prof. Samrat Mukhopadhyay, respectively; and a major grant from DBT to establish "Bioinformatics Center (BIC)" awarded to Drs. Kuljeet Sandhu, Shashi Bhushan Pandit and Monika Sharma. Appointments to Journal editorial boards have included Prof. Prasad as Associate Editor of Evolution; Dr. Samarjit Bhattacharyya at Journal of Neurochemistry and Frontiers in Molecular Neurosciences; Prof. Samrat Mukhopadhyay at Essays in Biochemistry and Journal of Cellular Biochemistry; Dr. Indranil Banerjee at Current Clinical Microbiology Reports; and Dr. Santosh Satbhai at Frontiers in Plant Science, Frontiers in Genetics, and BMC Plant Biology.

From the Department of Chemical Sciences, Dr. Santanu Pal's paper published in Journal of the American Chemical Society was selected for the ACS Select virtual issue (JACS young investigators 2020). Dr. Ramasastry received the 'RSC Research Fund' grant 2020. Dr. Debashis Adhikari and Dr. R. Vijaya Anand have been appointed as members of the Editorial Board of the journals Chemistry Open and Resonance, respectively. On the event of Departmental "Chem Day 2020" in October, 2020 the Department in association with the local chapter of Chemical Research Society of India (CRSI) organized a one-day virtual meeting on the theme "Chemistry at the Interface of Light, Matter and Life".

International recognition achieved by faculty members of the Department of Earth and Environmental Sciences have included the following. Dr. Sunil Patil was elected to the board of the International Society of Microbial Electrochemistry and Technology, was honored with the Applied Energy – 2020 highly cited paper award, and received a SERB-SUPRA individual research grant. He was also appointed as Associate Editor for the Microbiotechnology specialty section of several Frontiers group journals. Dr. Vinayak Sinha was appointed Scientific Steering Committee Member of the International Commission on Global Atmospheric Chemistry and Air Pollution. Dr. Baerbel Sinha was appointed to the editorial board of Environmental Science and Technology. Dr. Anoop Ambili has been appointed as group secretary of working group 1 in the Association of Quaternary Researchers and as Guest Associate Editor at Frontiers in Earth Sciences. Dr. Attada received the DST start-up grant, and was appointed as Review Editor of a specialty section of Frontiers in Climate. Dr. Chandrakant Ojha is an active member of the joint working group "Understanding the monsoon phenomenon from a geodetic perspective" of the Inter-Commission Committee on "Geodesy for Climate Research" at the International Association of Geodesy.

From the Department of Humanities and Social Sciences, Dr. Anu Sabhlok has been appointed to the Editorial Board of the journals Dialogues in Human Geography, Geopolitics and Geoforum. Dr. Debdulal Saha has been appointed as Associate Editor in the Indian Economic Journal. Dr. Ritajyoti Bandyopadhyay has been offered a Visiting Professor position in Centre for Modern Indian Studies (CeMIS), University of Göttingen, Germany.

Prof Kapil Paranjape from the Department of Mathematical Sciences has been appointed as a Council member of both the Indian National Science Academy and Indian Academy of Sciences; Dr. Sugandha Maheswary, an INSPIRE faculty of the department, has been selected as Core Committee-2021 member of the Indian Young Academy of Sciences. Dr. Mahender Singh co-organized an ICTS meeting on Knot theory, and Dr. Jotsaroop Kaur co-organized an NCM workshop. The third Inter IISER-NISER Mathematics Web meet to initiate research-oriented interactions among Departments of Mathematical Sciences across various IISERs and NISER was held in July 2020.

Faculty of the Department of Physical Sciences obtained the FIST grant for setting up Microwave Fabrication Facility. Prof. Kavita Dorai, Dr. Kamal Singh and Dr. Yogesh Singh were awarded STARS grants. Dr. Tripta Bhatia received the Ramalingaswamy Fellowship. Prof. Sudeshna Sinha is recipient of the prestigious J. C. Bose fellowship for a second time, and was also appointed on the editorial board of Pramana. Prof. Bagla has been appointed as member of (i) the working group and drafting group for the Astronomy and Astrophysics component of the Mega Science Vision-2035 Exercise for India, and (ii) the editorial Board of the journal Resonance. Dr. Aru Beri was awarded the Royal Society Newton International Alumni fellowship. Dr. Smriti Mahajan received the AWSAR award for science writing. Dr. Harvinder K. Jassal was elected to the International Astronomical Union. Colleagues working on QuST project organized an online conference on 'Quantum Foundations Technology and Applications 2020'.

Dr. Anosh Joseph co-organized an ICTS-TIFR international meeting on “Non-perturbative and Numerical Approaches to Quantum Gravity, String Theory, and Holography". Dr. Kamal Singh was granted an Indian Patent on a low-cost single-lens universal interferometer.

I am happy to record that the students and postdoctoral fellows of IISER Mohali have also won several laurels in the academic and research arenas during the past year. The list includes:

1. Deepinder Kaur (PhD) Garima Arya (PhD) and Sukrampal (PhD): Bill and Melinda Gates Foundation travel award to attend E Microbe Forum Conference
2. Jay Prakash Maurya, Shallu Dhingra, Krishna Moreshwar Shende, Sarbani Chatterjee, Srishti, Nischal Sharma (all PhD): Prime Minister’s Research Fellowship 2020.
3. Bankar Siddheshwar Kisan (PhD): SaiLife NOST best PhD thesis Award 2020.
4. Dr. Shubhash Chander (Postdoc): DS Kothari Postdoctoral fellowship; and selection as ACS Bridge Fellow by American Chemical Society.
5. Many students of MS 16 batch have received offers for PhD admission in universities of repute across the world.
6. Jayashree Mazumder (PhD): First runner–up at the Talk Your Thesis Competition of Indian Science Festival.
7. Ms. Swati Gavas (PhD): Third prize in the INYAS-International Sci-Art Image competition under the modelling and simulation category.
8. Dr. Sayak Basu (postdoc): INSA Young Scientist Medal 2020.
9. A start-up company called Scope set up by Saswat Pattnaik, Arpit Om Prakash and Bhavish Rajgopal (all BS-MS) and being incubated in the Technology Business Incubator of IISER Mohali has won a Rs. 15 Lakh grant in the competition Venture’21.

In the final section of this preface, I wish to outline how activities in the Institute have been both affected and influenced by the unprecedented COVID-19 pandemic. Teaching and student evaluations were done online for two consecutive semesters; for the undergraduate student batch that joined in December 2020, the second semester courses will be taught in the summer of 2021. The Institute has been reasonably successful in pursuing research activities in its labs during this period, including projects by the final year BS-MS students. All research students working in the labs, as well as undergraduate students with poor internet connectivity at home, have been permitted to stay in the hostels on campus.

Convocation 2020 was held as an online ceremony on 20 August 2020, although a promise has also been extended to the graduates that they are welcome to the Institute for any of the Convocations in the next three years to receive their degrees in person. During the year, the following new faculty have joined the institute: Drs. Jogender Singh (Biology), Vishal Bhardwaj and Tripta Bhatia (Physics), Chandrakant Ojha and Sourabh Bhattacharya (EES), Debdulal Saha (HSS), and Suman Barman (Chemistry).

The Institute was sanctioned 28 extramurally funded research projects (total sanctioned amount in excess of Rs. 30 crore). COVID-19 related research work is also being undertaken, such as on generation of neutralizing monoclonal antibodies, development of urea-based chemotherapeutic agents, and synthetic reconstruction of an attenuated SARS-CoV-2 virus for vaccine development. A diagnostic testing facility for COVID-19 (RT-PCR based) is functioning in the campus since July 2020 with the aid of faculty and student volunteers as well as support from the Government of Punjab and from DBT and ICMR of the Union Government.

With these words then, I commend the Annual Report to all its readers, and am confident that its contents will present an exciting picture of the Institute's achievements during 2020-21.

Thank you.

31 March 2021

Professor J. Gowrishankar
Director IISER, Mohali

1. Board of Governors

Dr. Renu Swarup
Chairperson
Secretary
Department of Biotechnology
Ministry of Science and Technology, Govt. of India
New Delhi

Secretary (DHE)
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Professor Jagdeep Singh
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Email: registrar@iisermohali.ac.in
(From 01-06-2020 to till date)

Sh. B. Nagarajan
Officiating Secretary & Registrar
IISER Mohali
Email: registrar@iisermohali.ac.in
(From 20-12-2019 to 31-05-2020)

2. Senate

Professor J Gowrishankar
Director, IISER Mohali, Sector 81, Mohali
Email: director@iisermohali.ac.in

Professor S. Bandyopadhayay
Director, ISI Kolkata

Professor Damodar Acharya,
Former Director, IIT Kharagpur

Professor Anand K. Bachhawat
IISER Mohali, Sector 81, Mohali

Professor Kapil Hari Paranjape
IISER Mohali, Sector 81, Mohali

Professor Sudeshna Sinha
IISER Mohali, Sector 81, Mohali

Professor Arvind
IISER Mohali, Sector 81, Mohali

Professor J. S. Bagla
IISER Mohali, Sector 81, Mohali

Professor P. Guptasarma
IISER Mohali, Sector 81, Mohali

Professor Sanjay Mandal
IISER Mohali, Sector 81, Mohali

Professor Kavita Dorai
IISER Mohali, Sector 81, Mohali

Professor Ramandeep Singh Johal
IISER Mohali, Sector 81, Mohali

Professor Chanchal Kumar
IISER Mohali, Sector 81, Mohali

Professor Kausik Chattopadhyay
IISER Mohali, Sector 81, Mohali

Professor N. G. Prasad
IISER Mohali, Sector-81, Mohali

Professor Samrat Mukhopadhyay
IISER Mohali, Sector 81, Mohali

Dr. Sanjay Singh
IISER Mohali, Sector 81, Mohali

Dr. Sanjeev Kumar
IISER Mohali, Sector 81, Mohali

Dr. Samarjit Bhattacharyya
IISER Mohali, Sector 81, Mohali

Dr. V. Rajesh
IISER Mohali, Sector 81, Mohali

Dr. Anu Sabhlok
IISER Mohali, Sector 81, Mohali

Dr. Santanu K. Pal
IISER Mohali, Sector 81, Mohali

Dr. S. Arulananda Babu
IISER Mohali, Sector 81, Mohali

Dr. Amit Kulshrestha
IISER Mohali, Sector 81, Mohali

Dr. Sugumar Venkataramani
IISER Mohali, Sector 81, Mohali

Dr. R. Vijaya Anand
IISER Mohali, Sector 81, Mohali

Dr. Abhishek Chaudhuri
IISER Mohali, Sector 81, Mohali

Dr. Baerbel Sinha
IISER Mohali, Sector 81, Mohali

Dr. Kamal Priya Singh
IISER Mohali, Sector 81, Mohali

Dr. Krishnendu Gongopadhyay,
IISER Mohali, Sector 81, Mohali

Dr. Ramesh Ramachandran
IISER Mohali, Sector 81, Mohali

Dr. Parth Chauhan
IISER Mohali, Sector 81, Mohali

Dr. Sunil Anil Patil
IISER Mohali, Sector 81, Mohali

Dr. P. Visakhi
IISER Mohali, Sector 81, Mohali

Dr. Manjari Jain
IISER Mohali, Sector 81, Mohali

Dr. Arunika Mukhopadhaya
IISER Mohali, Sector 81, Mohali

Dr. Lingaraj Sahu
IISER Mohali, Sector 81, Mohali

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(From 20-12-2019 to 31-05-2020)

3. Research Advisory Committee (till March 31, 2021)

Professor Arun Grover, Chandigarh (Chairperson)
Professor Hans-Gill, Emeritus Professor, CAS in Mathematics, Panjab University, Chandigarh
Professor T. R. Sharma, National Agri-Food Biotechnology Institute, Mohali
Professor Raghuram Rao Akkinepally, NIPER Mohali
Professor Kausik Chattopadhyay, Dean R&D, IISER Mohali Convener

4. Administration

Director	**Professor J. Gowrishankar**
Deputy Director	**Professor Sudeshna Sinha**
Registrar (Officiating)	**Sh. B. Nagarajan** (20-12-2019 to 31-05-2020)
Registrar	**Professor Jagdeep Singh** (since 01-06-2020)
Dean Faculty	**Professor J Gowrishankar**
Dean Academics	**Professor Jasjeet Singh Bagla**
Associate Dean Academics	**Dr. Sugumar Venkataramani**
Dean Students	**Dr. Anu Sablok**
Associate Dean Students	**Dr. Abhishek Chaudhuri**
Dean R&D	**Professor Kausik Chattopadhyay**
Associate Dean R&D	**Dr. R. Vijaya Anand**
Dean International Relations and Outreach	**Professor N. G. Prasad**
Librarian	**Dr. P. Visakhi**
Executive Engineer cum Estate Officer	**Shri Praveen Kumar Srivastava**
Sr. Medical Officer	**Dr. Gurpreet Singh**
Assistant Registrars	**Shri Sandeep Ahlawat**
	Shri Mukesh Kumar
Wardens	**Dr. Rhitoban Ray Choudhury**
	Dr. Ritajyoti Bandyopadhyay
	Dr. Neeraja Sahasrabudhe
	Dr. Sandeep Kumar Goyal
	Dr. Indranil Banerjee
	Dr. Baerbel Sinha
	Dr. Sanchita Sengupta
	Dr. Manjari Jain
	Dr. Santosh B. Satbhai
Veterinarian (Animal House)	**Dr. Chander Shekhar**
Scientific Officer/Computer Centre	**Dr. Paramdeep Singh Chandi**
Software Engineer/Computer Centre	**Ms. Garima Kaushik**
Software Assistant/Computer Centre	**Ms. Sangeetha Gurusamy**
Assistant Security Officer	**Shri Kamal Jeet**
Assistant Exe Engineer (Electrical)	**Shri Atul Kadwal**
Assistant Exe Engineer (Civil)	**Shri Rajiv Kumar**
Sr. Private Secretary (Director's Office)	**Ms. Amandeep Saini**
Sr. Personal Assistant (Registrar's Office)	**Ms. Poonam Rani**
Sr. Personal Assistant (Establishment Section)	**Ms. Yashoda**
Sr. Accountant	**Shri Sachin Jain**
	Shri Raman Kumar (on lien)
Accountant	**Shri Mansa Ram Gupta**

Office Superintendent	**Shri Arup Kumar Saha**
Sr. Library Information Assistant	**Shri Peeyush Dwivedi**
Office Assistants	**Ms. Kavita Pandey**
	Shri Charanjit Singh
	Shri Tarandip Singh
	Ms. Neena Kumari
	Ms. Deepika
Physical Education Instructor	**Shri Kirpal Singh**
Data Entry Operators	**Ms. Bhupali Sharma**
	Shri Sukhpreet Singh
Sr. Technical Scientific Assistants	**Shri Rakesh Kumar**
	Shri Ramesh Kumar
Sr. Scientific Assistants	**Shri Bhavin R. Kansara**
Scientific Assistants	**Shri Jayaraju Battula**
Technical Assistant	**Shri Triveni Shanker Verma**
Technical Assistant	**Shri Avtar Singh**
Lab Technicians	**Shri Anupam Pandey**
	Shri Mangat Ram
	Shri Tejinder Kumar
	(On Leave without Pay)
Lab Assistants	**Shri Prahlad Singh**
	Shri Balbir Singh
Staff Nurse	**Shri C. Periyasamy**
Peon	**Shri Bhopal Singh**

5. Faculty

5.1 Faculty Members

1. **Debashis Adhikari** (Assistant Professor, Chemistry)
Catalysis, Small Molecule Activation, M–L Multiple Bonding
2. **Anoop Ambili** (Assistant Professor, Earth & Environmental Sciences)
Paleoclimate and Geochemistry
3. **R. Vijaya Anand** (Associate Professor, Chemistry)
Synthetic organic chemistry
4. **Chandrakant S. Aribam** (Assistant Professor, Maths)
Number theory
5. **Arvind** (Professor, Physics)
Quantum information theory, Quantum optics
6. **Raju Attada** (Assistant Professor, Earth & Environmental Sciences)
Weather and Climate Modelling; Monsoon Dynamics
7. **S. Arulananda Babu** (Associate Professor, Chemistry)
Synthetic organic chemistry
8. **Kavita Babu** (Associate Professor, Biology)
Neurobiology (with lien)
9. **Anand K. Bachhawat** (Professor, Biology)
Glutathione and Sulphur Metabolism in Yeasts
10. **Jasjeet Singh Bagla** (Professor, Physics)
Cosmology, Astrophysics
11. **P. Balanarayan** (Assistant Professor, Chemistry)
Computational & Theoretical Chemistry
12. **Chetan T. Balwe** (Assistant Professor, Mathematics)
Applications of Homotopical Algebra to Algebraic Geometry
13. **Ritajyoti Bandyopadhyay** (Assistant Professor, Humanities and Social Sciences)
Urban History, Informal Economy and Infrastructure Studies
14. **Indranil Banerjee** (Assistant Professor, Biology)
Cellular Infectiology of Human Pathogenic Viruses
15. **Suman Kumar Barman** (Assistant Professor, Chemistry)
Bio-Inorganic Chemistry, Catalysis
16. **Vishal Bhardwaj** (Assistant Professor, Physics)
Experimental High Energy Physics: Exotic particles, Beauty and Charm physics
17. **Manabendra Nath Bera** (Assistant Professor, Physics)
Quantum Information and Quantum Physics
18. **Tripta Bhatia** (Assistant Professor, Physics)
Soft Matter & Biological Physics, Synthetic Biology
19. **Sourabh Bhattacharya** (Assistant Professor, Earth & Environmental Sciences)
Economic Geology, Granite metallogeny, Crustal fluids, Fluid inclusions
20. **Samarjit Bhattacharyya** (Associate Professor, Biology)
Neurobiology
21. **Samir Kumar Biswas** (Assistant Professor, Physics)
Problem, Instrumentation, microscope, PAT, Angiogenesis
22. **Rachna Chaba** (Associate Professor, Biology)
Bacterial Genetics and Physiology
23. **Dipanjan Chakraborty** (Associate Professor, Physics)
Soft Condensed Matter, Statistical Physics
24. **Kausik Chattopadhyay** (Professor, Biology)
Structure-Function Studies on Pore-Forming Protein Toxins
25. **Abhishek Chaudhuri** (Associate Professor, Physics)
Soft condensed matter physics
26. **Parth R. Chauhan** (Assistant Professor, Humanities and Social Sciences)

Paleoanthropology & Archaeology
27. **Rhitoban Ray Choudhury** (Assistant Professor, Biology)
Evolution, Genetics and Genomics
28. **Angshuman Roy Choudhury** (Assistant Professor, Chemistry)
X-ray Crystallography
29. **Adrene F. D'cruz** (Assistant Professor, Humanities and Social Sciences)
English Literature
30. **Arijit Kumar De** (Associate Professor, Chemistry)
Ultrafast non-linear spectroscopy and fluorescence microscopy
31. **Kavita Dorai** (Professor, Physics)
Biomolecular NMR, Quantum computing
32. **Shane D'mello** (Assistant Professor, Mathematics)
Topology of Real Algebraic Varieties
33. **Abhik Ganguli** (Assistant Professor, Mathematics)
Number Theory
34. **Jino George** (Assistant Professor, Chemistry)
Molecular Strong Coupling
35. **Krishnendu Gongopadhyay** (Associate Professor, Mathematics)
Groups, Geometry & Dynamics
36. **Samrat Ghosh** (Assistant Professor, Chemistry)
Materials chemistry
37. **Ujjal K. Gautam** (Associate Professor, Chemistry)
Functional nanomaterials and applications
38. **Sandeep K. Goyal** (Assistant Professor, Physics)
Quantum optics and quantum information theory
39. **J. Gowrishankar** (Professor, Biology)
(Director)
40. **Purnananda Guptasarma** (Professor, Biology)
Protein Engineering & Structural Biochemistry
41. **Manjari Jain** (Associate Professor, Biology)
Behavioural Ecology & Evolutionary Biology
42. **Anosh Joseph** (Assistant Professor, Physics)
Theoretical High Energy Physics
43. **Harvinder Kaur Jassal** (Associate Professor, Physics)
General Relativity and Cosmology
44. **Satyajit Jena** (Assistant Professor, Physics)
Experimental High Energy Particle and Nuclear Physics
45. **Ramandeep Singh Johal** (Professor, Physics)
Statistical Physics, Thermodynamics and Quantum Theory
46. **Rajeev Kapri** (Associate Professor, Physics)
Statistical Mechanics and Soft Condensed Matter Physics
47. **Jotsaroop Kaur** (Assistant Professor, Mathematics)
Fourier Analysis
48. **Tanusree Khandai** (Assistant Professor, Mathematics)
Lie Algebras and Representation Theory
49. **Amit Kulshrestha** (Associate Professor, Mathematics)
Quadratic forms, Central simple algebras and related structures
50. **Chanchal Kumar** (Associate Professor, Mathematics)
Algebraic Geometry and Combinatorial Commutative Algebra
51. **Sanjeev Kumar** (Associate Professor, Physics)
Condensed Matter Theory: Correlated electron systems, disordered systems
52. **Indrajit Lahiri** (Assistant Professor, Biology)
Molecular Mechanism of DNA replication
53. **Kinjalk Lochan** (Assistant Professor, Physics)
54. **Soma Maity** (Assistant Professor, Mathematics)

Riemannian geometry
55. **Alok Kumar Maharana** (Assistant Professor, Mathematics)
Algebraic Geometry
56. **Subhabrata Maiti** (Assistant Professor, Chemistry)
Bio-organic Chemistry, Molecular Self-assembly and Systems Chemistry
57. **Lolitika Mandal** (Associate Professor, Biology)
Hematopoiesis, Cardiogenesis and Molecular pathways in stem and progenitor cell development in Drosophila
58. **Sanjay Mandal** (Professor, Chemistry)
Organometallic Chemistry, Nanomaterials, and X-ray Diffractometry
59. **Sudip Mandal** (Associate Professor, Biology)
Mitochondrial regulation of cellular function
60. **Shravan Kumar Mishra** (Associate Professor, Biology)
RNA Splicing
61. **Arunika Mukhopadhaya** (Associate Professor, Biology)
Immunology
62. **Samrat Mukhopadhyay** (Professor, Biology/Chemistry)
Protein folding, Misfolding, Prion & Amyloid biology
63. **S. K. Arun Murthi** (Assistant Professor, Humanities and Social Sciences)
Philosophy of Science
64. **Chandrakanta Ojha** (Assistant Professor, Earth & Environmental Sciences)
65. **Santanu Kumar Pal** (Associate Professor, Chemistry)
Liquid Crystals, Interfacial Phenomena, Colloid and Gel Chemistry, Chemical and Biological Sensing, Nanoscale Science and Engineering
66. **Yashonidhi Pandey** (Assistant Professor, Mathematics)
Algebraic Geometry
67. **Shashi Bhushan Pandit** (Associate Professor, Biology)
Computational structural and systems biology, protein-ligand interactions, metabolomics
68. **Kapil Hari Paranjape** (Professor, Mathematics)
Geometry
69. **Sunil Anil Patil** (Assistant Professor, Earth & Environmental Science)
Environmental Microbiology and Biotechnology
70. **N. G. Prasad** (Professor, Biology)
Evolutionary genetics
71. **V. Rajesh** (Associate Professor, Humanities and Social Sciences)
History
72. **Sabyasachi Rakshit** (Associate Professor, Chemistry)
Single Molecule Manipulation & Imaging and Nanobiology
73. **Rajesh Ramachandran** (Associate Professor, Biology)
Cellular basis of tissue regeneration
74. **Ramesh Ramachandran** (Associate Professor, Chemistry)
Development of Solid-state NMR methods, Quantum mechanics
75. **Raj Kumar Roy** (Assistant Professor, Chemistry)
Polymer Chemistry
76. **Anu Sabhlok** (Associate Professor, Humanities and Social Sciences)
Feminist geography, Political-economy of contemporary India, Globalization, Identity (Gender and nation), Participatory Action Research, Ethnography
77. **Debdulal Saha** (Assistant Professor, Humanities and Social Sciences)
Labour Economics, Development Economics, Informal Economy, Public Policy
78. **Neeraja Sahasrabudhe** (Assistant Professor, Mathematics)
Theoretical and Applied Probability
79. **Lingaraj Sahu** (Associate Professor, Mathematics)
Operator Theory, Operator Algebras
80. **Kuljeet Singh Sandhu** (Associate Professor, Biology)
Systems Biology of Gene Regulation

81. **Pranab Sardar** (Assistant Professor, Mathematics)
Geometric Group Theory
82. **Santosh B. Satbhai** (Assistant Professor, Biology)
Plant genetics, plant stress physiology
83. **Sharvan Sehrawat** (Associate Professor, Biology)
Immunology and immunopathology
84. **K. R. Shamasundar** (Assistant Professor, Chemistry)
Quantum Chemistry
85. **Sanchita Sengupta** (Assistant Professor, Chemistry*)*
Functional Organic Material
86. **Mahak Sharma** (Associate Professor, Biology)
Cell Biology
87. **Goutam Sheet** (Associate Professor, Physics)
Condensed Matter Physics and Scanning Probe Microscopy
88. **Ambresh Shivaji** (Assistant Professor, Physics)
Particle Physics
89. **Kamal P. Singh** (Associate Professor, Physics)
Ultrafast Quantum Dynamics and Stochastic nonlinear dynamics
90. **Mahender Singh** (Associate Professor, Maths)
Topology and Groups
91. **Mandip Singh** (Associate Professor, Physics)
Quantum Optics and Bose Einstein Condensation
92. **Sanjay Singh** (Associate Professor, Chemistry)
Synthetic Inorganic and Organometallic Chemistry
93. **Yogesh Singh** (Associate Professor, Physics)
Experimental Condensed Matter Physics
94. **Jogender Singh** (Assistant Professor, Biology)
Cellular stress biology, innate immunity, C. elegans genetics
95. **Baerbel Sinha** (Associate Professor, Earth & Environmental Sciences)
Environmental Science
96. **Sudeshna Sinha** (Professor, Physics)
Nonlinear Dynamics, Chaos, Complex Systems, Networks, Computation
97. **Vinayak Sinha** (Associate Professor, Earth & Environmental Sciences)
Environmental Science: Atmospheric Chemistry Field Experiments
98. **Varadharaj R. Srinivasan** (Associate Professor, Mathematics)
Differential Algebra
99. **Sripada S. V. Rama Sastry** (Associate Professor, Chemistry)
Synthetic Organic Chemistry
100. **Vaibhav Vaish** *(*Assistant Professor, Mathematics)
Algebraic Geometry
101. **Sugumar Venkataramani** (Associate Professor, Chemistry)
Physical Organic Chemistry
102. **Ananth Venkatesan** (Associate Professor, Physics)
Mesoscopic Electronic & Electromechanical systems
103. **Ram Kishor Yadav** (Associate Professor, Biology)
Plant Developmental Genetics
104. **K. P. Yogendran** (Assistant Professor, Physics – *relieved on deputation*)
Quantum Aspects of Gravity

5.2 Honorary Faculty
1. **A.R. Ravishankara (**Professor, EES**)**
2**. Gautam Desiraju (**Professor, Chemistry**)**
3. **Raghvendra Gadagkar** (Professor, Biology) *Ecology*
4. **P. Balaram** (Professor, Biology) Biochemistry

5. **Mahesh Rangarajan** (Professor, HSS) History and Environmental Studies
6. **N. Sathyamurthy (**Professor, Chemistry**)**
7. Sabyasachi Bhattacharya (Professor, Biology**)**

5.3 Visiting Faculty
1. **Charanjeet Singh Aulakh** Visiting Faculty, Physics
2**. Kulinder Pal Singh** Visiting Faculty, Physics
3. **Sadhna Saxena** Visiting Faculty, Humanities and Social Sciences
4. **Srihari Keshvamurthy** Visiting Faculty, Chemistry
5. **Philose Koshy** Visiting Faculty, Humanities and Social Sciences

5.4 Adjunct Faculty
1. **Amitabha Joshi** (Biology)
2. **A. Pati** (Physics)
3. **Hriday Kant Dewan** (Physics)
4. **Pinaki Majumdar** (Physics)
5. **R. Murugavel** (Chemistry)
6. **Sarabjot Singh Anand** (Physics)
7. **Shiv Grewal** (Biology), Distinguished Investigator, NIH, USA
8. **Sarabjot Singh Anand** (Biology)
9. **T. Padmanabhan** (Physics), Distinguished Professor at the Inter-University Center for Astronomy and Astrophysics (IUCAA) at Pune

5.5 INSPIRE Faculty Fellows
1. **Aru Beri (**Physics)
2. **Debrina Jana (**Chemistry)
3. **Smriti Mahajan (**Physics)
4. **Monika Sharma (**Chemistry)
5. **Anirban Bose (**Mathematics)
6. **Sanjib De**y (Mathematics)
7. **Sugandha Maheshwary (**Mathematics)
8. **Sharmila Bhattacharya (**Earth & Environmental Sciences)

6 Events and activities: 2020-21

6.1 Meetings of Institute Bodies

During 2020–21, due to the COVID-19 pandemic, most of the meeting of Institute bodies took place through video conferencing (VC) mode or online platform. The following are the details.

Board of Governors Meetings	**39th Meeting of the BOG** (VC Mode)	**04.05.2020**
	40th Meeting of the BOG (VC Mode)	**18.08.2020**
	41st Meeting of the BOG (VC Mode)	**29.10.2020**
	42nd Meeting of the BOG (VC Mode)	**21.12.2020**
	43rd Meeting of the BOG (VC Mode)	**30.03.2021**

Finance Committee Meetings	**33rd Meeting of the Finance Committee** (VC Mode)	**04.05.2020**
	34th Meeting of the Finance Committee (VC Mode)	**18.08.2020**
	35th Meeting of the Finance Committee (VC Mode)	**29.10.2020**

Academic Senate Meetings	**39th Meeting of the Academic Senate** (LH 5)	**20.05.2020**
	40th Meeting of the Academic Senate (LH 5)	**18.06.2020**
	41st Meeting of the Academic Senate (VC Mode)	**16.07.2020**
	42nd Meeting of the Academic Senate (online mode)	**13.08.2020**
	43rd Meeting of the Academic Senate (online mode)	**16.12.2020**
	44th Meeting of the Academic Senate (online mode)	**06.01.2021**
	45th Meeting of the Academic Senate (online mode)	**22.03.2021**

6.2 Convocation 2020

Due to the COVID-19 pandemic, the Convocation 2020 was conducted through an online platform on August 20, 2020. The 9th batch graduated from IISER Mohali. Amongst a total of 240 students who received their degrees, 55 were PhD students. Programs where students graduated are: PhD, MS-PhD, MS, BS-MS, and BS. The Chairperson, Board of Governers, Dr. Renu Swarup presided over the function. Professor Gagandeep Kang (CMC Vellore) was the Chief Guest.

Prof. Gagandeep Kang is a scientist and medical microbiologist who has contributed immensely to research in the area of infectious diseases of the human gastrointestinal tract, especially those causing diarrhea in infants and children who live in tropical countries. Prof. Gagandeep completed her MBBS, MD and PhD degrees from the Christian Medical College, Vellore, and she runs a very successful research group and lab at CMC in clinical microbiology. Her research has provided major insights into major intestinal pathogens such as rotavirus, bacteria causing typhoid and dysentery, Campylobacter, and so on. Not only has her work in the lab been outstanding, Prof. Kang is also deeply immersed in public health research, and it is this combination of bench research and field research that have defined Prof. Kang's unique strengths and successes. Prof. Kang has made pioneering contributions to the development of rotavirus vaccine, which was a collaborative effort along with the late Prof. M.K. Bhan. Her research has also given us a clearer understanding of the intimate relationship between nutritional status and diarrheal diseases in children, especially in rural settings and in urban slums. She is also a role model for the medical students interested in research. Prof. Kang has received numerous awards and recognitions for her work. Amongst these the noteworthy ones are the Infosys Prize in 2016, and elections to Fellowships of the Indian National Science Academy and the Indian Academy of Science. Last year, Dr. Kang was elected as Fellow of the Royal Society, U.K.

Professor J. Gowrishankar presented the Director's report on the occasion. Mr. Kabeer Manali Rahul received the President's gold medal. Professor S N Kaul medal was presented to Mr. Yash Rana. Certificates of academic excellence were presented to Ms Tisya Banerjee, Ms Anjana R. Kammath, Mr. Kabeer Manali Rahul, Mr. Yash Rana and Mr. Hayman Gosain.

6.3 Foundation Day 2020

The IISER Mohali Foundation Day was celebrated on 27th September, 2020. The Foundation Day Lecture was delivered by Prof. Nitin Nitsure. The title of the lecture was '*What is curvature, and how to mold it?*'. Due to the COVID-19 pandemic, the whole program was conducted through an online platform.

Dr. Nitin Nitsure was born in Satara in 1957. Dr. Nitsure was with the TIFR, Mumbai, from 1980 to 2019. He is currently a free-lance researcher and writer, with wide interests not confined to any one discipline. In the past one year, he has authored research papers in Algebraic Geometry, Differential Geometry, Plastic molding and Developmental Biology. His current interests are the theory of moduli and political evolution in India. He is also an enthusiastic teacher of pure mathematics, and was conferred the Excellence in Teaching Award of TIFR in 2019.

6.4 Independence Day 2020

Independence Day 2020 was celebrated at IISER Mohali Campus. National Flag was hoisted by the Director, Professor J. Gowrishankar. CNR Rao foundation award and Academic Excellence awards were presented to the students by the Director on this occasion.

CNR Rao Foundation Prize

Reg. No	Name	Reg. No	Name
MS19004	Vasudev Mittal	MS19099	Nikhil Bansal
MS 19011	Utkarsh Bajpai	MS19117	James Watt
MS19064	Harsh Jain	MS19154	Akanksha Singh

Certificate of Academic Excellence for the Best performing students (2nd, 3rd & 4th year of BS-MS) in the 2019-20, 2nd semester:

MS18

Reg. No	Name
MS18035	Swapan Sasmit
MS18094	Abineet Parichha
MS18117	Akshay Shankar
MS18180	Aastha

MS17 Biology

Reg. No	Name
MS17006	Anjali Gupta
MS17019	Annant Bir Kaur
MS17030	Spatika C Jayaram
MS17033	Rajesh Kumar Sahu
MS17037	Astha Karwa
MS17040	Abhishek Dubey
MS17049	Geetika Aggarwal
MS17058	Devangi Sathe
MS17070	Jasmine
MS17133	Meesha Katyal

MS17 Chemistry

Reg. No	Name
MS17009	Abhishek Roy
MS17013	Anwita Chattopadhyay
MS17031	Roshan Nasare
MS17055	Praveen Bheraram Choudhary
MS17075	Sahil Sharma
MS17145	Rupali Singh
MS17159	Askanksha Kumari
MS17174	Harshit Jain
MS17178	Parbhat Kumar
MS17185	Aditi Aggarwal

MS17 Mathematics

Reg. No	Name
MS17069	Ramanujan Srihari
MS17123	Nilendu Das

MS17 Physics

Reg. No	Name
MS17036	Kaustav Chatterjee
MS17184	Aswini R

MS16 Biology

Reg. No	Name
MS16018	Soumyadip Poddar
MS16022	Harshath Amal
MS16028	Dipannita Ghosh
MS16046	Ardra Nandakumar
MS16063	Tekade Kimaya Nitin
MS16072	Hiral Gandhi
MS16074	Shagun Puri
MS16076	Nikhil C
MS16107	Liz Maria Luke
MS16124	Arpit Omprakash
MS16170	Cheshta Bhatia

MS16 Chemistry

Reg. No	Name
MS16034	Shradha Sapru
MS16051	Yashika Gupta
MS16083	Saumya Sebastian
MS16102	Sparsh Tyagi
MS16140	Pankaj Kumar Jangid
MS16182	Adarsh S Kurup

MS16 Mathematics

Reg. No	Name
MS16060	Gautam Neelakantan M

MS16 Physics

Reg. No	Name
MS16001	Kartik Chhajed
MS16036	Rahul Ramesh
MS16041	Upayan Roy
MS16099	Satyaoan Munshi

Certificate of Academic Excellence for the Best Performing Students (first & second year of Integrated PhD program) in the second semester of the academic session 2019-20

MP19 Biology

Reg. No	Name
MP19002	Walimbe Anuja Anand
MP19005	Anuraag Ghosh

MP19 Chemistry

Reg. No	Name
MP19014	Anshika Baghla

MP19 Mathematics

Reg. No	Name
MP19008	Pravin Kumar V

MP19 Physics

Reg. No	Name
MP19004	Abhishek Ranna

MP18 Biology

Reg. No	Name
MP18003	Tejal Hemant Pathak
MP18004	Ayush Jain
MP18013	Sanjeev Routh
MP18014	Koustav Ray
MP18017	Sugata Chaudhuri
MP18026	Saswata Bhattacharyya
MP18027	Syed Azeez Tehseen
MP18028	Anusha Sarbahi
MP18031	Pallavi Joshi

MP18 Chemistry

Reg. No	Name
MP18001	Shallu Dhingra
MP18023	Basundhra Dasgupta
MP18024	Ritobrata De
MP18025	Sukanya Dutta

MP18 Mathematics

Reg. No	Name
MP18010	Divya Setia

MP18 Physics

Reg. No	Name
MP18008	Mehak

6.5 Republic Day 2021

Republic Day of the Nation was celebrated in the Institute on 26th January 2021. Director, Prof. J. Gowrishankar hoisted the flag and gave away the prizes for the best academic performances in various academic programs. Following students receved the awards.

CNR Rao Foundation Prize for the Best Performance 1st Year Students of the BS-MS Programme (2020-21, 1st Semester)

Reg. No	Name
MS20024	Rabsan Galib Ahmed
MS20056	Sachin G Iyer
MS20098	Shreyas Jain
MS20130	Harsh Kashyap
MS20169	Abdul Gani
MS20175	Aprameyan Desikan
MS20220	Snigdha

Certificate of Academic Excellence for the Best Performing students (2nd, 3rd and 4th Year of BS-MS students) in the (2020-21, 1st semester)

MS19

Reg. No	Name
MS19029	Ritam Das
MS19045	Chinmayi Subramanya
MS19053	Radhika Rajendra

MS18 Biology

Reg. No	Name
MS18023	Abhilasha Jakhar
MS18060	Vishnu Soman
MS18083	Poonam Dhiman
MS18092	Tanvi Madaan
MS18099	Maia Lisa Dsouza
MS18123	Ayushi
MS18150	Yashvi Bhat
MS18153	Divyanshu Sahu
MS18165	Srishti
MS18171	Mitra Jayant Kulkarni
MS18194	Mirudula E
MS18212	Muskan kalra
MS18219	Maithily Somesh Hingmire

MS18 Chemistry

Reg. No	Name
MS18180	Astha

MS18 Mathematics

Reg. No	Name
MS18007	Himanshu N Tiwari

MS18 Physics

Reg. No	Name
MS18013	Arka Dutta
MS18094	Abineet Parichha
MS18117	Akshay Shankar
MS18118	Aalhad Abhay
MS18221	Suroj Dey

MS17 Biology

Reg. No	Name
MS17026	Barsa Das
MS17030	Spatika C Jayaram
MS17034	Achuthan Raja Venkatesh
MS17040	Abhishek Dubey
MS17049	Geetika Aggarwal
MS17070	Jasmine
MS17107	Sanat Mishra
MS17119	Aishwarya Ramya Viswamitra
MS17122	Jennifer John
MS17132	Bhavya Deepti Vadavalli
MS17133	Meesha Katyal
MS17176	Harshit Jain
MS17186	Aiswarya Sajeevan
MS17202	Akhil Ratan Mishra

MS17 Chemistry

Reg. No	Name
MS17009	Abhishek Roy
MS17113	Prateek Pranjal
MS17145	Rupali Singh

MS17 Mathematics

Reg. No	Name
MS17004	Sayan Chattopadhyay
MS17123	Nilendu Das

MS17 Physics

Reg. No	Name
MS17074	Ritoban Datta
MS17109	K S Swaparjith
MS17156	Dhruv Pathak
MS17184	Aswini R
MS17204	Abhinna Sundar Samantaray

Certificate of Academic Excellence for the Best Performing Students (first & second year of Integrated PhD program) in the first semester of the academic session 2020-21

MP20 Biology

Reg. No	Name
MP20001	Roopali Khanna
MP20014	Dhruba Chatterjee

MP20 Chemistry

Reg. No	Name
MP20002	Neetu

MP20 Mathematics

Reg. No	Name
MP20011	Anunoy Chakraborty

MP19 Biology

Reg. No	Name
MP19002	Walimbe Anuja Anand
MP19003	Aditya Biswas
MP19005	Anuraag Ghosh

MP19 Chemistry

Reg. No	Name
MP19014	Anshika Baghla

MP19 Mathematics

Reg. No	Name
MP19001	Deepanshi Saraf

6.6 Outreach Activities at IISER Mohali

We have a vibrant outreach culture at IISER Mohali. We have started a new series of talks called the IISER Mohali Public Outreach Talk Series. There have been seven talks so far in this series.

A science communications workshop called “How to tell your science story” was organised for students of IISER Mohali on 24th October 2020 and was conducted by noted science writer and communicator, Dr Anusha Krishnan.

In collaboration with Punjab Council for Science and Technology, we organised the National Science Day talk by Prof Raghavendra Gadagkar.

We have organised several teachers training sessions as part of the Vigyan Pratibha program. As part of outreach, we are coordinating the Prime Minister’s Research Fellowship. A total of 9 students from IISER Mohali have obtained the Fellowship. IISER Mohali was the National Nodal agency for the selection of PMRF candidates in Chemistry. This was carried out by the Department of Chemical Sciences, IISER Mohali along with a group of experts from around the country.

IISER Mohali has been a part of the KARYA program by DST, Govt of Rajasthan, which aims to provide research experience to undergraduate students.

IISER Mohali conducted an online Vigyan Manthan Yatra for about 600 students of Madhya Pradesh, in collaboration with Madhya Pradesh Council for Science and Technology

We have organised multiple virtual tours of IISER Mohali for more than 600 school students from Chandigarh.

IISER Mohali has been selected to be part of the Gender Advancement for Transforming Institutions (GATI) program of Department of Science and Technology, Govt of India, aimed at promoting the participation of women in STEMM areas through transforming institutional level practices.

6.7 Teachers’ Day 2020

The Best Teacher Award of IISER Mohali for the year 2020 was awarded to Dr. Adrene Freeda D'cruz (Dept. of Humanities & Social Sciences) & Dr. Shane D' Mello (Dept. of Mathematical Sciences) on Teachers Day, September 5, 2020 for their contributions to teaching. Prof. J. Gowrishankar, Director IISER Mohali presided over the function.

6.8 Students' Activities

The students of IISER Mohali enthusiastically participated in many sports activities organized by Sports department. Students show their great interest in the sports activities by participating in the different sports events like Intramural Tournament 2020 and Badminton Tournament 2021. We are successfully promoting Fit India Movement at our institute under the guidelines of Ministry of Youth Affairs with a huge number of participations in the events like Fit India Freedom Run and Fit India Cyclothon.

Approx. 200 students have participated in Intramural Tournament 2020. The list of the sports disciplines are given below: -

Athletics
Badminton
Lawn Tennis
Chess
Table Tennis
Basketball Men's
Basketball Women's
Football Men's
Football Women's
Kho Kho Men's
Cricket Men's
Cricket Women's
Volleyball Men's

Fitness Trainings: To increase the fitness and wellness of our students Aerobics and Yoga classes are also running successfully at institute. Students are highly motivated and taking the benefits of these classes to live a healthy life.

National Services Scheme and Bharat Scouts & Guides units were introduced in our institute in the year 2020. Almost 100 students are participating in NSS unit and 32 students in BSG unit.

Achievements and Participation outside IISER Mohali:

Ranbhoomi, Basketball Tournament organized by NIT, Kurukshetra Alumni Association: Girl's basketball team grabbed 2nd position in the year 2020.

Chandigarh Rapid Chess Tournament 2020 organized by Chandigarh Chess Association: Our student clinched 2nd position.

Tenacity: All IISER Games and Sports' Online sport competition: Our team stood Runner Up in "CS GO" event.

6.9 Cultural Activities

Revival fest: This was the largest event conducted in the year 2020-2021. It was hosted by IISER Kolkata. A committee of Cultural Secretaries was formed who coordinated the event. This online fest

was the temporary substitute for IICMI and all the IISERs along with institutes like IISc and CEBS came together online to conduct various cultural competitions including music, dance, photography, quiz and many more. The student participation from our institute was good and we also won many events. IISER Mohali won the dance competition and the photography event was hosted and managed completely by IISER Mohali photography club Lumiere convener Shounak Hinge.

The Biology club conducted the Darwin week online where various events and talks were organized.

Music club Aria: workshops were conducted for the fresher's covering Guitar, Harmonica, singing as well as piano.

For Teachers Day, a program was arranged by the students where they performed songs and dance as a tribute to the teachers. That program is also posted on the YouTube channel of IISER Mohali.

Many clubs have started their Instagram pages where they engage with the students as well as the outside audiences.

Manthan magazine has been doing pretty well this year and has released its issues that have interviews, articles, and illustrations by the students and faculty.

Rang club: An event called dooesta was arranged where participants had to create doodles and paintings on a given theme and the winners were given digital certificates.

7. Scientific Meetings/Conferences/Workshops

Vinayak Sinha
Title: Atmospheric Chemistry and Modeling Session, Earth Science Vertical, Vaishwik Bharatiya Vaigyanik Summit (VAIBHAV)
Name of the Organizers/Co-ordinators: Dr. Sachin Ghude (IITM Pune) and Dr. Vinayak Sinha (IISER Mohali), IITM Pune and MOES, India.

Brief description of the meeting: The Atmospheric Chemistry and Modeling Session (AS-040), VAIBHAV MEETING was held online on Oct 20, 2020 18:00- 20:30 hours with following additional panelists in addition to co-ordinators: Prof. A.R. Ravishankara (Colorado State University, USA), Dr. Duli Chand (Pacific Northwest National Laboratory, USA), Dr. Rao Kotamarthi (Argonne National Laborartory, USA) , Dr. Ranajit Talukdar (Earth System Research Laboratory, NOAA, USA), Dr. Pawan Gupta (NASA, USA) , Dr. Sudhanshu Pandey (Space research Organization of Netherlands, Holland), Dr. Rajesh Kumar (NCAR, USA), Ms. Chaitri Roy (IITM Pune).

In the opening remarks Indian panelist, Dr. Vinayak Sinha briefed about the current status of the Atmospheric Chemistry and Modeling research in India, what are the grey areas and what could be done to create strong foundation in atmospheric chemistry and modeling research in India through collaborations with Indian researchers abroad. Panelists were introduced and the following themes and points were flagged for topical discussions during the sessions. Thereafter short presentations were made by all panel experts. Key recommendations as an outcome of these were submitted to the Ministry of Earth Sciences for follow up with Government of India towards contributing to Atmanirbhar Bharat Mission.

Arijit K. De
Title: Chemistry at the Interface of Light, Matter and Life
Date: 17-October-2020
Name of the Organizers: Dr Arijit K De, Dr Sabyasachi Rakshit and Dr Ujjal K Gautam

Brief description of the meeting: On the event of Departmental "Chem Day 2020" on 17th October, 2020 (Saturday) the Dept of Chemical Sciences, IISER Mohali, in association with the Chemical Research Society of India [CRSI] (Local Chapter, Chandigarh/Amritsar) organized a one-day virtual meeting on the theme "Chemistry at the Interface of Light, Matter and Life". The purpose of this event was to bring together an active group of scientists who will share their insights in the rapidly growing diversities in Chemistry. The event was also broadcasted on Institute YouTube channel.

Amit Kulshrestha
Title: IISER-NISER Mathematics Webmeet 2020
Name of the Organizers: Department of Mathematical Sciences, IISER Mohali with committee consisting of Dr. Tanusree Khandai (Convenor), Dr. Soma Maity, Dr. Neeraja Sahasrabudhe, Dr. Vaibhav Vaish, Dr. Pranab Sardar, Dr. Krishnendu Gongopadhay.

Brief description of the meeting: The goal of Inter IISER-NISER Mathematics Meetings is to initiate research-oriented interactions and consequently collaborations between the faculty and postdoctoral fellows in the Departments of Mathematical Sciences across various IISERs and NISER. It also gives a platform for PhD students to showcase their work and interact with other researchers in related fields. Inter IISER-NISER webmeets were earlier held in 2017 at IISER Pune and in 2018 at IISER Bhopal, respectively. In 2020 a similar meeting was planned at IISER Mohali, however, due to the Covid-19 pandemic, the meeting was moved online. The webmeet was held during July 13-17, 2020. Professor D. S. Nagaraj (IISER Tirupati) and Professor Mainak Poddar (IISER Pune) were the plenary speakers. There were 30 invited speakers across seven parallel sessions in the research areas of Algebra, Harmonic Analysis, Number Theory, Probability & Partial Differential Equations, Algebraic Geometry, Operator Theory and Topology & Geometry. Besides, there was a panel discussion covering various aspects of online teaching and mathematical collaboration amid Covid-19 pandemic moderated by Dr. Amit Kulshrestha, Head, Mathematical Sciences, IISER Mohali. The webmeet had more than 200 registered participants from all IISERs and NISER.

Jotsaroop Kaur
Title: NCM online workshop in Harmonic Analysis
Name of the Organizers: Jotsaroop Kaur

Brief description of the meeting: This workshop was held online from 7 Dec, 2020 to 12 Dec, 2020. There were over 100 participants for this workshop from all over the country. This workshop was meant for graduate students who want to do research in analysis and related areas. We had three courses on current developments in Harmonic analysis. The speakers were Prof. K. Sandeep (TIFR CAM, Bangalore), Prof. Alessio Martini (University of Birmingham, UK) and Prof. Christoph Kriegler (Universite Clermont Auvergne, France).

Krishnendu Gongopadhyay
1. Title: IISER-NISER Math Meet, July 13—17, 2020.
Name of the Organizers: Tanusree Khandai, Soma Maity, Vaibhab Vaish, Neeraja Sahasrabudhe, Pranab Sardar, Krishnendu Gongopadhyay

Brief description of the meeting: The first and second inter IISER-NISER Mathematics Meetings (IINMM) were held in 2017 at IISER Pune and in 2018 at at IISER Bhopal, respectively.
The goal of these meetings is to initiate research-oriented interactions and consequently collaborations between the faculty and postdoctoral fellows in the departments of mathematical sciences at various IISERs and NISER. It also gives a platform for PhD students to showcase their works and interact with other researchers in related fields.
In 2020 a similar meeting was planned at IISER Mohali, however, due to the COVID-19 pandemic, the meeting has been moved online. The web-meet will be held from 13th to 17th July.

2. Title: Kalna College—TIMC Summer School, June 12—July 12, 2020
Name of the organisers: Krishnendu Gongopadhyay (IISERM) and Abhishek Mukherkee (Kalna College)

Brief description: In this "Summer School on Mathematics", there were several mini-courses that aimed to expose younger generation to several aspects of mathematics and convey the basic notions and ideas along with absolute mathematical precision wherever possible.

3. Title: Virtual Geometric Structures, May –December, 2020
Name of the organisers: Soumya Dey (IMSc Chennai), Krishnendu Gongopadhyay (IISERM), Arpan Kabiraj (IIT Palakkad)

Brief description: This was a semester long online lecture series by eminent experts from India and abroad. The aim was to keep discussions and expositions ongoing during the National lockdown. There were series of lectures in several topics related to the broad area of geometric structures that aimed to cover the basics and to provide an overview on that topic.

Mahender Singh
Title: ICTS Program Knots Through Web (online), 24--28 August 2020.
Name of the Organizers: Dr. Mahender Singh (IISER Mohali), Dr. Madeti Prabahakar (IIT Ropar) and Dr. Rama Mishra (IISER Pune)

Brief description of the meeting: Knots are fundamental objects of study in low dimensional topology and appear in diverse areas of sciences. Knot theory has seen tremendous progress in the recent years. The aim of this online program is to familiarise and enthuse younger researchers about the latest advances in the subject with a particular emphasis on computational aspects of (co)homological, combinatorial and polynomial invariants of knots.

Soma Maity
Title: IISER Mohali Geometry-Topology Seminars
Name of the Organizers: Dr. Soma Maity (Convenor), Dr. Shane D'Mello, Dr. Krishnendu Gongopadhyay, Dr. Pranab Sardar, Dr. Mahender Singh

Brief description of the meeting: This is a series of online seminars in the area of Topology and Geometry. Experts and leading mathematicians from various fields of topology and geometry were invited to give expository talks on their area of research. Students and researchers from various institutes including IISER Mohali participated in this activity.

Sugandha Maheshwary
1. Title: Mini-conference, International Mathematics Day
Name of the Organizers: Dr. Sugandha Maheshwary (jointly conducted with SPSTI)

Brief description of the meeting: An online mini conference was organized on the occasion of International Mathematics Day, i.e., March 14, 2021 in an online platform. Dr. Maheshwary acted as moderator as well as judge for declamation contest in the same. The event included lecture by eminent mathematician Prof. Rama Bhargava, Professor of Mathematics, former dean admin and member BOG at IIT, Roorkee. She talked on 'Exploring the potential of Mathematics'. This was followed with the speeches by shortlisted students of undergraduate, postgraduate and research scholars. These students were given topics in line of the themes of International Mathematics Day for the years 2020 and 2021. The event was jointly funded by INYAS (Indian National Young Academy of Sciences), INSA, New Delhi, whom I represented in the capacity of being a core-committee member (Secretary) and the SPSTI, (Society for Promotion of Science & Technology in India), with support from Haryana State Council for Science.

2. Title: All that you wanted to know about CORONA VACCINE
Name of the Organizers: Dr. Sugandha Maheshwary (jointly conducted with SPSTI)

Brief description of the meeting: INYAS, SPSTI and NASI (Chandigarh chapter) jointly conducted a week-long webinar series on the topic `All that you wanted to know about Corona Vaccine' during February 1-8, 2021. Four eminent scientists Prof. Javed N. Agrewala from IIT Ropar, Dr. Shravan Sehrawat from IISER Mohali Dr. R. Kumar, President of SPEAK India and: Prof. Rajesh Kocchar, Honorary Professor, Panjab University, Chandigarh threw light on various aspects of vaccination. The lecture in this vaccination awareness program were for connecting general public closely with researchers and help them understand about Vaccine

Ambresh Shivaji
Title: DPS Seminar Series
Name of the Organizers: Ambresh Shivaji, H K Jassal

Brief description of the meeting: We have organized a series of seminars where external speakers are invited to deliver talks on research topics relevant to the department. 11 such talks were organised during the last academic calendar year.

Anosh Joseph
1. Title: (Virtual) Shivalik HEPCATS Meeting - Summer 2020, IISER Mohali, July 30-31, 2020.
Name of the Organizers: Main Organizer: Anosh Joseph; Co-Organizers: Jasjeet Singh Bagla, Harvinder Kaur Jassal, Kinjalk Lochan, Ambresh Shivaji, and K. P. Yogendran.

Brief description of the meeting: The Shivalik HEPCATS Meeting series are intended to foster discussions and collaborations among researchers in and around the Shivalik range of the Himalayas. These meetings take place, ideally once every six months, at various institutes located in the region. The acronym HEPCATS stands for High Energy Physics, Cosmology, Astrophysics, Theory and Simulations. The organizers of the Shivalik HEPCATS Meeting — Summer 2020 were Jasjeet Singh Bagla, Harvinder Kaur Jassal, Anosh Joseph, Kinjalk Lochan, Ambresh Shivaji, and K. P. Yogendran. The speakers of the symposium were Rajesh Kumar Gupta (IIT Ropar), Ashish Kumar Meena (IISER Mohali), Amin Ahmad Nizami (Ashoka University), Md Sabir Ali (IIT Ropar), Shagun Kaushal (IIT Ropar), Avinash Singh (IISER Mohali), Manisha Kumari (NIT Jalandhar), Anjasha Gangopadhyay (ARIES Nainital), Sanat Tiwari (IIT Jammu), Hironori Hoshino (IIT Ropar), Rajesh Kumar (NIT Jalandhar), Navdeep Singh Dhindsa (IISER Mohali), Ayan Chatterjee (Central University of Himachal Pradesh), Himanshu Swami (IISER Mohali), Pinaki Roy (IISER Mohali), and Hemant Rathi (IIT Roorkie).

2. Title: (Virtual) Shivalik HEPCATS Meeting - Winter 2020, IISER Mohali, January 30, 2021.
Name of the Organizers: Main Organizer: Anosh Joseph, Co-Organizers: Jasjeet Singh Bagla, Harvinder Kaur Jassal, Kinjalk Lochan, Ambresh Shivaji, and K. P. Yogendran.

Brief description of the meeting: The Shivalik HEPCATS Meeting series are intended to foster discussions and collaborations among researchers in and around the Shivalik range of the Himalayas. These meetings take place, ideally once every six months, at various institutes located in the region. The acronym HEPCATS stands for High Energy Physics, Cosmology, Astrophysics, Theory and Simulations. The organizers of the Shivalik HEPCATS Meeting — Winter 2020 were Jasjeet Singh Bagla, Harvinder Kaur Jassal, Anosh Joseph, Kinjalk Lochan, Ambresh Shivaji, and K. P. Yogendran. The speakers of the symposium were Navdeep Singh Dhindsa (IISER Mohali), Rahul Sharma (IISER Mohali), Hironori Hoshino (IIT Ropar), Gopal Yadav (IIT Roorkee), Pramod Sharma (IISER Mohali), Ayan Chatterjee (Central University of Himachal Pradesh), Nitin Joshi (IIT Ropar), Mandeep Kaur (IISER Mohali), Ashish Meena (IISER Mohali), Md Sabir Ali (IIT Ropar), Jagbir Singh (Panjab University), Minati Biswal (IISER Mohali), and Arpith Kumar (IISER Mohali).

3. Title: (Online) Nonperturbative and Numerical Approaches to Quantum Gravity, String Theory, and Holography, ICTS-TIFR, Bangalore, India, January 18-22, 2021.
Name of the Organizers: David Berenstein (UCSB), Simon Catterall (Syracuse University), Masanori Hanada (University of Surrey), Anosh Joseph (IISER Mohali), Jun Nishimura (KEK Japan), David Schaich (University of Liverpool), and Toby Wiseman (Imperial College London)

Brief description of the meeting: The goal of the ICTS program 'Nonperturbative and Numerical Approaches to Quantum Gravity, String Theory and Holography' is to bring together theorists working in areas of lattice field theory, string theory and quantum gravity, to discuss the state of art nonperturbative methods and numerical approaches to tackle current and relevant research problems. The program has strong pedagogical component as it also aims to build a growing community of theoretical scientists in India, to engage more in nonperturbative field theories interconnecting string theory, supersymmetric/superconformal field theories, quantum black holes, gravity, and holography. The speakers of the program were Simon Catterall (Syracuse University, USA), Shailesh Chandrasekharan (Duke University, USA), Pau Figueras (Queen Mary University of London, UK), Daisuke Kadoh (National Center for Theoretical Sciences, Taiwan), Jack Laiho (Syracuse University, USA), Jun Nishimura (KEK, Japan), David Schaich (University of Liverpool, UK), Kostas Skenderis (University of Southampton, UK), Brian Swingle (University of Maryland, USA), Sandip Trivedi (TIFR, India), and Mithat Unsal (North Carolina State University, USA).

Aru Beri
Title: Observing Neutron stars through X-ray eyes
Name of the Organizers: Aru Beri (IISER Mohali), Rathnasree Nandi Vada (Director, Nehru Planetarium), Chetana Jain (Assoc. Professor at Hans Raj College, Delhi University)

Brief description of the meeting: This was National Science Day Celebrations through a half day workshop on Hands-on X-ray Astronomy. The workshop allowed participants to arrive at a beginner learning about neutron stars, and undertake some simple quantitative projects with X-Ray Astronomy data related to neutron stars. The workshop was conducted in an online mode (studio), we had more than 330 Youtube viewers (link given below). Students continued these projects after the workshop duration were constant touch with us via Whatsapp group and a few of them have also submitted their reports. https://youtu.be/rQ5OVSg_MhQ

Jasjeet Singh Bagla
1. Title: ISRC Online Symposium on Modelling spread of Covid-19 in India
Name of the Organizers: Jasjeet Singh Bagla, ISRC Modelling group.

Brief Description of the meeting: This was an online symposium of the ISRC (Indian Scientists Response to Covid) where different groups modelling the pandemic described their approaches and the lessons that can be learnt from these models in terms of policy choices for ending the lockdown in a controlled manner. The Symposium was held online on May 9, 2020 and a recording is available on the IISER Mohali YouTube channel.

2. Title: In Memoriam: Professor Govind Swarup.
Name of the Organizers: Jasjeet Singh Bagla, SPSTI, NASI (Chandigarh Chapter)

Brief Description of the meeting: Professor Govind Swarup had a long and productive career with many significant contributions to research and education in Astronomy and Sciences. He established several major facilities for radio astronomy research in India and also set up research groups to make the best use of these facilities and continue to develop these facilities. The three hour session was meant to provide an overview of Professor Govind Swarup's life, starting from a small village and his rise to the position of a renowned scientist. Different speakers provided a perspective on different aspects of his

life and achievements. This online meeting was held on September 20, 2020. A recording is available on the IISER Mohali YouTube channel.

3. Title: R C Gupta Endowment Lecture.
Names of the Organizers: Jasjeet Singh Bagla

Brief Description of the meeting: R C Gupta Endowment lecture of the Astronomical Society of India is a series of lectures on the history of astronomy. The lecture held on January 9, 2021 was given by Professor Mayank Vahia. Dean, School of Mathematical Sciences, Narsee Monjee Institute of Management Studies. The title of the lecture was *Origin and growth of astronomy in India*. A recording of this online session is available on the IISER Mohali YouTube channel.

4. Title: Generating realizations of distribution functions, and mock catalogs
Names of the Organizers: Jasjeet Singh Bagla, Nishikanta Khandai (NISER Bhubaneswar), Aseem Paranjape (IUCAA Pune).

Brief description of the meeting: This was a satellite workshop in the annual meeting of the Astronomical Society of India. In this day long workshop held on Feb.19, 2021, methods and techniques for generation of mock catalogs in general, and mock catalogs for galaxy surveys in particular were discussed. A recording of the lectures in the workshop is available on the IISER Mohali YouTube channel.

Kavita Dorai & Sandeep Goyal
Title: Quantum Foundations, Technology and Applications QFTA-2020
Name of the Organizers: Professor Kavita Dorai and Dr Sandeep Goyal

Brief description of the meeting: QFTA-2020 conference held during December 04-09, 2020 at IISER Mohali. The conference was held completely on an online platform and had around 200 participants, and around 60 eminent scientists from India and abroad delivered expert lectures

Ramandeep Singh Johal
Title: Quantum Foundations, Technologies and Applications' QFTA-2020,
Name of the Organizers: R.S. Johal (member of organizing committee)

Brief description of the meeting: Online international conference organised by IISER Mohali. The talks by international experts focussed on a broad spectrum of themes in quantum information processing, ranging from foundations of quantum mechanics, quantum entanglement and contextuality, quantum thermodynamics, quantum simulations and quantum algorithms, to physical implementations of quantum information processing protocols using various quantum technologies.

8. Research Activities

8.1. Department of Biological Sciences

8.1.1. Summary of the research work

Anand Kumar Bachhawat

Calcium channels (YVC1 and CCH1) in yeast S. cerevisiae are shown to be activated by Glutathionylation in our lab by specific enzymatic action. Activation of calcium channel YVC1 in response to oxidative stress is driven by the enzymatic glutathionylation of three critical cysteine residues (C17, C79, C191) catalyzed by GTT1 leading to opening and influx of calcium in cytoplasm. However, when the redox state of cell is back to normal, deglutathionyaltion of channel occur by thioredoxin (TRX2) deactivating the channel protein.

We have been investigating how GTT1 interacts with YVC1p. This is being done through mutational analsysis of GTT1 and YVC1, but also through a peptide array made of YVC1 protein peptides to find out which peptide fragment of YVC1 interact with GTT1. In the analysis of Yvc1p peptides interaction with Gtt1p, a number of peptides were detected to be interacting with Gtt1p. However, some were found to be moderately and strongly interacting based on fluorescence intensity (a.u). These are currently being assessed through mutational analysis and functional analysis.

In other projects in the lab, we have been attempting to identify inhibitors of the Chac1 protein involved in glutathione degradation through an in-silico analysis followed up by evaluation of the leads.

Arunika Mukhopadhaya

During an infection, the pathogen brings an arsenal of antigens with it to the host system. These antigens modulate the host responses in various ways. Understanding the role of various antigens in terms of their host-modulatory responses are important for designing the best therapeutic strategy or vaccine development, particularly in the context of emergence of multiple drug resistant strains. Research in our laboratory, is mainly focused on understanding the mechanism of host-modulatory responses by gram-negative enteric bacterial ligands/antigens. Our major goal is to look at the immune network, triggered by a single bacterial ligand on single cell-type aspect and also in vivo in multiple cell type's aspect.

Following are the major aims which we are currently working on:

1. Understanding the host-immunomodulatory responses by OmpU porin of human pathogenic Vibrio spp, such as, Vibrio cholerae, Vibrio parahaemolyticus, Vibrio vulnificus.
2. Understanding the host-cell death pathway triggered by OmpU porin of human pathogenic Vibrio spp.
3. Understanding the host immunomodulatory role of some of the traslocation effector proteins of Salmonella typhimurium.

Indrajit Lahiri

My group has been working towards understanding the molecular mechanism of organellar nucleic acid transactions in the human pathogen *Plasmodium*.

Indranil Banerjee

In the treatment of influenza, emergence of antiviral resistance due to continuous evolution of influenza viruses is a major clinical and public health concern. Currently, antiviral treatments against influenza viruses include the viral neuraminidase, polymerase and endonuclease inhibitors. However, widespread resistance to a neuraminidase inhibitor (oseltamivir) was observed among H1N1 viruses prior to the 2009 flu pandemic and resistance to other inhibitors was also reported in different clinical isolates. With the growing concern of potential for resistance to emerging influenza strains and the need for new generation anti-influenza drugs with a higher barrier to resistance, we, in collaboration with IIT Ropar, performed small molecule inhibitor screens, and identified several analogs of a urea-derivative compound that robustly blocked influenza virus infection in tissue culture cells. Some of the lead

molecules that emerged from our screens also showed protective effect against influenza virus in mice. Further, in collaboration with CSIR-IMTECH we tested the lead compounds against SARS-CoV-2 in tissue culture cells and found robust inhibition of infection, indicating that those molecules have potential for broad-spectrum antiviral activity. Currently, we are investigating the mechanism of action of the lead compounds and investigating which processes of viral infection are targeted by them. In parallel, we investigated the role of some host proteins (LIN7B, TXLNA, RAB43, and TRIM62) in influenza virus infection in transformed lung alveolar epithelial cells. Our results indicated that RNAi-mediated knockdown of LIN7B and TXLNA promoted IAV endocytic uptake, RAB43 facilitated uncleocapsid uncoating after fusion of the virus at late endosomes, whereas TRIM62 promoted IAV transcription. In addition, we performed two meta-analyses evaluating the role of IFN-γ gene polymorphism on clinical manifestations of dengue and assessing the effects of IL28B gene polymorphisms on PegINF-RVB-mediated HCV clearance in HIV-HCV co-infected patients. `

J. Gowrishankar

Topoisomerase I (Topo I) of Escherichia coli, encoded by topA, acts to relax negative supercoils in DNA. Topo I deficiency results in hypernegative supercoiling, formation of transcription-associated RNA-DNA hybrids (R-loops), and DnaA- and oriC-independent constitutive stable DNA replication (cSDR), but some uncertainty persists as to whether topA is essential for viability in E. coli and related enterobacteria. Our group has shown that several topA alleles, including ΔtopA, confer lethality in derivatives of wild-type E. coli strain MG1655. Viability in absence of Topo I was restored with two perturbations, neither of which reversed the hypernegative supercoiling phenotype: (i) in a reduced-genome strain MDS42, or (ii) by an RNA polymerase (RNAP) mutation rpoB*35 that has been reported to alleviate the deleterious consequences of RNAP backtracking and transcription-replication conflicts. Four phenotypes related to cSDR were identified for topA mutants: (i) One of the topA alleles rescued ΔdnaA lethality; (ii) in dnaA+ derivatives, Topo I deficiency generated a characteristic copy number peak in the terminus region of the chromosome; (iii) topA was synthetically lethal with rnhA (encoding RNase HI, whose deficiency also confers cSDR); and (iv) topA rnhA synthetic lethality was itself rescued by ΔdnaA. We propose that the terminal lethal consequence of hypernegative DNA supercoiling in E. coli topA mutants is RNAP backtracking during transcription elongation and associated R-loop formation, which in turn lead to transcription-replication conflicts and to cSDR.

Jogender Singh

Oxidation-reduction (redox) equilibrium is essential for cellular and organismal homeostasis. An increased amount of reducing equivalents leads to depletion of reactive oxygen species and creates reductive stress. Reductive stress is linked with several pathological conditions such as cardiovascular diseases, neurodegenerative diseases, etc. In an effort to characterize the reductive stress response, we studied the development of C. elegans on the reducing agent dithiothreitol (DTT). Surprisingly, we observed that the sensitivity of C. elegans development on DTT varied with different bacterial diets. The resistance to DTT on different bacteria appeared to correlate with the levels of vitamin B12 available in the different bacterial diets. We observed that supplementation of vitamin B12 on the E. coli OP50 diet enhanced resistance of C. elegans to DTT-mediated developmental arrest. We further observed that the effects of vitamin B12 on DTT resistance were specifically mediated through methionine synthase and not through methylmalonyl-CoA mutase. Vitamin B12 is involved in the conversion of homocysteine into methionine via methionine synthase. To understand the basis of vitamin B12 in providing resistance to DTT, we conducted a forward genetic screen for DTT-resistant mutants of C. elegans. We obtained 12 independent mutants and mapped the causative mutations by whole-genome sequencing. Interestingly, all the 12 mutants were alleles of a SAM-dependent methyltransferase. DTT enhances the expression of the identified SAM-dependent methyltransferase. Thus, our studies showed that DTT enhances methionine to homocysteine conversion via the identified SAM-dependent methyltransferase and causes toxicity. Hyperhomocysteinemia is known to cause ER stress, and thus, we tested whether DTT enhanced ER stress via accumulation of homocysteine. We observed that supplementation of vitamin B12 could, at least in part, relieve the DTT-mediated ER

stress. Our current studies provide a novel mechanism of modulation of the methionine-homocysteine cycle by DTT and challenge the current belief that DTT causes ER stress and exerts toxicity by reducing disulfide bonds in the ER.

Kausik Chattopadhyay

Our research activities remain focussed toward exploring the structure-function mechanisms of the pore-forming protein toxins (PFTs). PFTs are the unique class of proteins that are implicated in diverse biological processes ranging from bacterial pathogenesis to the inflammatory immune response generation. PFTs act by punching holes in the membrane lipid bilayer of the target cells that in turn permeabilizes the cell membranes, and eventually lead to cell killing. In one of our recent studies on Vibrio cholerae cytolysin, a potent bacterial PFT, we have shown how the structural rearrangement of the pore-forming motif is triggered in the presence of the membrane environment through involvement of the structural constraints in the hinge region of this motif. Our study suggests that the similar conserved mechanism could be operational in the structurally related members in the PFT family.

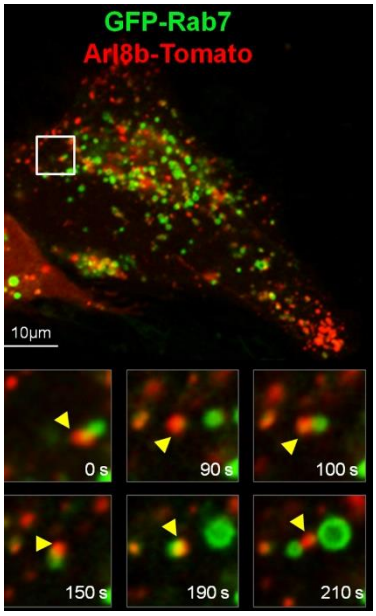
Kavita Babu

We were involved in understanding the role of an uncharacterized G-protein coupled receptor in sensing odour in the small nematode, C. elegans. We also went on to understand the role of a dopamine autoreceptor in maintaining locomotion of C. elegans in the presence of alcohol.

Lolitika Mandal

Our research group has been working on several projects that intends to unravel the signaling and metabolic requirement of stem cells/ progenitors and their niches. Using molecular genetic approaches, we have been striving to decipher the signaling crosstalk between different stem cell compartments during development and disease.

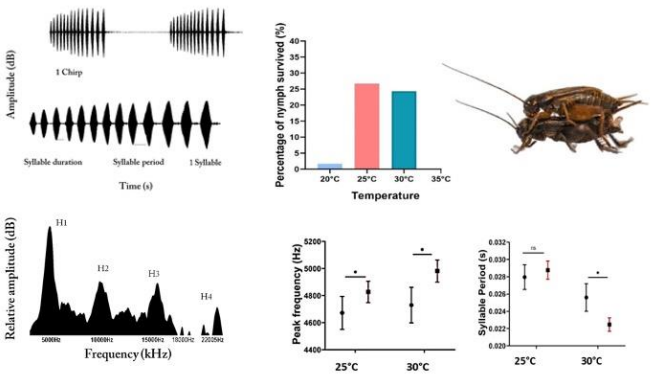
Mahak Sharma



The primary focus of my research has been to elucidate mechanisms regulating transport of proteins and lipids to subcellular compartment of the cell known as lysosomes. Cargo trafficking is a highly regulated and multistep process, which involves cargo sorting /packaging into vesicle, vesicle budding, motility, tethering, and finally, fusion with the target compartment. The small GTP-binding (G) proteins of Ras superfamily – Rabs, Arfs, and Arf like (Arl) GTPases play crucial role in this vesicular transport by orchestrating recruitment of their effectors on specific organelles/endosomes, which, in turn, mediate the downstream steps of vesicular transport. We have studied the function of an Arf-like subfamily small G protein, Arl8b that localize to late endosomes/lysosomes and regulate microtubule-based motility of lysosomes and fusion with other vesicular intermediates. We have now identified a novel interaction partner of Arl8b that regulates cargo receptor trafficking from early endosomes to trans-Golgi network. Depletion of this effector impairs the trafficking of this cargo receptor and thereby impairs delivery of lysosomal enzymes and therefore composition and function of lysosomes. [**Picture caption**: "The image is live-cell imaging of a human cells (HeLa cells) showing late endosomes in the cell (marked by GFP-Rab7) undergoing transient interactions with lysosomes (marked by Tomato-tagged Arl8b)"]

Manjari Jain

Crickets are nocturnal insects that communicate acoustically. Being insects, crickets are ectotherms and serve as a good model system to examine how environmental changes, especially temperature, impact the biology of an organism. We studied the life history traits, body morphometry, development and reproductive behaviour in crickets in relation to immediate ambient and rearing temperatures. While life history traits are a proxy for the survival of individuals, body morphometry and call characteristics in male crickets have been shown to be an important determinant of mate choice decisions. The study was conducted on a tropical field cricket, *Acanthogryllus asiaticus*. We found that the developmental temperature significantly impacted survival and development of the species. We also demonstrate, the independent as well as interactive effects of rearing and immediate ambient temperatures on features of the mating call of the species. This implies that not just the immediate environmental conditions, but the rearing environmental conditions can impact the behaviour of crickets in adulthood. Taken together, our findings elucidate the influence of temperature on the Darwinian fitness (both survival and reproduction) of this ectotherm.



N. G. Prasad

Our research has focussed on three major areas of male-female coevolution, density dependent selection and evolutionary ecology of immunity. We have shown the evolution of plasticity in male reproductive behaviour as a consequence of evolution under differential sexual selection. Our results suggest that density dependent selection acting on the larval stages can select for the increased expression of Hsp 70 gene, probably as a mechanism of ameliorating larval stress. We additionally show that adaptation to larval stress improves the ability of the adults to tolerate heat stress. We have successfully completed the world's first host-pathogen coevolution experiment using an insect host and a bacterial pathogen. The results indicate that the consequences of one-sided host evolution are very different from coevolution between host and pathogen. Hosts evolve to be more resistant to pathogens and the pathogens evolve to be more virulent. The virulence of the pathogen is generalisable, affecting even nonlocal hosts. This is important as it suggests that evolution against a particular host can make a pathogen more virulent to a wide range of hosts.

Rachna Chaba

My research group at IISER-Mohali is interested in identifying and characterizing new players and networks in bacterial metabolism, with a special focus on the metabolism of long-chain fatty acids (LCFAs) and sugar acids, carbon sources implicated in host-bacterial interactions.

LCFAs, carboxylic acids with a linear aliphatic chain of 12-20 carbon atoms, are an energy-rich nutrient source for several bacteria. Although LCFA metabolic pathway has been extensively studied, especially in E. coli, how LCFA metabolism affects bacterial physiology had not been investigated. We previously showed that LCFA degradation generates elevated levels of reactive oxygen species in E. coli and ubiquinone, an electron carrier in the electron transport chain (ETC), is a key antioxidant that mitigates LCFA-induced oxidative stress. More recently, we showed that an increased electron flow in the ETC during LCFA metabolism titrates ubiquinone, limiting its availability for disulfide bond formation in secreted proteins, thereby compromising envelope redox homeostasis. However, the Cpx envelope stress response pathway is activated which helps restore redox balance. Our work suggests that one of the mechanisms by which Cpx restores cellular homeostasis is by increasing the oxidizing power of ETC; whereas ubiquinone accumulates in LCFA-utilizing cells, this upregulation is prevented in a strain unable to induce Cpx response. We are currently investigating how Cpx regulates ubiquinone levels and the additional mechanisms by which this pathway maintains envelope redox homeostasis during LCFA metabolism.

E. coli uses a variety of sugar acids (oxidized derivatives of sugar) as carbon and energy source. Genome-scale studies in the last couple of decades have emphasized the importance of the metabolic pathway of a sugar acid, D-galactonate, in the interaction of enteric bacteria with their host. The transcriptional repressor, DgoR, negatively regulates the expression of the transporter and enzymes involved in D-galactonate metabolism. We recently established DgoR as a GntR/FadR family transcriptional regulator and identified its promoter, operator, effector and effector-binding cavity in a laboratory strain of E. coli. These fundamental studies have provided the basis to examine the influence of genetic variations in DgoR in natural enterobacterial isolates on host-bacterial interactions. Till now, we have identified four genetic variations amongst natural E. coli isolates which alter the sensitivity of the repressor to D-galactonate. We are currently investigating the effect of these variations on the growth of E. coli isolates in D-galactonate.

Rajesh Ramachandran

Rajesh Ramachandran's laboratory focussed on reprogramming of zebrafish Müller glia after the retinal injury. They have demonstrated the involvement of various pathways such as PTEN/PI3K/Akt, Shh and Tgf-β signaling; inevitability of pluripotency factors such as Oct4, cMyc and Lin28; importance of microRNAs such as let-7, miR-143/145, and miR-200a/miR-200b/miR-200c during retina regeneration.

Ram Yadav

Our current research work focuses on phytohormone auxin and cytokinin (CK). We are investigating how auxin biosynthesis is regulated by WUSCHEL. In this regard, our genetic studies have shown an interaction between auxin and its role in stem cell differentiation. In the context of CK, we have discovered the role of NAC domain transcription factor NAC062 in shoot maintenance. Plant lacking NAC062 are resilient to chilling stress. Further we show that NAC062 directly regulates the transcription of CK receptor and biosynthesis gene involved in CK signaling, thereby allows plant to maintain the shoot growth in normal condition. However, the continuous activation of CK signalling under abiotic stress leads to termination of shoot.

Samarjit Bhattacharyya

Cellular and molecular mechanisms of glutamate receptor trafficking in the central nervous system and its physiological implications

An essential requirement for maintenance of homeostasis in any living organism is the ability of cells to sense the external environment and, in the case of multicellular organisms, for cells to communicate with each other via mediators released into the extracellular milieu. In the brain, a variety of neurotransmitters and neuromodulators act on target receptors to activate cellular signaling events which transfer information from one cell to the next. Normal signaling depends on accurate localization of such receptors in specific regions of the cell, and the process of receptor trafficking plays a critical role in controlling this localization. Despite the obvious significance of this process, we still know very little about the protein machineries that mediate trafficking of neurotransmitter receptors in the brain, the regulatory events that control these protein machineries, and the functional consequences of these regulatory events. At this point research in our laboratory is directed to elucidate the cellular and molecular mechanisms that regulate the trafficking of (a) ionotropic glutamate receptors and (b) G-protein coupled receptors (GPCRs) in the central nervous system. These trafficking events are thought to be critical for various physiological processes. For example, glutamate receptor trafficking is believed to be involved in virtually all forms of experience-dependent plasticity including learning and memory. On the other hand, GPCR trafficking is believed to play crucial role in various physiological processes as well as in various neuropsychiatric disorders. Our laboratory employs multi-disciplinary approaches ranging from biochemistry and molecular biology to cell biology, imaging, and mouse genetics to address these questions.

Samrat Mukhopadhyay
The Mukhopadhyay laboratory is actively investigating the conformational characteristics of intrinsically disordered proteins that undergo liquid-liquid phase separation and amyloid formation involved in physiological functions and human diseases. His team has developed a new approach to perform ultrasensitive surface-enhanced Raman scattering of the prion protein via electrostatically tethering of highly charged intrinsically disordered terminus with surface-functionalized silver nanoparticles (Journal of Physical Chemistry Letters 2021). His previous studies on site-specific excitation energy migration via homoFRET illuminated the supramolecular architecture of amyloid fibrils particularly elucidating the fuzzy inter-filament interfaces that remained elusive via other high-resolution structural tools (Biophysical Journal 2020). Additionally, his findings published in the Journal of Molecular Biology (2020) presented a unique case to demonstrate that an interplay of electrostatic screening, charge-peptide interactions, and hydration, coupled with secondary events critically govern the course of a unique biphasic amyloid assembly kinetics that is governed by an intriguing dual Hofmeister effect. This observation reveals the unique role of Hofmeister ions in modulating the autocatalytic amplification process during amyloid formation. He has also written an invited feature article in the Journal of Physical Chemistry B (2020) summarizing his lab's work on the dynamic personalities of intrinsically disordered proteins in directing coupled binding and folding, aggregation, and phase separation.

Santosh B. Satbhai
How plant root development and growth is influenced and regulated by environmental signals is a major research question of our group. In particular, we focus on the effects of nutrient starvation, high temperature, cold temperature, salinity and drought on root system architecture (RSA) using Arabidopsis plants. We are applying forward/reverse genetics approach, transcriptomics approach, biochemical techniques, high-throughput phenotyping, Genome-Wide Association Studies (GWAS) and live imaging approaches to answer this question. As stress signalling pathways are evolutionary conserved, we also aim to translate knowledge gained from Arabidopsis to crop plants such as wheat, tomato and rice.

Sharvan Sehrawat
We are putting in efforts to investigate immune responses leading to immunity and immunopathology following virus infections. In last year we have developed an animal model for investigating Pestes des petits ruminants virus (PPRV) pathogenesis and the involvement of critical immune mediators responsible for protective and pathological roles following the virus infection. We also have generated a pseudovirus system for investigating the protective ability of in-house generated single domain antibodies against COVID-19 causing SARS-CoV2 and Dengue virus. We not only demonstrated the neutralizing potential of generated anti-SARS-CoV2 single domain antibodies from phage display libraries but also established their utility to decipher events in the virus biogenesis.

Shashi Bhushan Pandit
The excellent mechanical strength and toughness of spider silk are well-characterized experimentally and understood atomistically using computational simulations. However, a little attention has been focused on understanding whether the amino acid sequence of β-sheet nanocrystals, which is the key to render strength to silk fiber, is optimally chosen to mitigate molecular scale failure mechanisms. We have investigated the optimal design of silk β-sheets nanocrystals by building modeled structures of various representative small/polar/hydrophobic amino acid repeats. Subsequently, we measured the nanomechanical tensile strength and toughness using steered molecular dynamics by applying constant velocity pull to the central β-strand in the nanocrystal. These constant velocity pull experiments showed that the homopolymer of small amino acid (Alanine/Alanine-Glycine) sequence motifs, occurring in natural silk fibroin, have better nanomechanical properties than other modeled structures. The hydrogen bond and β-strand pull dynamics of modeled nanocrystals were analyzed to understand variation in rupture mechanisms and explore sequence-dependent mitigating factors contributing to mechanical

properties. Surprisingly, the enhanced side-chain interactions in homopoly-polar/hydrophobic amino acid models are unable to augment hydrogen bond cooperativity to increase mechanical strength. Importantly, we showed that nanocrystal of pristine silk sequence most likely achieves superior mechanical strength by optimizing side chain interaction, packing, and main-chain hydrogen bond interactions. In another work, we developed nomenclature of exon to facilitate modeling of alternative splicing (AS) events in eukaryotic genes. Since massive amount of alternative splicing data is mostly available only in the form of genomic coordinates, we have devised a nomenclature for exons from protein perspective to incorporate all possible instances when gene undergoes alternative splicing with changes at the level of exons. This was applied on various eukaryotic genomic sequences and is documented in a database. This will facilitate understanding on how structures accommodate changes in isoforms. In collaboration with experimental group, we studied allosteric behaviour of Vibrio cholerae cytolysin (VCC), a type of alpha-hemolysin.

Shravan Kumar Mishra

Intron-specific splicing and alternative splicing

Since coding parts of genes are often split by non-coding parts (called introns), splicing of precursor messenger RNAs becomes essential for gene expression. This process also promotes alternative splicing wherein more than one protein coding RNAs can be formed from each mRNA. During splicing, introns are recognised by various splice signals that include 5' splice sites, branch point, 3' splice sites etc. The diversity of these splice signals is crucial for regulated gene expression and alternative splicing. We have been studying the process of intron-specific splicing with the aim to understand how the choice of alternative splicing is made by the cell.

1. Mechanism of intron-specific splicing by the ubiquitin-fold-activated protein Sde2: Introns with longer gaps between branch point and 3' splice site is spliced poorly. This is because the excess RNA impedes the splicing machinery, the spliceosome. We demonstrate that pre-mRNA splicing involving such introns require the ubiquitin fold activated Sde2. We identify additional factors that help in splicing such introns. These include Cactin and Tls1. Human Cactin regulates innate immune response and Tls1 regulates telomere length. Our study elucidates a common molecular function of the proteins that are associated with distinct cellular processes.

2. Determinants of alternative splicing mediated via competing 5' splice sites: The cell employs multiple mechanisms of alternative splicing. What are the determinants of different types of alternative splicing are not known. An important mode of alternative splicing involves competing 5' splice sites which generates distinct mRNAs and we have studied protein and RNA determinants of this type of alternative splicing. This form of alternative splicing is completed by a set of RNA and protein splicing factors working at distinct stages of splicing. These include the core splicing factor Prp8 and the U5 and U6 small nuclear RNAs. The outcome of alternative splicing is determined by relative strength of pairing of U5 and U6 snRNAs to the competing 5' splice sites. This RNA-RNA paring is likely stabilized by the protein factors identified in our studies.

Sudip Mandal

Our laboratory aims to understand the mechanistic basis of metabolic control of cell biological processes during normal and pathophysiological conditions. For our studies we employ advanced genetic and molecular tools available in the model organism, Drosophila melanogaster. In one of the projects, we unraveled the signaling pathway by which systemic lactate levels trigger an interorgan communictaion ciruitry by which the adult pericardial cells regulate the expression of fat cell specific pericardin expression to modulate cardiac function in Drosophila. The manuscript is under review. Two other projects are poised to undertsand how altered metabolic conditions resulting from diet-induced type 2 diabetic conditions impact the cardiac function and behaviour of adult cells. Specifically, we are analysing the efects on intestinal stem cells and female gerline stem cells. Finally, in another project we are investigating whether the differentiating blood cells of the developing lymph gland (the larval hematopoietic organ of flies) have any metabolic control on the state of the hematopoietic niche under

normal developmental conditions as well as during leukemic conditions. This project is funded by SERB, DST.

8.1.2. Visits of the faculty members

J. Gowrishankar

— Centre for DNA Fingerprinting and Diagnostics, Hyderabad – five visits (06 to 14 June 2020; 01 to 08 August 2020; 19 to 27 September 2020; 13 to 22 November 2020; and 01 to 16 January 2021)

Kavita Babu

— Indian Institute of Science (IISc), Bangalore: May 2019- present (on lien from IISER Mohali)

8.1.3. Talks delivered

Anand K Bachhawat

— Anand K Bachhawat. International Webinar on "Dynamics of Microbes and Plants (WDMP-2021)" and delivered an invited lecture. The Webinar was organized on February 22-23, 2021 by the Centre of Advanced Study in Botany, Institute of Science, Banaras Hindu University, Varanasi, India.

— Anand K Bachhawat. Glutathione Degradation revisited at IISER Kolkata, Dept. of Biology on March 6, 2021.

— Anand K Bachhawat. Synthetic Biology for Complex Chemical Synthesis: The Artemisinin Story on March 18 at Summer school (Synthetic Biology) from March 16-29 2021, GNDU, Amritsar.

— Anand K Bachhawat. Synthetic Genomics & The Quest for the Minimal Genome. March 19 at Summer school (Synthetic Biology) from March 16-29 2021, GNDU, Amritsar.

Arunika Mukhopadhaya and lab members

— Arunika Mukhopadhaya. Modulation of host cellular responses by Gram-negative bacterial ligand Vibrio cholerae OmpU. Cell and Molecular Biology Seminar Series (Online). IISER Kolkata. 28th November, 2020.

— Arunika Mukhopadhaya. Viral vaccine and Covid-19. Webinar on "human-virus interaction: present and future perspective". Department of Botany in collaboration with IQAC, Sonamukhi College, Bankura, West Bengal. 26th August, 2020.

Indranil Banerjee

— Indranil Banerjee. "Coronavirus crisis: are we seconds closer to midnight of the Doomsday Clock?" Invited talk at Amity University, Noida, UP, during 09/05/2020.

— Indranil Banerjee. "Dealing with COVID-19 crisis" Invited talk at Scottish Church College, Kolkata, during 02/07/2020.

— Indranil Banerjee. "Understanding the mechanisms of SARS-CoV-2 infection" Invited talk at Guru Govind Singh College, Chandigarh, during 16/12/2020

Kausik Chattopadhyay

— Kausik Chattopadhyay. Curious case of pore-forming toxins: the w(hole) story. Virtual guest lecture series. Amity University of Biotechnology. Amity University Kolkata. 4th December, 2020.

Kavita Babu

— Kavita Babu. Drinking and dopamine: what's the connection? Monsoon Brain Meeting (virtual meeting). 24-26, June 2020.

— Kavita Babu. Drinking and dopamine: what's the connection? Invited talk on the Biomics platform (virtual talk). 06, Dec. 2020.

— Kavita Babu. Maintaining Acetylcholine Receptors: What have Claudins got to do with it?

— Invited talk at St. Joseph's College, Trichy, Tamil Nadu (virtual talk). 16, Feb., 2021.

— Kavita Babu. Drinking and dopamine: what's the connection? Invited talk at Temasek Life Science Laboratory (TLL), Singapore (virtual talk). 26, Feb. 2021.

Lolitika Mandal

— Lolitika Mandal. Blood cell development: Lessons learned from Drosophila, Biology Series, IISER Thiruvananthapuram, 30th October 2020.

— Lolitika Mandal. To or not to differentiate: Nexus between Blood cells and Fatty acid oxidation. "BioNext 2021; Frontiers in Modern Biology", Adamas University Kolkata, 24th April 2021
— Lolitika Mandal. Blood cell development: Lessons learned from Drosophila, Anniversary General Meeting, NASI Chandigarh Chapter, 12th March 2021.

Mahak Sharma and lab members

— Mahak Sharma. "Regulation of lysosome positioning and cargo trafficking by small G protein Arl8b", Thirsting for Theoretical Biology 2021, 12th January 2021.
— Shalini Rawat. "Rabip4' interacts with Arl8b and mediates retrograde trafficking from endosomes to the trans-Golgi network", American Society for Cell Biology, 6th December 2020.
— Mahak Sharma. "Nobel Prize in Chemistry 2020", Society for Promotion of Science & Technology in India (SPSTI) and the Chandigarh Chapter of National Academy of Sciences, India (NASI), 05th December 2020.
— Mahak Sharma. "Location, Location, Location: mechanisms regulating intracellular protein trafficking", She Inspires: a CSIO-INYAS webinar series for girl students in STEM, 21st November 2020.
— Mahak Sharma. "Regulation of lysosome positioning and cargo trafficking by small G protein Arl8b", Biological Sciences and Bioengineering Department at IIT Kanpur, 29th July 2020.
— Mahak Sharma. "Understanding the biology of SARS-CoV2 and how it causes infection", Manav Rachna International Institute of Research and Studies, 4th June 2020.
— Mahak Sharma. Understanding COVID-19 and remedial measures: how to protect from the Virus, Let's Talk Science: What, Why, and How?" organized by CSIR-CSIO (Chandigarh) in collaboration with INYAS, INSA, 18th April 2020.

Manjari Jain and lab members

— Manjari Jain. Small birds, big repertoires. Indian National Young Academy of Sciences. 31st May 2020.
— Manjari Jain. Animal Architects. Nature Conservation Foundation. 28th June 2020.
— Manjari Jain. Fish in troubled waters: how do zebrafish forage in high turbid conditions? CPDHE, UGC; University of Delhi. 30th October 2020.
— Manjari Jain. Methods in Ethology: bioacoustics for behaviour. National Institute of Advanced Studies, Bangalore. 12th January 2021.
— Manjari Jain. Understanding the living world: natural history, ecology and animal behaviour. Vigyan Manthan. Madhya Pradesh Council for Science and Technology. 23rd January 2021.
— Manjari Jain. Making sense of animal sounds. Bioacoustics as a tool to study biology. PGSC. 28th February 2021.
— Manjari Jain. The secret world of nocturnal insects. NPTEL. 30th March 2021.

N G Prasad and lab members

— Aparajita*, Aabeer Basu, Biswajit Shit, Tejashwini Hegde, Nitin Bansal, N. G. Prasad. Jack of all trades or master of one: Cross-reactivity in Drosophila populations experimentally evolved against bacterial pathogens. Ecological immunology workshop 2020: Resistance, tolerance & symbionts. Free University of Berlin.
— Aparajita*, T. Hegde, A. Basu, A. Chauhan, P. Das, N. Bansal, N. G. Prasad. Generalized immunity of immune evolved flies: Dealing with two pathogens at a time. OIKOS Denmark 2021, Denmark. March 2021.

Rajesh Ramachandran

— Invited lecture by Rajesh Ramachandran in a Faculty Development Program on the topic "Advancements in Biotechnology and Nanotechnology" is jointly being organized by UIET, Panjab University and GCET Jammu from 21st Sept-26th Sept 2020.

Ram Yadav and lab members

— WUSCHEL dynamically regulates auxin biosynthesis to promote stemness and progenitor cell differentiation in the shoot apical meristem of Arabidopsis. SLS'20: Pluripotency in Plant Development; 22-25 September, 2020

Samrat Mukhopadhyay

— Samrat Mukhopadhyay. Title of the talk: The Dynamism of Intrinsically Disordered Proteins in Phase Separation. Name of the Conference/Institute: IDP Seminars organized by Alex Holehouse (Washington University School of Medicine, USA) & Magnus Kjaergaard (Aarhus University, Denmark). Date: 09-07-2020.

— Samrat Mukhopadhyay. Title of the talk: The Role of Intrinsic Disorder and Dynamics in Biological Phase Transitions. Name of the Conference/Institute: Molecular Bases of Proteinopathies organized by Joan-Emma Shea (University California Santa Barbara, USA), Magdalena Ivanova and Ayyalusamy Ramamoorthy (University of Michigan, USA). Date: 09-07-2020.

Santosh B. Satbhai

— Santosh B. Satbhai. Underground Tuning: The Genetic Bases of Natural Variation for Iron Homeostasis and Root Growth. Webinar series on developing tools for sustainable crop development, organized by Durham University, UK. (27 – 29th May 2020).

Sharvan Sehrawat

— COVID 2019 Pandemic, Its Impact, Human Resistance and Immunity and Possible Future Management: A logical approach. Faculty development program at National Institute of Teachers Technical Training and Research, Chandigarh. August 19, 2020.

— A logical approach to manage COVID-19: Is there any? Faculty development program at University Institute of Engineering and Technology, Panjab University, Chandigarh. September 23, 2020.

— Harnessing the power of your immune system for personal and public health as it relates to COVID19. Expert lecture, Society for Promotion of Science and Technology Innovation. 6th Feb 2021.

— Therapeutic single domain antibodies to manage viral infection. Lead paper, Society for Immunology and Immunopathology. 19th Feb 2021.

— Generation of anti-viral nanobinders to reduce COVID-19 infectivity and beyond! International Conference on "आत्मनिर्भर भारत": Technological Transformation and Preparedness in the Post COVID World". Held at DCRUST Murthal on March 22-23, 2021.

8.1.4. Conferences attended by the researchers

Indranil Banerjee

— Winter Symposium 2021: Research in Biological Sciences (Organized by the J. C. Bose University of Science and Technology, YMCA, Haryana) Interplay between influenza a virus and host factors: an emerging paradigm for antiviral drug development, 22 January, 2021.

Kavita Babu and lab members

— Pratima Pandey. An excitatory GABA receptor, EXP-1 switches odor preference and regulates metabolic plasticity in C. elegans. Monsoon Brain Meeting (virtual meeting). 24-26, June 2020.

— Nagesh Kadam. The G-protein coupled receptor SRX-97 is required for concentration dependent sensing of benzaldehyde in C. elegans. Monsoon Brain Meeting (virtual meeting). 24-26, June 2020.

Mahak Sharma and lab members

— Mahak Sharma. “Thirsting for Theoretical Biology 2021”, 11th - 22nd January, 2021.

— Mahak Sharma. “Cell Bio Virtual 2020: An Online ASCB/EMBO Meeting”, 05th – 9th December, 2020.

— Shalini Rawat. “Cell Bio Virtual 2020: An Online ASCB/EMBO Meeting”, 05th – 9th December, 2020.

— Mahak Sharma. “She Inspires: a CSIO-INYAS webinar series for girl students in STEM”, 21st November – 23rd November, 2020.

— Mahak Sharma. “Autophagy, Lysosomes, and Membrane Trafficking: Mechanisms and Diseases”, 15th October – 6th November, 2020.

Manjari Jain and lab members

— Sonam Chorol and Manjari Jain. Phonological syntax in the breeding song of Purple Sunbird. National Symposium on Avian Biology. Haridwar. 31st March 2021.

Ram Yadav and lab members

— SLS'20: Pluripotency in Plant Development; 22-25 September, 2020, online symposium organized by the Sainsbury laboratory Cambridge University UK.

Sharvan Sehrawat

— Sharvan Sehrawat. Generation of anti-viral nanobinders to reduce COVID-19 infectivity and beyond! International Conference on "आत्मनिर्भर भारत": Technological Transformation and Preparedness in the Post COVID World". Held at DCRUST Murthal on March 22-23, 2021.

Shravan Kumar Mishra and lab members

— Shravan Kumar Mishra (poster presentation), Annual Meeting of the RNA Society, May 26-31, 2020

8.2. Department of Chemical Sciences

8.2.1. Summary of the research work

Arijit K. De

The central theme of research is to explore, through a combination of theory and experiments, a wide range of problems in condensed phase dynamics with applications in chemistry, biophysics and condensed matter physics. For this, the group has developed some cutting-edge spectroscopic tools and his group is the first (and so far, the only group) in India to develop and implement these novel techniques (for example, sub-20 fs broadband pump-probe spectroscopy, two-dimensional electronic spectroscopy, time-resolved impulsive stimulated Raman spectroscopy, multimodal optical tweezers, etc).

More specifically, during the one year, the main focus of the group has been to investigate energy and charge (electron or proton) transfer dynamics, covering a wide range of timescales (few tens of femtoseconds to few tens of nanoseconds), within a variety of systems and the effect of local environment (for example, solvation, nanoscale confinement, etc) on it:

1) Molecular aggregates: Excitation energy transfer within multichromophoric light-harvesting systems
2) Photovoltaic systems: Exciton/charge (electron and hole) transfer within quantum dots and perovskites
3) Fluorescent proteins: Photocycle, photoconversion and photoswitching in fluorescent proteins
4) Structural dynamics: Structural evolution of chromophores in ground and excited electronic states
5) Solvation dynamics: Initial regime of polar solvation in bulk and confined medium

They extensively use ultrafast (<20 femtosecond resolution) broadband (400 nm to 1 μm) pump-probe (transient absorption) spectroscopy. They constructed a two- dimensional electronic spectroscopy (2DES) set-up using an acousto-optic programmable dispersive filter (AOPDF) pulse shaper for exquisite phase stability. Quite recently, they have also started working on pump-dump-probe spectroscopy to capture dynamics involving transient ground states and built a time-resolved impulsive stimulated Raman spectroscopy (TR-ISRS) set-up to further explore structural dynamics in electronic excited state.

The group also pioneered in deciphering the nature of:

6) Nonlinear force in femtosecond optical trapping.

For this, they designed and built a versatile optical tweezer (OT) set-up having multimodal detection capabilities to explore non-linear optical effects in laser trapping under femtosecond pulsed excitation; for this they have also developed analytic theoretical models to numerically simulate force/potential. Quite interestingly, the Nobel Prize in Physics in 2018 was awarded “for groundbreaking inventions in the field of laser physics" with one half for “optical tweezers and their application to biological systems”, the other half for “method of generating high-intensity, ultra-short optical pulses.” Dr De’s group made the very first attempt to build a bridge between these two different areas. Recently, they have integrated laser beam shaping (using a 2D LC-SLM) to build a holographic optical tweezer (HOT)

set-up for exploring long-range interaction between trapped particles in an array leading to emergence of collective phenomena.
Notably, the work on isolating distinct ultrafast excited-state relaxation pathways, polar solvation VS isomerization probed by two-dimensional electronic spectroscopy (The Journal of Physical Chemistry B, 6825-6834, 124 (31), 2020) was featured in the *Virtual Issue on Ultrafast Spectroscopy* in The Journal of Physical Chemistry B) and the work on optical trapping under femtosecond pulsed excitation using multimodal laser tweezers (Applied Physics Letters, 161102 (1-6), 117 (16), 2020) was cited in *Nature Index 2021*.

Debashis Adhikari
Adhikari's group is involved in synthetic inorganic/organometallic chemistry. They are keenly interested to develop new redox-active ligands to develop vase metal catalysts, where the tandem operation of both metal and redox-responsive ligand will be feasible. Along that direction they have made significant progress. Leveraging on the 2e/2H+ redox process of a azo/hydrazo redox couple they have studied a whole host of dehydrogenation reactions. The successful dehydrogenation reaction also led to an array of heterocycle synthesis. Many of the reaction mechanism studied by them closely mimic the natural enzymes, which brings new knowledge in the biomimetic chemistry.

Jino George
Molecular Strong Coupling (MSC) Group:

Our group is a pure interdisciplinary, focus mainly on two aspects:
1. Polaritonic chemistry:

Here, the major thrust is given to understand the effect of strong light-matter interaction that can control chemical reactions. Last year we have explored the effect of vibrational strong coupling (VSC) on biomolecular reactions. We found that enzymatic reactions can be controlled by coupling water O-H vibrations to cavity field.[1] We found that cavity catalysis follows non-linear enhancement by varying the coupling strength. This was recently proved spectroscopically. We showed that self-dipolar interaction follows a non-linear relation upon varying the coupling strength of the medium.[2]

2. Polaritronics:

This is another usage of the hybrid states. Half-photon-half-molecule like states formed here has many interesting properties: (i) they are dispersive in nature (momentum-energy relation) and (ii) show coherence/delocalization. We studied the delocalization behaviour of the hybrid states by measuring the effective mass of the coupled system. Atomically thin monolayer of a 2D material shows a drop of effective mass by 105 times at ON resonance condition in a Fabry-Perot cavity configuration.[3] We utilized the same material in a field effect transistor/Fabry-Perot cavity configuration and extracted the electron mobility under strong coupling condition. Electron mobility enhanced by 50 times at ON resonance condition and a clear correlation is obtained with effective mass variation and Schottky barrier height suggesting a modification of the material property by vacuum field coupling.[4]
Ref:
[1] Lather, J.; George, J., Improving Enzyme Catalytic Efficiency by Co-operative Vibrational Strong Coupling of Water. J. Phys. Chem. Lett. 2020, 379-384.

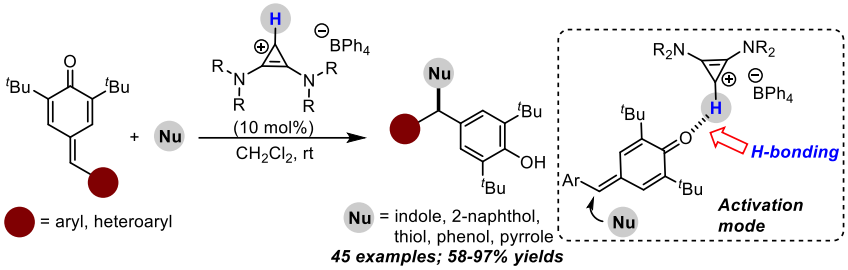
[2] Kadyan, A.; Shaji, A.; George, J., Boosting Self-interaction of Molecular Vibrations under Ultra-strong Coupling Condition. J. Phys. Chem. Lett. 2021, 4313-4318.

[3] Bhatt, P.; Dutta, J.; George, J., Electromagnetic Field Dependence of Strong Coupling in WS2 Monolayers. Phys. stat. solidi (RRL) – Rap. Res. Lett. 2021, 15, 2000580.

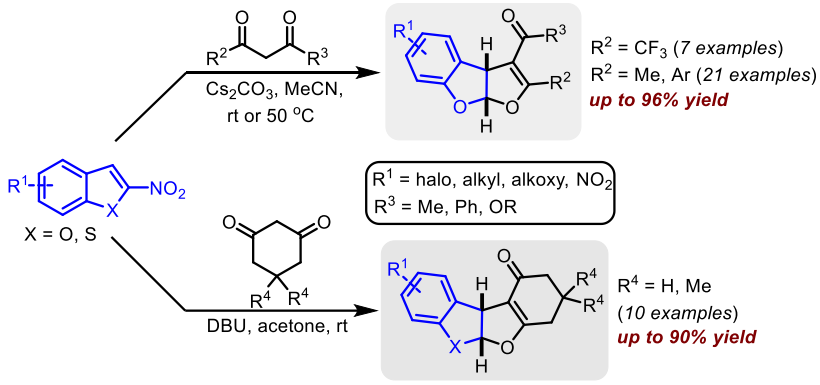
[4] Bhatt, P.; Kaur. K.; George, J., Enhanced Charge Transport in 2D materials through Polaritonic States. ChemRxiv 2021. https://doi.org/10.26434/chemrxiv.14484672.v1

N. Sathyamurthy
Time-dependent and time-independent quantum dynamics, atoms and molecules in a confined environment.

R. Vijaya Anand
Recently, Anand's group investigated, for the first time, the catalytic application of the bis(amino)cyclopropenium ion in conjugate addition reactions. The hydrogen atom, which is attached to the cyclopropene ring of bis(amino)cyclopropenium (BAC) salts, is moderately acidic and can potentially serve as a hydrogen-bond donor catalyst in some organic transformations. This hypothesis has been applied in the 1,6-conjugate addition reactions of p-quinone methides with various nucleophiles such as indole, 2-naphthol, thiols, phenols, etc. The spectroscopic studies (NMR and UV–vis) and the deuterium isotope labelling studies clearly revealed that the hydrogen atom (C–H) that is present in the cyclopropene-ring of the catalyst is, indeed, solely responsible for catalysing these transformations (*J. Org. Chem*. **2021**, *86*, 4994).



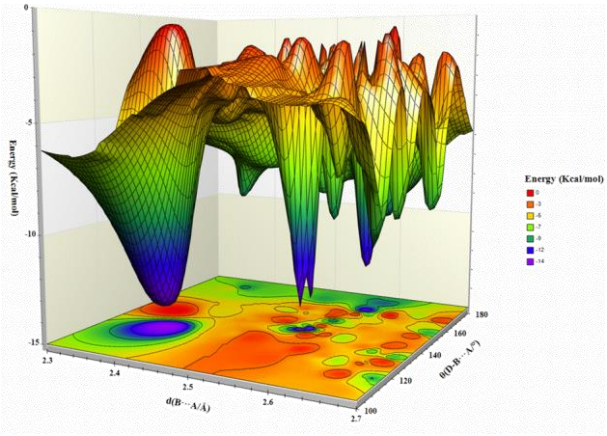
Anand's group also developed an effective approach for the synthesis of a dihydrofuro[2,3-*b*]benzofuran derivatives through a base-mediated Michael addition of 1,3-dicarbonyls to 2-nitrobenzofurans followed by intramolecular cyclization. A variety of 1,3-dicarbonyls, including cyclic as well as trifluoromethylated ones, have been subjected to react with 2-nitrobenzofurans under optimal conditions, and the respective dihydrofuro[2,3-*b*]benzofurans could be accessed in moderate to excellent yields (*Chem. Asian J.* **2021**, *16*, 1271).



In addition, a one-pot approach has been developed for the synthesis of 2,3-disubstituted indoles through a base-mediated *N*-alkylation of 2-(tosylamino)aryl-substitued p-quinone methides with halo-methylaryl ketones followed by intramolecular cyclization and tosyl group elimination sequence. This one-pot protocol provides direct access to a wide range of 2,3-disubstituted indoles in moderate to good yields under mild conditions (*Tetrahedron* **2021**, *82*, 131950).

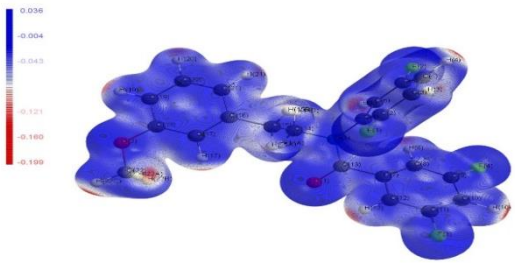
Angshuman Roychoudhury
Our group works on crystal engineering, polymorphism, drugs and pharmaceuticals, study of weak intermolecular interactions and charge density analysis, synthesis, characterization and property studies of metal organic framework materials. During the Covid19 pandemic in 2020 and 2021, the experimental work of our laboratory was severely affected. Due to nation-wide lockdown in 2020 and

later various restrictions on performing experimental laboratory activities resulted in loss of valuable time for research. During this period the students had to "work from home", which meant that they could only study and do literature survey etc with very limited progress in experimental work. The properties of intermolecular C-H•••F-C hydrogen bond were studied computationally (with limited access to the laboratory to access the workstation) using our internal library of crystal structures reported earlier by us during this pandemic to ascertain the most favourable parameters for such interactions to be stabilising in nature. The following plot indicates the preferences of C-H•••F-C hydrogen bond in stabilizing crystal structures. The work is still in progress.

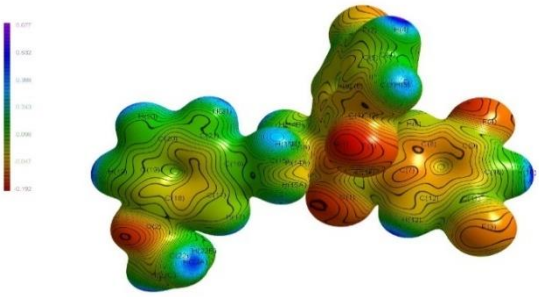


Plot of distance, angle and stabilization energy offered by various C-H•••F-C hydrogen bonds using computational analysis

During this period, we were fortunate to establish a collaboration with Dr. Craig Robertson of the University of Liverpool, UK. He kindly agreed to help us with high quality charge density data sets collected using rotating anode-based X-ray diffractometer (currently not available in India) on our crystals for the study of intermolecular C-F•••F-C interactions observed on fluorinated small organic molecules. Dr. Robertson was able to collect 5 very useful data sets for us during this pandemic. The analyses of those data sets are in progress. The PhD student involved in this project has been able to visualize the electron density around such interaction using the data sets from Liverpool as shown below. The analysis is in progress.



3D Deformation density map (experimental)



3D electrostatic potential map (experimental)

Raj Kumar Roy

Folding of Periodically-grafted amphiphilic Polyamides: In this objective, we have prepared a series of amphiphilic polyamides varying their capability of intramolecular H-bonding and π-surface area. We have shown the folding of such amphiphilic polyamides is dynamic in nature. For example, they formed helical structure in solution by the use of intramolecular H-bonding, however, such helical secondary structure transforms to β-sheet structure with the help of C-T interactions. Currently, we are pursuing the detail characterization of those secondary structures.

Self-assembly propensity of randomly-grafted amphiphilic linear and hyperbranched polyesters:
In this objective, we have prepared an amphiphilic hyperbranched polyesters and their linear analogue by using melt-transesterification along with click chemistry. Both of the amphiphilic polymers self-assembled to micellar structure in water as characterized by using DLS, TEM and dye encapsulation studies. The question we are trying to address is as follows: (a) is there any role of architecture for the micellar structure (b) does the core of the micelles are equally compact (c) How does the dye encapsulation capability depends on the architecture? We have already addressed some of those questions and rest are under investigations.

Controlling Polyproline helical sense by using suitable initiating motifs: To this context, our objective is to design a suitable acceptor-containing (electron-deficient) initiator for polyproline synthesis such that the initiator fragments reside at the chain end of the polymers. At this point, we have asked the question whether the C-T complexation induced by external guest (electron-rich) molecule occurs at the chain end can influence the helical sense of the polyproline? In our preliminary studies, we have observed that the interconversion between PPI and PPII structure took place quite efficiently with respect to the native polyproline when the initiating motifs are engaged in C-T complexed state. Such observation suggests that the free-energy barrier between PPI and PPII structure presumably reduced at the C-T state. Currently, we trying to understand the detail mechanism of this process by using computational chemistry as well as by using Molecular Dynamic simulations.

Ramesh Ramachandran
Our research group here in Mohali is primarily focused on developing theoretical methods based on time-dependent quantum mechanics for both designing new SSNMR experiments and building models for quantifying NMR experimental data.

S. Arulananda Babu
Dr. Babu's group works with the goals comprising of (a) development of C-H activation/functionalization method for the synthesis of functionalized carbo- and heterocycles and unnatural amino acid derivatives and peptides and antimalarial agents, (b) metal-mediated stereoselective C-C bond construction, (c) usage of magnetically recoverable catalysts transformations and (d) synthesis of new racemic and chiral crown ether-type compounds.
Accordingly, recent works carried out by Dr Babu's group are; (a) We reported the application of the Pd(II)-catalyzed, directing-group-aided C–H arylation/alkylation tactics to functionalize the pyrene core, especially, the relatively inaccessible C2 and K-region C10 positions of the pyrene core and augmentation of the library of pyrene derivatives with C1,C2- and C1,C10-disubstituted pyrene motifs. (b) Unsymmetrical triarylmethanes are valuable molecules in organic-, medicinal and materials chemistry. In this regard,we reported an investigation comprising of the synthesis of 1-naphthol-based unsymmetrical triarylmethanes via the Pd-catalyzed Heck-type desulfitative reaction and conjugate addition of arylsulfonyl chlorides with tetralone-derived chalcones. (c) Phenylglycinols are remarkable building blocks and have found different applications in synthetic organic and medicinal chemistry. In this regard, reported the Pd(II)-catalyzed picolinamide-aided ortho-C−H arylation-, alkylation-, and halogenation of phenylglycinol substrates. This work is a contribution towards the expansion of the library of phenylglycinol scaffolds and also substrate scope development by using the Pd(II)-catalyzed bidentate directing group picolinamide-aided C−H activation tactic. (d) 2-/3-Alkylated thiophene/furan and benzothiophene/benzofuran motifs are found in pharmaceutically active molecules. In this regard we reported the scope of the 8-aminoquinoline-aided sp3 γ-C−H alkylation method, and its usefulness to enrich the libraries of 3-alkylated thiophene/furan and benzothiophene/benzofuran motifs. (e) We also developed a method for the synthesis of medicinally important 3-oxoquinolin-2(1H)-one motifs from 2,3-dihydrobenzo[b][1,4]dioxine-2-carboxamides, (derived from 2,3-dihydrobenzo[b][1,4]dioxine-2-carboxylic acid and 2-haloanilines) involving ring-opening and Heck-type reaction. (f) We also reported the synthesis of various β-cyanoalanine derivatives and enantiomerically enriched aspartates via the Zn and In-mediated nucleophilic addition reactions to imine systems.

Santanu Kumar Pal

Research work has been ongoing involving three different aspects of supramolecular chemistry:

- Design and synthesis of liquid crystals (discotic and bent-core) for applications in optoelectronics, and exploring their importance in other avenues of material science.
- Design and synthesis of covalent organic frameworks and their applications.
- Liquid crystal-based bio-sensing.

S. S. V. Rama Sastry

Major objective of our research is the development of new C-C, C-O, C-N bond forming reactions with relevance to both medicinal and natural products chemistry with a particular emphasis on catalysis and application of these strategies to the total synthesis of architecturally complex heterocycles of biological significance.

Some of the key highlights are presented here:

Cyclopentannulated arenes and heteroarenes are the primary molecular architectures of many bioactive natural products and drug candidates; they also find potential applications in medicinal chemistry and in materials science. Towards this end, an efficient Pd(II)-promoted 5-endo-trig cyclisation of (hetero) aryl allyl acetates to spirocyclopentene oxindoles, indenes and cyclopentene-fused heteroarenes was developed. Further, this method was successfully applied as the key step in the total synthesis of diterpene natural products taiwaniaquinone H and dichroanone. (Singh, B.; Bankar, S. K.; Kumar, K.; Ramasastry, S. S. V. Chem. Sci. 2020, 11, 4948).

On the other hand, an unprecedented metal- and acid-free ring opening/recyclization cascades of cyclopropyl aryl ketones have been demonstrated. All the new strategies described here provide straightforward and efficient access to unique pentannulated aromatics such as 2-(2-hydroxyethyl)indenones, 2,2-disubstituted-3-hydroxyindanones, 2-styryl-3-arylindenones, and 2,3-disubstituted fluorenones. (Mishra, U. K.; Patel, K.; Ramasastry, S. S. V. Org. Lett. 2020, 22, 3815).

Further, A Pd(II)-catalysed and conceptually novel intramolecular allylic alkylation strategy was developed for the synthesis of carbazoles and dibenzothiophenes. The method was realised to be practical and scalable, and offers great potential for the synthesis of novel heterocycles. (Yadav, S.; Ramasastry, S. S. V. Chem. Comm. 2021, 57, 77-80).

In a continuation of our research interest in the development of concept-based strategies for the synthesis of a wide range of cyclopentannulated arenes and heteroarenes, we have demonstrated the synthesis of a variety of 2,2-disubstituted-3-hydroxyindanones (DHIs) via a cascade of Michael/aldol/hemiketalization/retro-aldol reactions from easily accessible starting compounds. The divergence prevailed in a true sense when α-substituted enone-aldehydes and 2,4-dioxobutanoates provided dihydrobenzotropones and benzothiophenefused dihydrotropones. (Maurya, J. P.; Ramasastry, S. S. V. J. Org. Chem. 2021, 86, 525-537).

Sabyasachi Rakshit

(a) Significance of Crankshaft motion in protein on hearing and how a loss of crankshaft in gating springs may yield age-related hearing loss (A part is published)
(b) Role of inter-domain linkers on domain stability (A part is published)
(c) Phase separations of cadherins on cell membrane and implications of accelerated cell-cell adhesion (Under review)
(d) Importance of complex stereochemistry in the protein mechanics (Under 2nd revision).

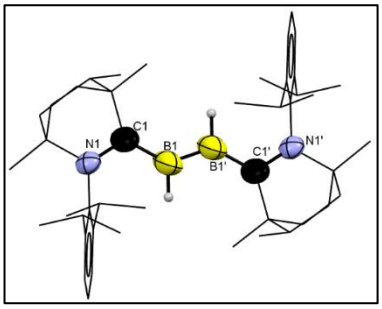
Sanchita Sengupta

The research interest of my group involves design, synthesis and characterization of □-conjugated organic small molecules, dyes and pigments for optoelectronic applications. Furthermore, their optical and electronic properties and applications are intended to be explored. The work involves extensive organic synthesis and structural characterization of new molecules followed by optical spectroscopy such as UV/Vis, fluorescence, emission lifetimes, fluorescence anisotropy, and internal quantum efficiency (IQE) measurements. Along these lines, research in my group has been aimed at developing new light harvesting systems based on π-conjugated molecules/dyes specifically in the last one year following results have been achieved:

1) Donor-acceptor (D-A) systems (in configurations such as D-A-D, A-D-A, D-A-A etc.) for efficient twisted intramolecular charge transfer (TICT) have been developed which are excellent polairty, viscosity and temperature sensors (Phys. Chem. Chem. Phys. 2020, 22, 25514-25521) and the ultrafast dynamics of their charge transfer process have also been investigated in a collaborative work (Phys. Chem. Chem. Phys. 2021, 23, 8900-8907).
2) Synthesis of covalently connected multichromophoric systems (based on aza-BODIPY dyes and bay substituted perylene bisimides) with the aim of achieving efficient Förster resonance energy transfer (FRET) have been achieved. These molecules have been efficiently utilized as ratiometric temperature sensors, multiple metal cation sensors as well as efficient electron transport materials (J. Mater. Chem. C 2021, 9, 4607-4618).

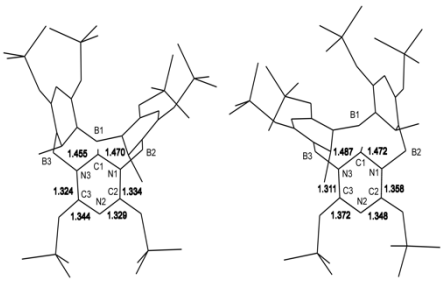
Sanjay Singh

Our research activities focus on different aspects of main group and transition element organometallic chemistry to address some fundamental questions in this area. Special aspects of organometallic chemistry of group 13 elements and transition elements (Ni, Cu, Pd, Au, Zn, Ir and Ru) in the form of their cyclic Alkyl Amino Carbene (cAAC) adducts, bicyclic Alkyl Amino Carbene (BICAAC) their reaction chemistry and applications in molecular transformations. In addition to this, we have also successfully explored synthesis and properties of inorganic macrocycles, pyridinophanes and cryptands.



Carbene complexes of group 13 and transition elements: we have successfully prepared BICAAC-borane adducts and using them prepared a series of >B-B< and >B=B< and -B≡B-molecules with single, double and triple bond between two B atoms. In the area of transition elements we have prepared a series of zero-valent transition metal $(BICAAC)_2M(0)$ complexes (M = Mn, Ni, Cu, Zn, Pd, Au etc.) for further reactions to yield unusual reactivity and functionality. The figure below shows the X-ray structure of a diborane stabilized by BICAAC.

Inorganic macrocycles and cryptands: Conformationally rigid boron containing pyridinophanes and the aluminum congeners are very novel molecules including the aluminum anchored bicyclic pyridinophane. More recently, we have developed a protocol to prepare boracalixarenes by exploiting the dearomative hydroboration route of pyridine moieties with different boron hydrides. The picture below shows a boracalixarene like macrocycle in a partial cone conformation assembled from dearomatized triazine moieties.



Subhabrata Maiti

Chemists have had a longstanding interest in the origin and evolution of life happened over time. Understanding and excavating promiscuous behavior of proteins/enzymes are crucial factors for the interpretation of protein function, evolution as well as in broadening the chemical repertoire of

biocatalytic reactions. Most importantly, biocatalytic promiscuity is of great importance as these are the starting point for the evolution of new functions in nature and thus supposed to be manifested in proteins found in primitive organisms in evolutionary timescale. To this end, the catalytic promiscuity of one of the most primitive proteins, cytochrome c (cyt c) has been investgated which is present in almost all aerobic and also anaerobic organisms, towards proton transfer reactions (using Kemp Elimination (KE) reaction as model). Cyt c is majorly known for its essential role in electron transfer chain and it can also show peroxidase like activity in lipid membrane. Here we have found that cyt c can also show excellent catalytic activity towards KE reaction, increasing the rate up to 750-fold. Interestingly, this behavior is observed only when cyt c is present in membrane-mimetic media like micelles and vesicles. This work presents forward a new unexplored and unknown property of cyt c i.e. catalytic promiscuity towards proton transfer reactions in membrane-mimetic media, which have significance as following – (i) firstly, it strengthens the previous claim of promiscuous biocatalytic property of early developed protein/enzymes in evolutionary process; (ii) the fact that KE catalytic effect of cyt c can only be observable in specific presence of self-organized media exemplifies the emergent behavioral property of biomolecules in response to its surrounding environment.

In addition, we have also developed systems as enzyme-host with an aim of significantly augment the catalytic activity of industrially relevant enzymes and also the development of biosensors for diagnostic purpose (DNA, protein etc.). Design of bioreactor for thermophilic enzyme is important for expanding catalytic range of enzymes in diverse biotechnological applications. Herein, sucrose-based microemulsion based gel (MBG) have been developed as columnar bioreactor towards enzymes effective at high temperatures. As the gel can simultaneously arrest both water and organic solvent, we have also shown that it is possible to multicycle HRP catalysis for both water and organic soluble substrate in a same system. Heat-stiffening property of this gel enable us towards catalysis of thermophilic enzyme, α-glucosidase by utilizing the column at higher temperature (60 °C) and encouragingly, ~3-4-fold higher efficiency of the enzyme was obtained for several cycles. This result also paves the way for future studies towards fundamental understanding of biophysical and biochemical properties of different physiologically relevant protein and enzymes with respect to carbohydrate crowding which has relevance to diseases like diabetes, alzheimer etc.

Sugumar Venkataramani

Heterocyclic Radicals: Stability and reactivity are the two essential aspects of utilizing the radicals for various applications in different fields. The presence of heteroatoms in the radicals can influence both of these aspects. Considering that the lone pair of electrons of the heteroatoms can interact with the radical electron, various interactions such as 2-centered-3-electrons (2c-3e) and 3-centered-4-electrons (3c-4e) in pyridyl and diazinyl radicals, respectively are possible. Such interactions are strongly dependent on the relative positions of these two electrons. To understand their role in the reactivity aspects, separate studies have been investigated for the isomeric pyridyl (Comput. Theor. Chem., 2020, 1191, 113025) and diazinyl radicals (J. Phys. Org. Chem. 2020, 34, e4152). The investigations provided qualitative and quantitative aspects related to the reactivity of these species. Apart from that, several key products of astrochemical importance have also been identified in the reactivity channels. The matrix isolation experiments on some of these radical species are currently underway.

Photoswitchable Systems and Functional Molecules: Tripodal C3 symmetric architectures found widespread applications in various domains of material chemistry. The introduction of photoswitches to those systems can be beneficial as the light modulates the functions. Although several such systems with azobenzenes have been reported in recent times, most of them are restricted to one type of connection. However, their light modulation is partial or limited. For gaining tunability and also to rationalize the structure-property relationship, the C3 symmetric systems have been explored. The variation of the cores, linkers, azoarenes/azoheteroarenes, and the orientation of the azo group concerning the linker, etc., have been systematically investigated. The major outcomes of those

investigations are the identification of factors for tuning the reversible photoswitching, imparting stability of the photoswitched states, and also in the application prospects (Chem. Eur. J., 2021, 27, 3463-3472). In yet another prospects, the application of C3 symmetric system in catalysis, in particular, temporal control of the reactions by light has been explored. In this regard, anion binding catalysts functionalized with photoswitches have been synthesized and investigated for their catalysis in the tritylation reactions. The studies revealed the native state of the tripodal catalyst enhances the reaction yields, whereas, upon photoirradiation, the reaction can be slowed down by a factor of two (Catal. Sci. Technol., 2020, 10, 7027 - 7033). The fundamentals and applications of photoswitchable functionals molecules are currently being investigated in our laboratory.

Ujjal K Gautam

Conversion of waste-plastic to functional nanomaterial for aerial oxygen and solar energy harvesting: The group work attempts to address two contemporary research challenges of handling plastic-waste to create value-added products (graphene quantum-dots, GQDs) in a sustainable way, and then to employ them to enable the use of the ambient air as a free-oxidant in chemical transformations, instead of pressurized oxygen or other toxic oxidizing reagents. The conversion process developed by us is the first example of converting plastic to graphene and advantageous over the conventional synthesis of carbon-dots due to a complete, residue-free conversion, quick-processing and simple purification approach.

The use of the inexpensive, non-toxic carbon-dots is emerging as a potential candidate for diverse applications in catalysis, energy harvesting and environmental remediation, sensing, optoelectronic devices, and bio-imaging and diagnostics wherein interactions of carbon-dots with oxygen and light are unavoidable. In this broad context, the findings on oxygen-carbon-dot interactions, light induced 'hypoxia' and 'autophagy' in graphitic carbon dots are very significant, and have potential implications for diverse applications.

8.2.2. Visits of the faculty members

None

8.2.3. Talks delivered

Arijit K. De and lab members

— Arijit K. De. Ultrafast dynamics of near-infrared dyes probed by Two-dimensional electronic spectroscopy (2DES). IIT Mandi, India. 16 March, 2020.
— Arijit K. De. Freezing molecules in motion by shedding light on them, Faculty Development Program (webinar). UIET (Panjab University), India. 4 August, 2020.
— Yogita Silori, Water-mediated excess energy dissipation within photosynthetic light- harvesting mimics. Chem Day 2020 (Chemistry at the Interface of Light, Matter and Life), Department of Chemical Sciences, IISER Mohali, India. 17 October 2020.
— Arijit K. De. Witnessing choreography of molecules by shedding light on them. National Science Day talk (webinar). BITS Pilani, Hyderabad, India. 1 March, 2021.

Debashis Adhikari

— Nickel catalyzed N-alkylation reactions by hydrogen atom transfer, Amity University, Noida, November, 2020
— Nickel catalyzed N-alkylation reactions by hydrogen atom transfer, IISER Tirupati.

Jino George

— George, J., Co-operative Vibrational Strong Coupling: A New Route to Control Chemical Reactions. Bulletin of the American Physical Society, 2021.
— George, J. Controlling Chemical Reactions through Co-operative Vibrational Strong Coupling, Polariton Chemistry conference, Feb. 02, 2021; https://www.youtube.com/watch?v=KK4Pi4LVS_Y

— Clement, C.; George, J.; Subotnik, J.; Simpkins, B. Ground-state vibropolaritonic chemistry, Polariton Chemistry conference, Dec. 02, 2021; https://www.youtube.com/watch?v=rg4FcCnjgiU
— George, J. Hybrid Light-matter States, Jain University, Sept. 02, 2020

R. Vijaya Anand and lab members

— R. Vijaya Anand. "p-Quinone Methides: Versatile Synthons for the Construction of Carbocyclic & Heterocyclic Frameworks". Recent Trends in Chemical Sciences (RTCS 2020) organized by IISER Kolkata. December 27-28, 2020.
— R. Vijaya Anand. "Construction of Carbocyclic & Heterocyclic compounds from p-Quinone Methides". Recent Advances in Organic, Medicinal and Biological Chemistry webinar organized by VIT Vellore. July 8-9, 2020.
— R. Vijaya Anand. "Construction of Carbocyclic & Heterocyclic compounds from p-Quinone Methides". A Scientific Webinar Session" organized by BITS Pilani. June 6, 2020.
— Rekha. "Tropylium Salt Mediated 1,6-Vinylogous Aza-Michael Addition of Unactivated Amines to p-Quinone Methides'. First Virtual J-NOST Conference (JNOST-16) for Research Scholars organized by IISc Bangalore. October 31 to November 1, 2020.

Raj Kumar Roy

— "Controlling the Polyproline's helical sense from the chain end", Changing Trend in Polymer Science and Technology, 21/01/2021

S. K. Pal

— Dr. S. K. Pal. Recent Trends in Advanced Materials and Devices, Dr. B. R. Ambedkar National Institute of Technology Jalandhar, India (September 2020) titled- "Highly Efficient Ambipolar Charge Carrier Transport Properties in Discotic Liquid Crystals.
— Dr. S. K. Pal. Webinar on Frontiers in Organic Electronics, National Institute of Technology, Rourkela, India (July 2020) titled- "High Hole Mobility and Ambipolar Charge Carrier Transport in Discotic Liquid Crystals.

S. S. V. Rama Sastry and lab members

— S. S. V. Ramasastry. New Strategies for the Construction of Privileged Structures. Professor Ram Chand Paul National Symposium on Chemistry and Interdisciplinary Sciences, Panjab University, Chandigarh. 05-Mar-2021.
— S. S. V. Ramasastry. The Present and Future of Excellence in Organic Synthesis. Tezpur University, Assam. 08-Jan-2021.
— S. S. V. Ramasastry. Diversity in Catalytic Approaches. National Institute of Technology (NIT) Manipur, Imphal. 30-Oct-2020.
— S. S. V. Ramasastry. Webinars during the Faculty Development Programs (FDPs). University Institute of Pharmaceutical Sciences (UIPS), Chandigarh. 03-Aug-2020.
— S. S. V. Ramasastry. Webinars during the Faculty Development Programs (FDPs). Adikavi Nannaya University, Rajahmundry, Andhra Pradesh. 12-Jun-2020.
— Bara Singh. Palladium-catalysed intramolecular allylic (hetero)arylation. Junior National Organic Symposium Trust (J-NOST). 31-Oct to 01-Nov, 2020.Ramesh Ramachandran and lab members

Sabyasachi Rakshit

— Crankshaft motion in proteins and its implication in hearing-loss with aging, BITS Pilani (Online), 8th September, 2020
— Crankshaft motion in proteins and its implication in hearing-loss with aging, ChemDay (Online), 19th October, 2020

Sanjay Singh

— Delivered an invited online lecture at the Department of Chemistry, National Institute of Technology Jalandhar on October 23, 2020, title "Renaissance in the chemistry of main group elements: Role of stable carbenes as ligands"

Subhabrata Maiti and lab members

— Subhabrata Maiti. Biosupramolecular Chemistry: Origin and Its Implications. National Webinar on "Interface of Chemistry & Biology: A Molecular Approach", Krishnanagar Govt. College, 14th July, 2020.

— Basundhara Dasgupta, Subhabrata Maiti. Promiscuous proton transfer property of cytochrome c in self-organized media. 'Chemistry at the Interface of Light, Matter and Life', IISER Mohali, 17th October, 2020.

Sugumar Venkataramani and lab members

— Sugumar Venkataramani. Reactive intermediates: what can be learned from these unstable species? Webinar Government Arts College, Kumbakonam. 24-06-2020
— Sugumar Venkataramani. Further insights into reactive intermediates. International Webinar on Research Evolution Towards Current Scenario (RETCS) 2020 / Department of Chemistry, Periyar EVR College, Trichy- 23. 13th & 14th, July, 2020.
— Sugumar Venkataramani. Raman Spectroscopy – Principles, Technique and Applications. First National Students Conference on Spectroscopy (NSCoS-2020) co-organized by Sci-Rox (GNDU) and CRSI Local Chapter Chandigarh/Amritsar. 16-17 October, 2020.
— Mayank Saraswat. Matrix-Isolation FT-IR Spectroscopy of Nitrogen Based Heterocyclic Radicals. Astrochemistry Frontiers- Quarantine Edition, June 15 - 19, 2020.
— Surbhi Grewal. Light controlled catalysis in tritylation reactions through reversible encapsulation of chloride ions. First Virtual JNOST Conference (JNOST -16). October 31- November 1, 2020.
— Debapriya Gupta. Tripodal C3 Symmetric Multiple Azoheteroarene connected Photoswitchable Systems: Fundamentals to Applications. First virtual JNOST conference (JNOST-16)-October 31-Nov 1, 2020.
— Ankit Kumar Gaur. Photoswitching and photochromism of tripodal based photoswitches. Chemday 2020, "Chemistry at the Interface of Light, Matter and Life", IISER Mohali. 17th October 2020.

8.2.4. Conferences attended by the researchers

Arijit K. De and lab members

— Subhash Chander, Garima Bhutani, Sakshi Chawla, Subho Mitra. Conference on Lasers and Electro–Optics (CLEO), virtual web conference. May 11-15, 2020.
— Subhash Chander. 24th Annual Green Chemistry & Engineering Virtual Conference. American Chemical Society's Green Chemistry Institute (Virtual event). June 15-20, 2020.
— Subhash Chander. Online RSC Workshop: How to publish your work in high impact journals, Royal Society of Chemistry (RSC) and nanoGe (Virtual event). June 17, 2020.
— Sumit Yadav. OSA Advanced Photonics Congress (Virtual event). July 13-16, 2020.
— Subhash Chander. DST & ACS Virtual Workshop, ACS Publications (Virtual event). July 28, 2020.
— Anita Yadav, Shaina Dhamija, Garima Bhutani. The National Academy of Sciences, India (NASI) - Delhi Chapter- & MHRD-Institution Innovation Council (IIC) Deen Dayal Upadhyaya College Chapter (University of Delhi), special public lecture (webinar) by Professor Graham R Fleming FRS. August 20, 2020.
— Sumit Yadav, Anita Devi, Arijit K. De. Reversal in axial symmetry of nonlinear optical trapping potential for metallic nanoparticles: generalized Lorenz-Mie theory, SPIE Optics + Photonics, Optical Trapping and Optical Micromanipulation XVII. August 20, 2020.
— Sumit Yadav. SPIE Optics + Photonics, Optical Trapping and Optical Micromanipulation XVII. 24 August 24 -September 4, 2020
— Subhash Chander, Anita Yadav, Yogita Silori, Shaina Dhamija, Samita Mishra, Garima Bhutani, Sumit Yadav, Sakshi Chawla, Subho Mitra. Frontiers in Optics + Laser Science (FiO + LS) virtual web conference. September 4-17, 2020.
— Subhash Chander. RSC Desktop Seminar with ChemComm, RSC Publications (Virtual event). September 8, 2020.
— Subhash Chander, One Week Online Short-Term Training Program 'Research Scholars' Week: Applied Sciences and Humanities, National Institute of Technology Kurukshetra (Virtual event). September 23-27, 2020.
— Anita Yadav, Shaina Dhamija, Samita Mishra, Garima Bhutani, Sakshi Chawla. The National Academy of Sciences, India (NASI) - Delhi Chapter- & MHRD-Institution Innovation Council

(IIC) Deen Dayal Upadhyaya College Chapter (University of Delhi), special public lecture (webinar) by Professor Biman Bagchi. October 8, 2020.

— Anita Yadav, Garima Bhutani, Sakshi Chawla. National Students Conference on Spectroscopy (NSCoS), web conference jointly organized by SciRox (Science Club), Guru Nanak Dev University, Amritsar and Chemical Research Society of India (Local Chapter Chandigarh/Amritsar). October 16-17, 2020.

— Yogita Silori. Water-mediated excess energy dissipation within photosynthetic light-harvesting mimics, Chem Day 2020 (Chemistry at the Interface of Light, Matter and Life), Dept. of Chemical Sciences, IISER Mohali, October 17, 2020.

— Subhash Chander. ACS Workshop on 'ACS Career Kick-Starter Workshop'. (Virtual event). November 13-15, 2020.

— Anita Yadav, Yogita Silori, Shaina Dhamija, Samita Mishra, Garima Bhutani, Sakshi Chawla, Subho Mitra. Ultrafast phenomenon (UP), virtual web conference. November 16-19, 2020.

R. Vijaya Anand and lab members

— Feroz Ahmad. "An Efficient Metal Catalysed Approach to the Synthesis of Indolizine Containing Unsymmetrical Triarylmethanes' (poster presentation). First Virtual J-NOST Conference (JNOST-16) for Research Scholars organized by IISc Bangalore. October 31 to November 1, 2020.

S. Arulananda Babu and lab members

— Debabrata Bhattacharya. Serendipitous construction of 1-naphthol-based unsymmetrical triarylmethanes via the Heck-type desulfitative reaction of arylsulfonyl chlorides with chalcones. 16th J-NOST Symposium. Oct 31 - Nov 1, 2020 (Poster and Short oral Presentation, Online conference).

S. K. Pal and lab members

— Dr. Manisha Devi, Joydip De, Indu Bala, Supreet Kaur, Vidhika Punjani, Varsha Jain, Ipsita Pani, Shruti Suthar, Madhusudan Maity, Ritobrata De and Shallu Dhingra attended Webinar on Frontiers in Organic Electronics, 29 June – 3 July, 2020 at National Institute of Technology, Rourkela, India.

S. S. V. Rama Sastry and lab members

— Dipto Mukhopadhyay. Desymmetrisation of bis-enones triggered by corey-chaykovsky reagent. Junior National Organic Symposium Trust (J-NOST). 31-Oct to 01-Nov, 2020 (Poster Presentation).

— Lona Dutta. Phosphine mediated Cyclopentannulation of alpha-substituted Dienones. Junior National Organic Symposium Trust (J-NOST). 31-Oct to 01-Nov, 2020 (Poster Presentation).

Sabyasachi Rakshit and lab members

— Jagadish P Hazra (Final year PhD) and Sabyasachi Rakshit, Entire session, Annual Meeting of the Biophysical Society, USA, Feb 22-26, 2021

— GRC on single-molecule spectroscopy: got invitation to present our work, hwoever, the meeting is postponed for 2022.

Sanchita Sengupta and lab members

— Sanchita Sengupta. Only participation without presentation, 'World Nano Congress on Advanced Science & Technology (WNCST-2021), 8th- 13th March, 2021. (Online Conference)CRIKC Chemistry Symposium, National conference, IISER Mohali, Nov 2-3, 2019.

— Sanchita Sengupta. Only participation, PCCP 2019 Emerging Investigators Desktop Seminar Lectureship, 23 March, 2021. (Online RSC event)

Subhabrata Maiti and lab members

— Ekta Shandilya, Subhabrata Maiti. Deconvolution of competitive transient species in multivalent fuel-driven assembly. Systems Chemistry Virtual symposium 18-21 May, 2020.

Sugumar Venkataramani and lab members

— Mayank Saraswat. Lindau Online Science Days, 28th June - 1st July 2020

— Anjali Mahadevan and Chitranjan Sah. International e-workshop on "Electronic structure theory and application to chemical systems" organised by Department of Chemical Sciences NIT, Thiruchirappali during 02-06 November 2020.

— Harjasnoor Kakkar. Virtual ACES-CRSI Symposium 2020- Organic Synthesis by Wiley-VCH. 5-6th October 2020

— Debapriya Gupta and Surbhi Grewal. Light controlled catalysis in tritylation reactions through reversible encapsulation of chloride ions. First Virtual JNOST Conference (JNOST -16). October 31- November 1, 2020.

8.3. Department of Earth and Environmental Sciences

8.3.1. Summary of the research work

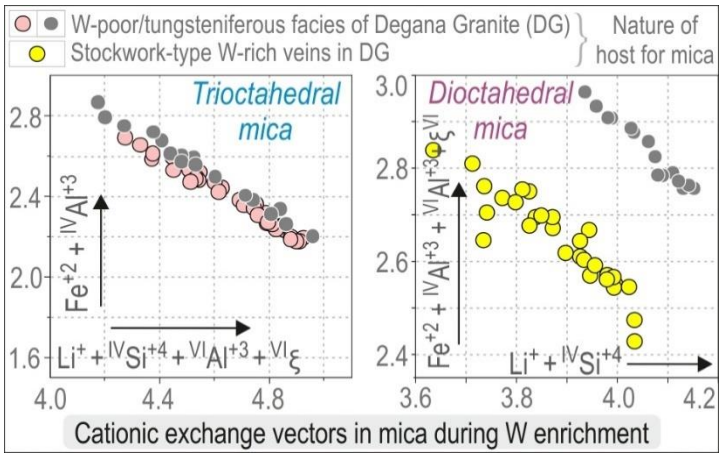
Anoop Ambili

My research was focussed on understanding the occurrence, distribution, characterization and quantification of microplastics (MPs) and phthalates (PAEs) from the fresh water aquatic environment in the Indian Himalayas. My lab has investigated the presence of MPs and for the first time analyzed PAEs in an aquatic system from Indian subcontinent. The MPs were detected in all water and sediment samples with abundances ranging from 02–64 n/L and 15–632 n/kg, respectively. The abundance of MPs, dominated by polyethylene and polystyrene, with the majority being fibres and fragments indicated that they were derived from plastic paints, boats or synthetic products. The concentrations of PAEs in the surface sediment samples varied from 06–357 ng/g. The most abundant phthalic acid ester in the sediments were dibutyl phthalate (DBP) and di(2-ethylhexyl) phthalate (DEHP), since they were present in all the samples collected from the lake basin. The relatively higher abundances of MPs and higher concentrations of PAEs were generally found in the vicinity of areas impacted by anthropogenic activities. A clear correlation between the abundance of microplastics and PAEs concentration was observed suggesting that they are closely attributed to a single source. Our study also provides an alternative approach to utilize the chemical additives in plastics as biomarkers to trace the presence and distribution of MPs in the aquatic environment.

Baerbel Sinha

Our research in 2020-2021 focus quantifying the sources of ozone precursors and aerosol sources over the North West Indo Gangetic plain using various source receptor modelling tools and in-situ observations. We characterized different low-cost particulate matter sensors and evaluated whether the same can be used to substitute research grade equipment. We also work towards improving VOC emission inventories over South Asia and quantify the impact of air pollution on crops and natural vegetation using in-situ measurements and stomatal flux-based approaches.

Sourabh Bhattacharya



Our focus was on identifying the controls for wolframite mineralization in the richest tungsten deposit in India at Degana (Rajasthan). Mineral paragenetic records infer several successive alteration events – a magmatic stage followed by K (±Na) alteration and greisenization. We appreciate the greisen stage that led to W enrichment in terms of mineralogical variations, elemental gains/losses in rocks, effects of acidic fluids on mica composition and evolution of such fluids. The chemical disequilibrium between greisen ore fluids and potasically-altered Degana granite induced K-feldspar and muscovite hydrolysis. Such reactions played a key role in acid neutralization of ore fluid, a prerequisite for reducing W solubility in ore fluid. The ore genetic model

argues for pervasively present potassic alteration in Degana granite as a critical pre-conditioning process for W enrichment. A manuscript detailing the findings of this work is under review in 'Ore Geology Reviews' [ORGEO-D-21-00532]. In addition to this, I have submitted an Early Career Research proposal to SERB on 'Investigating the factors affecting the W (±Sn) budget of S-type magma in suprasolidus conditions: phase equilibria modeling of crustal anatexis and mineral-chemical studies on granite-metapelite assemblage in Sirohi region, NW India'.

Sunil A. Patil

Our research activities aim to advance the understanding of Electromicrobiology, a new sub-discipline of Environmental Microbiology, and contribute to developing sustainable electrochemistry-driven biotechnologies to valorize liquid and gaseous wastes. Electromicrobiology pertains to the study of electrochemical interactions or extracellular electron transfer processes between microorganisms and the solid-state electron acceptors or donors and their implications in different environments. It is essential to understand the diversity of extreme electroactive microorganisms and their extracellular electron transfer mechanisms not only to advance the Electromicrobiology discipline but also to develop niche-specific microbial electrochemistry-driven applications. In this context, we have been working on understanding the Electromicrobiology of the highly saline-alkaline environment of Lonar lake. During the last year, we isolated and characterized two novel Geoalkalibacter spp. from the enriched haloalkaliphilic microbial electroactive biofilm. These isolates possess membrane components with a high formal potential that are putatively involved in the electron transfer process. We are currently working on the understanding of these redox-active components.

Our group also achieved considerable research progress on the electricity-driven bioproduction of acetic acid from unpurified industrial CO2 via a microbial electrosynthesis approach. We demonstrated acetic production from brewery CO2 with low impurities with both enriched mixed and pure microbial cultures. Further work on reactor design and process parameters is ongoing to demonstrate the process at a semi-pilot scale. In addition, we optimized the reactor design and components of the novel wastewater management technology based on the integration of biological and bioelectrochemcial processes. We refer to it as iHYDROMET after its full name, "integrated hydroponics-microbial electrochemical technology." It is a low-cost and easy-to-implement technology for efficient wastewater management at the households and small community levels. The research on its long-term performance assessment and understanding of microbial groups involved in removing various wastewater constituents is currently in progress.

Vinayak Sinha

Our current research is focused on improving fundamental process-based understanding of reactive gaseous emissions-atmospheric chemistry-air quality and climate and their bi-directional feedbacks over South Asia. The experimental studies are combined with relevant modeling tools (chemical box models and chemical transport models) to accurately assess air pollution and climate change effects on atmospheric chemistry for proposing mitigation strategies and policies.

In the past one year, our group has worked on a number of projects. Here we describe three key studies led and published by us. In the first one led by our group (published in Mishra and Sinha, Env Poll, 2020), we reported discovery of a large biogenic source of isoprene during monsoon season over the Indo-Gangetic Plain based on real time ambient measurements of isoprene, and its atmospheric oxidation products. The abundance of isoprene was found to rival those of tropical rainforests. Cropland agroforestry trees as well as eucalyptus and poplar planted by road side and near cities were identified as the major biogenic source. Due to the short atmospheric lifetime of less than 90 minutes, the isoprene emissions impact ozone formation rapidly. Isoprene, its oxidation products methyl vinyl ketone and methacrolein as well as acetaldehyde, influence regional air quality and atmospheric chemistry and these datasets are the first to have been measured over India. In the second major study (Mishra et al., STOTEN, 2021), we undertook a comprehensive and novel modelling study, installing and customizing a chemical transport model to investigate links between chemical emissions from cropland trees and

their feedbacks on micrometeorological parameters in the atmosphere. The modelling study was validated against in-situ observations and demonstrated that cropland trees which are missed in land use land cover modules of major models over several agriculturally intensive regions of the world, can have very significant consequences on the ambient temperature, relative humidity and boundary layer dynamics as well as trace gas concentrations of ozone, isoprene, methyl vinyl ketone and methacrolein. Our analyses demonstrated that the tree cover over intensely farmed regions in Asia, Australia and South America are significantly underestimated/ neglected by the current chemistry-climate models, including all the ones used by the Intergovernmental Panel on Climate Change. Incorporation of the actual tree cover (~10%) over the north-west Indo Gangetic Plain in the land use land cover scheme of the model greatly improved agreement between the modelled and measured temperature, boundary layer height and surface ozone which were earlier overestimated by the model. Agreement between measured and modelled isoprene and its oxidation products was achieved with accuracy close to 90%, the surface latent heat flux regionally increased by 100%-300% while surface sensible heat flux reduced by 50%-100%, leading to a reduction in daytime boundary layer height by 200-400 m, a key result with implications for the modulation of air pollution over the Indo-Gangetic Plain and accurate air quality forecasting. Trees over croplands in north India were found to mitigate the peak daytime temperatures and ozone, improving rice production yields by 10 to 20%. Expanding agroforestry cropland tree cover to 50% of the cropland area could improve rice yields by up to 40% yield regionally, a finding of great economic value. In the third project (Ashish Kumar et al., 2020 Atmos Chem Phys) our group developed new non-methane chemical fingerprints through source sampling of pollution sources active over the India. Source apportionment studies require information on the chemical fingerprints of pollution sources to correctly quantify source contributions to ambient composition. These chemical fingerprints vary from region to region, depending on fuel composition and combustion conditions, and are poorly constrained over developing regions such as South Asia. This work characterised the chemical fingerprints of urban and agricultural sources using 49 non-methane hydrocarbons and their environmental impacts, provide a new foundational framework for quantitative source apportionment studies in complex emission environments such as India and other developing regions of the world.

8.3.2. Visits of the faculty members

None

8.3.3. Talks delivered

Sunil A. Patil and lab members

- Sunil A. Patil, “Electromicrobiology of the extreme saline-alkaline environment” at 2020 KSBB Fall Meeting and International Symposium organized by the Korean Society for Biotechnology and Bioengineering, South Korea, 21-23 Oct 2020.
- Sunil A. Patil, “Integrated biological and bioelectrochemical processes for wastewater treatment and resource recovery” at e-Faculty Development program on "Advances in Biological Wastewater Treatment Methods: Teaching and Learning Strategies" organized by the Department of Biotechnology, NIT Warangal, 7-11 Sep 2020.
- Sunil A. Patil, “Electricity-driven production of chemicals from waste CO2 using microorganisms” at e-Faculty Development program cum workshop on ‘Waste-to-Bioenergy’ organized by Sharda University, NCR & MIT, Aurangabad, 28 Jun - 4 Jul 2020.
- Srishti, Ramandeep Singh, Sukrampal Yadav and Sunil A. Patil, "Electrochemical enrichment of haloalkaliphilic nitrate-reducing microbial biofilm at the cathode of bioelectrochemical systems" at the IWA Biofilms 2020 Virtual Conference organized by University of Notre Dame, USA, 7-9 Dec 2020.
- Sukrampal Yadav, Ramandeep Singh, Srishti and Sunil A. Patil, "Novel Geoalkalibacter spp. isolated from a haloalkaliphilic microbial electroactive biofilm " at the ISME 2020 conference

(Virtual Microbial Ecology Summit) organized by the International Society of Microbial Ecology (ISME), The Netherlands, 11-12 Nov 2020.

Vinayak Sinha

— Vinayak Sinha. Research and innovation tools at IISER Mohali for tackling agriculture and air quality issues. Agriculture and Air Quality in India: Science and Solutions organized at Chadha Centre for Global India, Princeton University. October 19, 2020.
— Vinayak Sinha. Stratospheric Ozone Depletion. UGC Lecture Series for School teachers organized by Human Resource Development Centre (HRDC) of Pandit Ravishankar Shukla University (PRSU), Raipur. October 14, 2020.
— Vinayak Sinha. Photochemical Smog & Impacts of Agricultural Practices on Air Quality. UGC Lecture Series for School teachers organized by Human Resource Development Centre (HRDC) of
— Pandit Ravishankar Shukla University (PRSU), Raipur. October 15, 2020.
— Vinayak Sinha. Talk on the theme: Ozone for Life. World Ozone Day Commemoration by School of Environmental Studies, Jawaharlal Nehru University. September 16, 2020.
— Vinayak Sinha. Atmospheric Chemistry and Air Pollution Brew What We Breathe. Public Engagement Series IISER Mohali. November 28, 2020.

8.3.4. Conferences attended by the researchers

Baerbel Sinha

— Dr. Baerbel Sinha participated as panellist in the event on 'Clean Air in India: What are the challenges for the future scientists, academician and policymakers' during the India International Science Festival (IISF) 2020 on 24 December 2020.

Sunil A. Patil

— Srishti, IWA Biofilms 2020 Virtual Conference: Emerging Trends and Developments on " Biofilms and bioelectrochemical systems" organised by University of Notre Dame, USA, 7-9 Dec 2020.
— Srishti, Sukrampal Yadav, Rashmi Kiran, Moumita Roy, Ravi Kumar Yadav, Ramandeep Singh, Sunil A. Patil. 1st Virtual ISMET Meeting on "Microbial Electrochemistry and Technology" 7-9 Oct 2020.
— Rashmi Kiran, Sukrampal Yadav. ISME - 2020 conference (Virtual Microbial Ecology Summit) organised by International Society of Microbial Ecology (ISME), The Netherlands, 11-12 Nov 2020.
— Ravi Kumar Yadav. Workshop on 'Advances in Biological Wastewater Treatment Methods: Teaching and Learning Strategies' organized by the Department of Biotechnology in association with the Teaching Learning Centre (TLC), NIT Warangal, 7-11 Sep 2020.

Vinayak Sinha

— Vinayak Sinha. Panel Discussion on National Clean Air Program Actionable and Implementable Solutions. India International Science Festival, December 24, 2020.

8.4. Department of Humanities and Social Sciences

8.4.1. Summary of the research work

Adrene Freeda Dcruz

I have been working on a research paper titled "Performative Science: Carl Djerassi and Roald Hoffmann's Oxygen and Shelagh Stephenson's An Experiment with an Air Pump." I shall be soon sending out the paper for publication.

Currently, I am conceptualising on the arrival of sound in film industry and how directors such as Charlie Chaplin (Hollywood) Fritz Lang (Germany) grappled with the change in technology in 1931. I

will draw on Chaplin's City Lights (1931) and Lang's M (1931) to expand on the proposed statement of research.

Anu Sabhlok

I have been conducting an ethnographic study of seasonal migrants working on road construction sites in the upper Himalayas on projects of national development and defence for more than 6 years now. My research brings forth both the palpable and obscured processes surrounding road construction activity in India's border areas. It is about the system of substrates and the laboring subaltern bodies– geological and human - that animate a road in the upper Himalayas. In particular, it explores the material, social and political process that accompany the construction of the Indo-Tibetan border road. Using an ethnographic approach and geographically stretched-out fieldwork, my research looks at infrastructures that enable infrastructures that enable mobility. The emphasis is on embodied everyday practices in and surrounding the road construction sites including the distant networks that are central to the making of the road. I have also investigated how gendered meanings and social relations shift across the multiple contexts that migrants inhabit. In my recent paper, published in Geoforum, I argue that the emerging area of Infrastructural Studies needs to integrate labour as central to infrastructural assemblages. In February 2021, I have submitted (with Dr. Yaffa Truelove, CU Boulder) an edited collection titled Gendered Infrastructures: Exploring Dialiactics of Space, Scale and Identity for review to the Gender, Geography and Feminisms book series published by the West Virginia University Press. The book in under contract with the WVU press.

Debdulal Saha

In 2020-2021, Debdulal Saha has been engaged in research on COVID-19 and its impact on migration and labour markets which are mainly based on secondary data. He is brining out a Special Issue as Guest Editor on 'COVID-19 and its impact on the Indian Labour Market' for the Indian Economic Journal— a quarterly Journal of the Indian Economic Association (IEA). The Special Issue will be appeared in 69(3). He prepared a policy paper on 'Legislating Street Vending in India: Issues and Challenges' for 'National Study on Future of Work for the Urban Informal sector workers' carried out by Self Employed Women's Association (SEWA), Ahmedabad which was submitted to NITI Aayog, Government of India.

Parth R. Chauhan

Due to the Covid-19 pandemic (nearly 3 months were spent in Himachal Pradesh due to the lockdown in 2020), it was not possible to carry out any of the usual lengthy archaeological fieldwork this past year (except for occasional brief visits to the Siwalik Hills Mohali and Chandigarh). Instead, the time at the institute from early June 2020 onwards was spent on the following activities: guiding nine PhD students (three of whom are planning to submit their doctoral theses this year) and one 5th year project student (working on a stone tool assemblage collected from Mahadeo Piparia, M.P.) during their ongoing lab work and thesis writing work, giving numerous talks and lectures online as invited by different colleagues and institutions, participating in numerous online administrative and research-related meetings, working on several key publications (including both single-authored and co-authored with students and/or colleagues; some of those will start getting published soon) and planning future research work for the next one year (including student fieldwork, some of which cannot be cancelled and some of which has to be modified due to the pandemic) and establishing new collaborations with specific colleagues for personal and student research. Unfortunately, some of the PhD students will even be forced to slightly alter their research topics due to the pandemic. Personal research work included extensive stone tool analyses on a part of the lithic assemblage from Koloshi (a prehistoric cave site in the Konkan region being investigated by the Government of Maharashtra) as well as comprehensive compilation of various paleoanthropological data for comparative analyses and future publications. Substantial time was also spent on formally reviewing several important papers being contributed to a special proceedings volume to be published by the Geological Society of London and

co-edited by three of my PhD students. Finally, labwork and short field visits were carried out by three PhD students on the MoE-funded STARS project awarded to Parth R. Chauhan and Anoop Ambili in collaboration with Panjab University and Birbal Sahni Institute of Palaeosciences (BSIP, Lucknow) (ID: 651; Subsistence and symbolism in prehistoric India: Understanding environmental contexts in relation to Homo sapiens dispersals and adaptations): Rajesh Poojari carried out geological fieldwork and mineral sample collection in relation to rock art sites in the Narmada Valley (Madhya Pradesh); Shashi Mehra completed geoarchaeological sample collection in the Son Valley (Uttar Pradesh); Yezad Pardiwalla continued geoarchaeological surveys in the Damoh Valley (Madhya Pradesh). In addition, multiple one-day field visits were also made to the local Siwalik Hills in relation to palaeontological discoveries by Anubhav Preet Kaur including numerous ostrich eggshell fragments for the first time in the Indian Siwalik zone and possibly the oldest-known such evidence in Quaternary context in India. Geological and geochronological samples were also collected from some of these palaeontological sites, generally dominated by fossilized bones and teeth of Plio-Pleistocene mammals.

Caption: Rock painting of a warrior on horseback in the Narmada Valley, M.P. (Pic: Rajesh Poojari).

Caption: Ostrich eggshell fragment found in the nearby Siwalik Hills (Pic: Anubhav Preet Kaur).

V. Rajesh

During the last one year I have completed a chapter titled ‘Progressivism in Tamil Literature’ as a part of book manuscript on critical history of Tamil literature. I received positive feedback from the anonymous reviewers for the chapter and the editor of the volume. Since then, I have been working on another chapter on poetics and politics of classical Tamil literature. The progress of the book manuscript is slow due to several impediments ranging from pandemic induced restrictions on mobility and consequently access to crucial primary and secondary publications related to the work. I attended a meeting of authors in the series ‘Critical Histories of Bhasha Literatures’ in October 2020 organised by the editors and publisher and updated my ongoing work on the history of Tamil literature. My essay ‘The Making of Classical Tamil Literature: Multiple Sources in its Construction’ in the edited volume Seeking History through Her Sources: South of the Vindhyas was due to appear in the first half of the 2021 but delayed due to pandemic. The publisher has sent a letter indicating that the volume will be out by the second half of the year. I am also developing an article on regional lives of progressivism for a journal which I anticipate to send for review this year.

8.4.2. Visits of the faculty members

None

8.4.3. Talks delivered

Anu Sabhlok

— Anu Sabhlok. 'Road Chronicles: subaltern stories from the Indo-Tibetan Border Road' Invited lecture delivered online. Hofstra University, NY

— Anu Sabhlok 'Writing ethnography' Invited Lecture delivered online. Ambedkar University, Delhi.

Parth R. Chauhan and group members

— Akash Srinivas. 'Archaeology 101: An Introduction to Archaeology and South Asian Prehistory', at Mount Carmel College (Autonomous), Bangalore (6 February, 2021).

— Akash Srinivas. 'Variability of Mode 2 technology: A reinvestigation into the implications of the Movius Line and 'Acheulean-like' technologies of South, East and Southeast Asia', at Binalot Talks Online Edition (18 November, 2020).

— Akash Srinivas. 'Archaeology 101: Introduction to Archaeology and the South Asian archaeological record', at Christ PU College, Bangalore (10 August, 2020).

— Akash Srinivas. 'Variability of Mode 2 techno-complexes in the South Asian Lower Palaeolithic: Three case studies of technological and reduction sequence analyses', at Palaeo Talks Session I: South Asian Acheulean (3 May, 2020).

— Parth R. Chauhan. Reconstructing the Indian past using stone tools and rock art. Central University of Karnataka (online). June 18, 2020.

— Parth R. Chauhan. When Archaeology meets Geology. Mission Devrai (online). October 13, 2020.

— Parth R. Chauhan. Human evolution in the centre of the Old World: An updated review of the South Asian Palaeolithic. Nagaland University (online). October 16, 2020.

— Parth R. Chauhan. Prehistoric humans, animals & art: Current mysteries in Indian paleoanthropology. Indian Institute of Technology-Gandhinagar (online). November 20, 2020.

— Parth R. Chauhan. Pursuing prehistoric archaeology in India. University of Kerala (online). December 4, 2020.

— Parth R. Chauhan. Paradigm shifts in paleoanthropological research & the role of South Asia. University of Connecticut-Stony Brook University archaeology lecture series (online). February 4, 2021.

V. Rajesh and group members

— V. Rajesh, 'Regional Lives of Progressivism: The Tamil Experience', Department of History Webinar Series, School of Social Sciences, University of Hyderabad, 10 September 2020.

8.4.4. Conferences attended by the researchers

Debdulal Saha

— Debdulal Saha. Urban Precarity: Insights from North-East India. Living on the Edge: Poor and Vulnerable in Indian Cities. Organised by the School of Development Studies, Tata Institute of Social Sciences (TISS) Mumbai. 17 October 2020.

Parth R. Chauhan and group members

— Akash Srinivas. 2020. A Century of Prehistory at Kibbanahalli: Paralleling trends in South Asian Prehistoric Studies, at Archaeology from Home: Connecting Thoughts and Things hosted by the Sharma Centre for Heritage Education, Chennai, India (22 June, 2020 to 27 June 2020).

— Akash Srinivas. 12th Experimental Archaeology Conference (EAC12), organised by EXARC (29 March, 2021 to 1 April, 2021)

— Akash Srinivas. 1st Virtual Conference for Women Archaeologists and Palaeontologists, organised by TRACES, Université Toulouse Jean Jaurès and PALEVOPRIM, Université de Poitiers, France (8 March, 2021 and 9 March, 2021).

— Akash Srinivas. Online Training Program on Quaternary Palynology, organised by the Association of Quaternary Researchers (AOQR) and Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow, India (22 February, 2021 to 24 February, 2021).

— Akash Srinivas. Training Program on Geospatial technologies in Prehistoric Geo-archaeological studies, conducted by Prabhin Sukumaran, Charotar University of Science and Technology (CHARUSAT), Anand, India (18 September, 2020 to 13 October, 2020).
— Akash Srinivas. International Conference on Paleoclimate Changes, organised by the Vellore Institute of Technology, Vellore, India (9 July, 2020 to 10 July, 2020).
— Akash Srinivas. The Dmanisi Paleoanthropological Field School Online 2020 Lecture Series, organised by Dmanisi Paleoanthropological Field School Team, Georgian National Museum, Tbilisi, Georgia (15 June, 2020 to 10 July, 2020).
— Jayashree Mazumder. 2021: Attended an online one-day workshop (an interactive session with experts) on "Grant writing and Management' organised on 26th February 2021 by India Offices of Max Planck Gesellschaft (MPG) and University of Cologne (UoC), in association with the German Centre for Research and Innovation (DWIH), New Delhi.
— Jayashree Mazumder. 2020: Attended an online two-day workshop on "Grant writing and Management' organized on 23rd and 24th November 2020 by India Offices of Max Planck Gesellschaft (MPG) and University of Cologne (UoC), in association with the German Centre for Research and Innovation (DWIH), New Delhi.
— Jayashree Mazumder. 2020: Presented a paper on "Primate archaeology: Revisiting our past by exploring the present", at an international webinar Archaeology from home: Connecting things and thoughts organized from 22nd to 27th June 2020.
— Parth R. Chauhan. New paleoanthropological evidence from the central Narmada Basin, India (2014-2019). Allchin Symposium- University of Cambridge, U.K. (online). December 5, 2020.
— Parth R. Chauhan. Digging through prehistoric India. International Science Festival (online). December 2020.
— Vivek Singh, Observations on the distribution of Palaeolithic sites in the central Narmada valley, India. Palaeo Talks. Date: 3rd May, 2020.

V. Rajesh and group members

— V. Rajesh, 'A Proposal for a Critical History of Tamil Literature', Critical Histories of Bhasha Literatures, Series Meeting, 23-24 October 2020.

8.5. Department of Mathematical Sciences

8.5.1. Summary of the research work

Abhik Ganguli

Jointly with Mr. Suneel Kumar, we proved local constancy of the mod p reduction of certain families of crystalline representations (typically coming from modular forms) in the weight space. Using the mod p local Langlands correspondence, an explicit radius of local constancy dependent only on the slope is given by computing the exact reduction.

Preprint: Abhik Ganguli and Suneel Kumar, "On the local constancy of certain mod p Galois representations", 37 pages.

Amit Kulshrestha

My research interests are broadly in the field of algebra. Continuing my ongoing work on word problems in linear groups, in a collaboration with Anupam Singh and Rijubrata Kundu we studied images of power maps in finite reductive groups and obtained asymptotic bounds on the ratio of powers in such groups. Very explicit computations were done for general linear groups and unitary group. In another work with Varadharaj Srinivasan we study splittings on derivations on quaternion algebras. In particular, we proved that there are quaternion algebras with derivations which are not split by their generic splitting fields for any choice of derivation on the generic splitting field.

Chanchal Kumar
We have been studying the properties of the skeleton ideals of graphs. We have computed all the multigraded Betti numbers of the skeleton ideals of the complete graphs. Further, we could give an interpretation of the spherical parking functons of certain graphs in terms of the uprooted spanning trees. Now we are trying to extend this beautiful relationship between the algebraic invariants like standard monomials of the skeleton ideals of graphs and the combinatorial invariants like uprooted trees, to more general classes of graphs.

Chetan Balwe
My research area is motivic homotopy theory, which explores the homotopy theory of algebraic varieties in which the affine line plays the role of the unit interval. The following results were obtained:
(i) (Joint work with Amit Hogadi and Anand Sawant) We proved that standard norm varieties (which are used in the proof of the Bloch-Kato conjecture) are A1-connected, and hence R-trivial, over an algebraically closed field of characteristic zero. This improves a result of Karpenko and Merkurjev.
(ii) (Joint work with Bandna Rani and Anand Sawant) For any positive integer n, we prove that there exists a sheaf of sets X such that the functor of naively A1-connected components must be iterated n times on X to obtain the sheaf of A1-connected components of X. We also prove that for any sheaf of sets F, the field valued points of the universal motivic quotient and the sheaf of A1-connected components are identical. This provides evidence for Morel's conjecture on the A1-invariance of the sheaf of A1-connected components.

Jotsaroop Kaur
In an ongoing project with Saurabh Shrivastava, we have extended the result of Sanghyuk Lee and E. Jeong (Maximal estimates for the bilinear spherical averages and the bilinear Bochner-Riesz operators, Journal of Functional Analysis) regarding the boundedness of maximal bilinear Bochner Riesz means in all dimensions. The preprint is on arxiv (arXiv: 2010.06843) and has been submitted.
In some cases, our results are very sharp. Exploiting these techniques, we are further investigating the boundedness of Stein's square function for bilinear Bochner Riesz means.

Kapil Hari Paranjape
K-theory for projective schemes: Nori's proof of the Adams-Riemann-Roch theorem extended to the relative case.
Intermediate Jacobians: In collaboration with Nori, looked at certain threefolds associated with K3 surfaces with complex multiplication.
Vector Bundles: In collaboration with Nori, Mohankumar, Srinivas, looked at the work of O'Sullivan associating a reductive algebraic group scheme with vector bundles on a projective variety.

Krishnendu Gongopadhyay
I continued investigation to classify reversible and strongly reversible elements in certain groups. Also investigated presentation of some special quotients of a generalised braid group.

Lingaraj Sahu

I am mainly working on the following themes.

Self-adjoint operators on Hilbert spaces play an important role in mathematics as well as in physics. The class of such operators is well studied and have a rich theory in general. We are intrested in studying special class of conctrete operators involving Laplacian operator and its perturbation by a suitable potential. Many mathematicians and physicst have been studied such operators from a long time, however, many questions are still unsettled. With Alok, we are studying mathematical aspect like distribution of eigen values, their gaps and simplicity. Also, we are intrested in behaviour of eigenfunctions and their nodal structure.

There is an analog notion of convexity in the non-commutative algebras of operators. In this set-up, the scalar co-eficiants in the convex linear combination are replaced by positive operators. This convexity, know as C*-convexity, plays a crucial role in studying of C*-algebras. With Murugan, we are investigating the structure of C*-extreme completely positive maps and exploring possible relaion to Arveson's hyperigidity of opertor systems. We are also trying to verify hyperrigidity conjecture in certain approxomately finite dimentional C* -algebras.

Mahender Singh

My research group has been working on structural and topological aspects of planar braid groups. We proved Alexander and Markov theorems for higher genus analogues of planar braid groups and developed the theory from algebraic point of view. Also, we have been working on orderability and cohomology of quandles with a focus on link quandles. Our work also touched upon cohomological aspects of algebraic solutions of the quantum Yang-Baxter equation.

Neeraja Sahasrabudhe

My current area of focus is interacting urn models and their applications to random graphs and opinion dynamics. We consider N urns with non-zero number of balls of two colours (white and black). At each time step, the urns are reinforced with more balls. The reinforcement scheme of each urn depends on all urns or on a non-trivial subset of the given set of the N urns, called the dependency set of that urn. An example of such a model is a graph based interacting urn model, where a natural choice for the dependency set of an urn is the collection of urns in its neighbourhood. The main ob-jective is to study asymptotic properties of such models. More precisely, we would like to answer questions on local/global synchronisation (by synchronisation we mean that fraction of balls of each colour converges to a common local/global limit), distributional properties of the synchronisation limit and obtain corresponding fluctuation limit theorems.

We are currently working on extending some already studied models by introducing two new as-pects, namely, reinforcements based on multiple drawings from urns and graph-based interaction. We specifically want to study how the structure of the graph influences the convergence results and the rates of convergence. We have studied an interacting urn model on a finite directed graph, where each urn at a node, reinforces all the urns in its out-neighbours according to a fixed, non-negative and balanced reinforcement scheme. We obtain conditions for almost sure convergence of balls of either colour depending on the type of reinforcement and the underlying graph structure. Conditions for synchronisation are also obtained along with fluctuation limit theorems for some cases.

There are several areas in probability theory that can be explored from the point of view of urn models. We are currently working on some applications to preferential attachment graphs. We have also used similar tools to obtain optimal influencing strategies for opinion evolution of a fixed population. We are currently working on generalising these results to graph-based majority model for opinion dynamics as well as to growing population model, with or without graph structure.

Shane D'Mello

Results in affine glued knots (a special class of real rational knots) including their low degree classification and relationships with some classical knot properties (joint with student, Mr. Vinay Gaba).

Soma Maity

Consider a proper geodesic metric space (X,d) equipped with a Borel measure m. We established a family of uniform Poincare inequalities on it if the given measured metric space satisfies a local Poincare inequality and a condition on the growth of volume. In particular if m is doubling then it satisfies a uniform (sigma, beta, sigma)-Poincare inequality. If (X,d,m) is a Gromov-hyperbolic space, then using a volume comparison theorem we obtain a uniform Poincare inequality with an exponential growth of the Poincare constant. Next, we relate the growth of Poincare constants to the growth of discrete subgroups of isometries of (X,d), which act on it properly. We show that if (X,d) is the universal

cover of a compact CD(K,N) space, it supports a uniform Poincare inequality, and the Poincare constant depends on the growth of the fundamental group of the quotient space. This is a joint work with Gautam Neelakantan from MS 16. We submitted this paper to a journal.

Sugandha Maheshwary

During this period, I continued investigations around the unit group of an integral group ring. Three major directions followed during this time are as listed below:

ABELIANIZATION OF THE UNIT GROUP OF AN INTEGRAL GROUP RING: For a finite group G and U:= U(ZG), the group of units of the integral group ring of G, we (joint work with Leo Margolis and Andreas Bachle, Vrije Universitat Brussel, Belgium) studied the implications of the structure of G on the abelianization U/U′ of U. We posed questions on the connections between the exponent of G/G′ and the exponent of U/U′ as well as between the ranks of the torsion-free parts of Z(U), the center of U, and U/U. We showed that the units originating from known generic constructions of units in ZG are well-behaved under the projection from U to U/U′ and that our questions have a positive answer for many examples. We also exhibited an explicit example which show that the general statement on the torsion-free part does not hold, which also answers some other relevant questions.

Units and augmentation powers in integral group rings: The augmentation powers in an integral group ring ZG induce a natural filtration of the unit group of ZG analogous to the filtration of the group G given by its dimension seriee. We (joint work with I.B.S. Passi, IISER Mohali) investigated this filtration, in particular, the triviality of its intersection and obtained some interesting results.

The lower central series of the unit group of an integral group ring: The aim of this work was to draw attention towards various natural but unanswered questions related to the lower central series of the unit group of an integral group ring.

THE GRUENBERG-KEGEL GRAPH OF A FINITE SOLVABLE cut GROUP: In this project, we (joint work with A. del Rio, University of Murcia, Spain, A. Kiefer, A. Bachle) study the Gruenberg-Kegel graphs of finite solvable cut groups. It is known that a finite solvable cut group has at most four elements in its prime spectrum. We give complete classification of the Gruenberg-Kegel graphs of finite solvable cut groups which have at most three elements in their prime spectrum. For the remaining case, we give fairly good restrictions on the possibilities. The prime graph question has also been answered for most finite cut groups.

Most of the above work has been accepted for publication and the work on GK graphs of cut groups is under compilation process.

Tanusree Khandai

One can associate with every finite-dimensional simple Lie algebra $\mathfrak{g}$ over the complex field, an infinite-During this period I have continued my study on the finite-dimensional integrable representations of the affine Kac-Moody Lie algebras. Using combinatorial methods, we have been able to construct a basis of the truncated Weyl modules of current algebras of type A_2. Using our methods, we were also able to answer questions on the analogs of Schur-positivity in the context of finite-dimensional representations of the current Lie algebras of type A_2. We are currently writing up our results.

Vaibhav Vaish

Along with my thesis student Ms. Shikha Bhutani, we began exploration of arc spaces in Algebraic Geometry which connect naturally to the study of singularities and their resolutions. Additionally, we continued exploration of motives associated to Shimura varieties, in particular attempting to understand the eccentric Borel-Serre compactification.

Varadharaj R. Srinivasan

In order to determine whether or not a given differential equation admits a closed form solution, one needs to understand the structure of the extension field generated by the closed form solutions. In the article "Differential Subfields of Liouvillian Extensions", I have proved a structure theorem for

extension fields generated by closed form solutions and used it to show that certain classes of differential equations can not have closed form solutions.

Yashonidhi Pandey

1. joint with Vikraman Balaji, preprint “On a “wonderful” Bruhat-Tits group scheme”
2. joint with Vikraman Balaji, preprint “On homomorphisms of $\pi_1(\mathbb{P}^1 \setminus \matcal{R}) $ into compact semisimple groups”

8.5.2. Visits of the faculty members

Kapil Hari Paranjape

— Department of Mathematics, IIT Bombay, Mumbai: May 2020.

Yashonidhi Pandey

— Indian Statistical Institute, Delhi 29th-31st March 2021

8.5.3. Talks delivered

Amit Kulshrestha

— Amit Kulshrestha. Ramanujan: Life and Work. St. Xavier's College, Goa. March 13, 2021.
— Amit Kulshrestha. Extracting Roots in Groups and Matrices. Indian Women and Mathematics Regional Workshop, IIT Bhilai. February 21, 2021.
— Amit Kulshrestha. A series of three lectures on groups and spatial symmetry. Miranda House, Delhi. January 27-29, 2021.
— Amit Kulshrestha. Word maps and Goto's method. Group Theory Sangam. January 19, 2021.
— Amit Kulshrestha. From Linear Algebra to Google. Teachers' Enrichment Workshop, IIT Jodhpur. November 29, 2020.
— Amit Kulshrestha. Teaching mathematics at undergraduate level. UGC-HRDC Refresher Course, Punjabi University, Patiala. November 19, 2020.
— Amit Kulshrestha. Constructing mathematics: A demonstration. UGC-HRDC Refresher Course, Punjabi University, Patiala. November 18, 2020.
— Amit Kulshrestha. Life and work of Srinivasa Ramanujan (in Hindi). Ramanujan Yatra Series, Vigyan Prasar. October 20, 2020.
— Amit Kulshrestha. Orbits and stabilizers, Symmetry in Sciences and Engineering. University of Mumbai. September 16, 2020.
— Amit Kulshrestha. Mathematics without borders. Faculty Development program, Interconnections between Science and Technology, UIET, Panjab University, Chandigarh. August 04, 2020.

Chetan Balwe

— Chetan Balwe: Geometric approach for the sheaf of A1-connected components, Algebraic Geometry Seminar at IIT Bombay, August 31, 2020.
— Chetan Balwe: Geometric criteria for A1-connectedness, Seminar on A1-topology, motives and K-theory at Euler International Mathematical Institute, March 04, 2021

Jotsaroop Kaur

— Ramanujan’s Master Theorem for Sturm Liouville operator (Inter IISER NISER meet, IISER Mohali, 13-17 July, 2020)
— Maximal estimates for bilinear Bochner Riesz means (APRG seminar, IISc, Bangalore, 21 October, 2020)
— Fourier series: Classical and Modern Aspects (International Women’s Day in Mathematics, IISER Behrampur, 12 May, 2021)

Kapil Hari Paranjape

— Kapil Hari Paranjape, “Tools for Teaching Mathematics Online”, DFOT, 1st November 2020.

— Kapil Hari Paranjape, “An algebraic group scheme for vector bundles on a projective variety”, IISER Pune. 4th December 2020
— Kapil Hari Paranjape, “Debian on a Chromebook”, MiniDebConf India 2021, 24th January 2021
— Kapil Hari Paranjape, “Beyond Abel and Jacobi”, IIT Gandhinagar, 19th February 2021.

Krishnendu Gongopadhyay

— Krishnendu Gongopadhyay. Classical geometries and linear algebra. Bangabashi College, Kolkata. 8th June, 2020. (Online talk)
— Krishnendu Gongopadhyay. The geometry of the ICM-2010 logo. Srinivasa Ramanujan Memorial Lecture Series, Karnataka Science and Technology Academy, December 22--24, 2020. (online talk)
— Krishnendu Gongopadhyay. Real unipotent elements in simple Lie groups, Invited speaker at the 35th Annual Conference of the Ramanujan Mathematical Society, December 28--30, 2020, Central University of Rajasthan. (online)
— Krishnendu Gongopadhyay. On some decomposition of singular braid groups. Group and quandls in low-dimensional topology. Tomsk State University, Russia. 3rd October, 2020. (online)
— Krishnendu Gongopadhyay. Minicourse on Hyperbolic geometry (6 lectures). Kalna College-TIMC Summer School in Mathematics (Online workshop), 12th June--12th July, 2020. (online)
— Krishnendu Gongopadhyay. The geometry of the ICM-2010 logo. Sikkim University, International Day of Mathematics Celebration, March 15, 2021. (online)
— Krishnendu Gongopadhyay. Real unipotent elements in simple Lie groups. Group Theory Sangam: A confluence of group theorists in India. March 23, 2021. (online)

Lingaraj Sahu

Lingaraj Sahu, C*-convexity, ‘Intrer IISER NISER Matrhematics Webmeet 2020’, IISER Mohali, July 13-17, 2020 (online).

Mahender Singh

— Mahender Singh. Algebra of knots: quandles and braids. Novosibirsk State University. July 2020 (online).
— Neha Nanda (PhD student of Dr. Mahender Singh). An excursion on doodles on surfaces and virtual twins. Moscow-Beijing topology seminar series. 16 December 2020 (online).
— Mahender Singh. Doodles on surfaces and related groups. Indian Statistical Institute Bangalore. January 2021 (online).
— Manpreet Singh (PhD student of Dr. Mahender Singh). Algebraic structures in knot theory. Lomonosov Moscow State University. 08 February 2021 (online).
— Mahender Singh. Automorphisms of Coxeter groups. Harish-Chandra Research Institute. February 2021 (online).
— Neha Nanda (PhD student of Dr. Mahender Singh). An excursion on doodles on surfaces. Moscow State University. 15 February 2021 (online).
— Mahender Singh. Surface knot theory and related groups. Moscow State University. March 2021 (online).
— Dr. Tushar Naik (Postdoc of Dr. Mahender Singh). Finite groups with exactly two conjugacy class sizes and the analogous study in Lie algebra. Online Weekly Research Seminar. 19 March 2021 (online).

Neeraja Sahasrabudhe

— Public Understanding of Mathematics and Mathematicians' Understanding of Society: Gender Perspective, Panel discussion at Virtual Math Fest 2020, 20-26 July 2020.

Shane D’Mello

— Shane D’Mello. Real Rational knots. IISER-NISER Mathematics webmeet 2020. 17th July, 2020

Soma Maity

— Soma Maity, “Uniform Poincare inequalities on measured metric spaces”, IISER Bhopal, 26th March, 2021.
— Soma Maity, “Uniform Poincare inequalities on measured metric spaces”, University of Calcutta, 17th March, 2021.

Sugandha Maheshwary

— Dr. Sugandha Maheshwary, the upper and the lower central series of U(ZG), IISER-NISER WebMeet, conducted by Department of Mathematical Sciences, IISER Mohali, July 13-18, 2020.
— Dr. Sugandha Maheshwary, the unit group of an integral group ring., IISER-NISER WebMeet, conducted by Department of Mathematical Sciences, IISER Mohali, Dates: July 13-18, 2020
— Dr. Sugandha Maheshwary, The unit group of sn integral group ring., Group Theory Sangam [Weekly seminars for group theorists from 3:30pm to 5:30pm on Tuesday from Tue Jan 5 to Tue Jun 29 (IST)], Dates: 02 February 2021
— Dr. Sugandha Maheshwary, An introduction to algebraic coding theory, IISER Mohali, GSG seminar, Dates: February 17, 2021.
— Dr. Sugandha Maheshwary, Computational Mathematics, webinar series conducted by DST, Govt. of Rajasthan in association with INYAS, Dates: April 19, 2020.
— Dr. Sugandha Maheshwary, 'Triangles and Triangular numbers', a webinar for students of Govt. School, Dariya, Dates: February 6, 2021.
— Dr. Sugandha Maheshwary, She Inspires (own experience of scientific journey), 'She Inspires', webinar series conducted by INYAS Dates: November 21-23, 2020.

Tanusree Khandai

— Ms Shushma Rani, Combinatorial view point of root spaces of Borcherds Kac-Moody Lie superalgebra, CUP-IISERM Mathematics Graduate Student Workshop, Dates: 15 December, 2020

Vaibhav Vaish

— Vaibhav Vaish. An introduction to abstract nonsense (aka Category Theory). Berchmans Centre for Mathematical Sciences (Online). September 2020.
— Vaibhav Vaish. What is Algebraic Geometry? IISER Mohali Outreach Program (Online), September 2020.

8.5.4. Conferences attended by the researchers

Kapil Hari Paranjape

— Kapil Hari Paranjape. No talk. Inter IISER-NISER Math Meeting. 13-17 July 2020
— Kapil Hari Paranjape, No talk. RMS Annual Meeting. 28-30 December 2020
— Kapil Hari Paranjape. "Debian on a Chromebook", MiniDebConf Indian 2021, 23-24 January 2021

Krishnendu Gongopadhyay

— Krishnendu Gongopadhyay. ``Topics at the Interface of Low Dimensional Group Actions and Geometric Structures", 4—15 January, 2021. (virtual)
— Krishnendu Gongopadhyay. Geometry Lab United Conference (virtual). July 16—17, 2020. ICERM.

Mahender Singh and group members

— Manpreet Singh (PhD student of Dr. Mahender Singh). Virtually symmetric representations and marked Gauss diagrams. Conference on Physical Knotting, Vortices and Surgery in Nature. Novosibirsk State University. 19 August 2020 (online).
— Manpreet Singh (PhD student of Dr. Mahender Singh). A generalization of Gauss diagrams. 3rd International Conference Groups and Quandles in Low Dimensional Topology. 03 October 2020 (online).
— Neha Nanda (PhD student of Dr. Mahender Singh). Virtual twins and doodles. 3rd International Conference Groups and Quandles in Low Dimensional Topology. 03 October 2020 (online).
— Mahender Singh. Quandle cohomology, extensions and automorphisms. 3rd International Conference Groups and Quandles in Low Dimensional Topology. 03 October 2020 (online).
— Neha Nanda (PhD student of Dr. Mahender Singh). Virtual twins and doodles. First Korea-Russian Conference on Knot theory and related topics. 02-06 November 2020 (online).
— Neha Nanda (PhD student of Dr. Mahender Singh). Doodles on surfaces and related groups. CUPIISERM Mathematics graduate student workshop. 15 December 2020 (online).
— Mahender Singh. Doodles on surfaces. 86th Annual Conference of the Indian Mathematical Society. December 2020 (online).

— Mahender Singh. Surface knot theory and related groups. IISER Bhopal Math Symposium. March 2021 (online).

Neeraja Sahasrabudhe

— Advances Urn Models and their Applications, Indian Women & Mathematics Annual Conference, 27-28 March 2021.

Sugandha Maheshwary

— Multiple, conducted by IMSC Chennai, -series of talks, Virtual Math Fest 2020, Dates: July 20-26, 2020.

— Science Leadership Workshop, Dates: June 22-28, 2020., Central University of Punjab, Bathinda

— An Introduction to R for Data Science, Dates: December 14-17, 2020, University of Cambridge

Tanusree Khandai

— Discussion Meeting on Representation Theory 2020, December 10-12, 2020 (online).

Abhik Ganguli

— Inter IISER NISER Mathematics Webmeet 2020, July 13-17, 2020.
Number theory Session Chair, July 13.

— Recent developments around p-adic modular forms (online), ICTS (TIFR), Nov 30 - Dec 04, 2020. Morning Session Chair, Dec 04.

8.6. Department of Physical Sciences

8.6.1. Summary of the research work

Abhishek Chaudhuri

We consider a model of an extensible semi-flexible filament moving in two dimensions on a motility assay of motor proteins represented explicitly as active harmonic linkers. Their heads bind stochastically to polymer segments within a capture radius, and extend along the filament in a directed fashion before detaching. Both the extension and detachment rates are load-dependent and generate an active drive on the filament. The filament undergoes a first order phase transition from the open chain to spiral conformation and shows a reentrant behaviour in both the active extension and the turnover, defined as the ratio of attachment–detachment rates. Associated with the phase transition, the size and shape of the polymer change non-monotonically, and the relevant autocorrelation functions display a double- exponential decay. The corresponding correlation times show a maximum signifying the dominance of spirals. The orientational dynamics captures the rotation of spirals, and its correlation time decays with activity as a power law.

Ambresh Shivaji

a) Di-vector boson + Higgs production via gluon fusion

We have extended the work on di-boson production in association with a Higgs boson via gluon fusion and, have studied the role of identifying events with specific polarization states of the vector bosons. We found that the relative contribution of gluon-gluon channel with respect to the dominant quark-quark channel can be enhanced by studying the events in which massive vector bosons are polarized longitudinally. We hope that such stratigies would be useful in probing new physics in gluon fusion processes where one or more vector bosons are produced in the final state.

b) Precise prediction for $H \to 4\ell$ decay

We have considered QCD correction in the four-lepton decay channel of the Higgs boson which appears at two-loop level in the perturbation theory. We have indentified all the two-loop Feynman diagrams which contribute to the decay amplitude. The diagrams are reduced to master integrals which are calculated numerically. At this stage we have performed the UV renormalization of the two-loop amplitude and, within working precision, the result is finite. In the next step, we have to combine the

two-loop amplitude with the three-level amplitude and perform the phase space integration in order to obtain the O(αs) correction to the partial decay width.

c) Probing anomaous VVH couplings at eP collider
Electron-Proton (eP) collider can play an important role in stuying new physics beyond the standard model as at an eP collider i) sufficently large energy can be achieved as compared to an e+e- collider and ii) the hadronic background is relatively less compared to the background at a pp collider. We have studied the non-standard couplings of vectors bosons (V) with a Higgs boson (H) in eP →eHj + X process. We have identified that the angle between the electron (e-) and the jet (j) can distinguish CP-even and CP-odd couplings of Higgs with Z boson. We have made some progress towards a statistical analysis based on signal and background processes which would allow us to assess the potential of future eP collider in probing anomalous ZZH couplings.

Ananth Venkatesan
We investigated vortex motion induced dissipation in super conducting nano beams.
We investigated novel surface electronic states in ceramics that clearly showed quantum oscillations.
Students were made to device a pedagogical experiment on mechanical detection of phase transitions in a liquid crystal.
Several MS students developed cryogenic and room temperature Microwave electronic components for future measurements.

Anosh Joseph
During this period, our group focussed on strongly coupled quantum field theories using numerical methods. We are continuing our investigations on the BMN matrix model. This model takes part in the holographic duality conjecture. We have looked at spontaneous supersymmetry breaking in quantum mechanics with the help of complex Langevin dynamics (Complex Langevin Dynamics and Supersymmetric Quantum Mechanics, arXiv E-print: 2011.08107). As part of another project we looked at dynamical supersymmetry breaking in a quantum mechanics with two supercharges (Probing Non-perturbative Supersymmetry Breaking through Lattice Path Integrals, arXiv E-print: 2011.08109). We also looked at a class of models with complex actions using the Lefschetz thimble method (Lefschetz Thimbles and Quantum Phases in Zero-Dimensional Bosonic Models, arXiv E-print: 2011.10486, Published in: Eur. Phys. J. C 80 (2020) 10).

Aru Beri
(i) My first project during this period is based on the following theme “Evolution of timing and spectral characteristics of 4U 1901+03 during its 2019 outburst using the Swift and NuSTAR observatories”.

We have studied an X-ray transient source, 4U 1901+03 which hasbeen classified as a Be-X-ray binary based on its X-ray timing properties. There have been several debates regarding the plausible value of cyclotron scattering resonance feature (CRSF or cyclotron line) in its X-ray spectrum. During its previous outbursts, 10 keV absorption feature was believed to be its cyclotron line. In 2019, this source underwent a very bright (with peak X-ray flux of ∼ 8× 10-9 erg cm-2 s-1) and long (duration of 6 months) Type-II outburst. During this outburst, several multiwavelength observations were performed as part of Simultaneous Multiwavelength Astronomy Research in Transients NETwork (SmartNet) and 4U 1901+03 was observed four times with Nuclear Spectroscopic Telescope Array (NuSTAR) and several Swift observations were made. In our work, we have used Swift and NuSTAR observations. We performed broadband spectroscopy in the 1-70 keV energy band using four observations made with Swift and NuSTAR at different intensity levels. Our timing results reveal the presence of highly variable pulse profiles dependent on both luminosity and energy. Our spectroscopy results showed the presence of CRSF at 30 keV. This feature at 30 keV is highly luminosity and pulse-phase dependent. Phase-averaged spectra during the last two observations, made close to the declining phase of the outburst

showed the presence of this feature at around 30 keV. The existence of CRSF at 30 keV during these observations is well supported by an abrupt change in the shape of pulse profiles found close to this energy. We also found that 30 keV feature was significantly detected in the pulse-phase resolved spectra of observations made at relatively high luminosities. Non-detection of CRSF at certain pulse phases is explained as a result of large gradient of the magnetic field strength over the visible column height or latitudes on the stellar surface. Moreover, all spectral fit parameters showed a strong pulse phase dependence. In line with the previous findings, an absorption feature at around 10 keV is significantly observed in the phase-averaged X-ray spectra of all observations and also showed a strong pulse phase dependence.

In this work Mr. Tinku (MS15178) worked along with me and the paper has now been published in the Monthly Notices of Royal Astronomy Journal (MNRAS) with the following details.

Aru Beri*, Tinku, Nirmal K. Iyer, Chandreyee Maitra "Evolution of timing and spectral characteristics of 4U 1901+03 during its 2019 outburst using the Swift and NuSTAR observatories" MNRAS, 2021, 500, 1350-1365

(ii) My second project is based on the study of "AstroSat Observations of the first Galactic ULX Pulsar Swift J0243.6+6124"

Ultra-luminous X-ray sources (ULXs) are non-nuclear point-like objects with apparent luminosities exceeding 1039 erg s-1. A majority of the ULXs are found in external galaxies and are often considered promising candidates to host heavier than stellar-mass black holes. Coherent X-ray pulsations were discovered from a ULX in M82, thanks to the fast-timing capability of NuSTAR, making it the first Ultra-luminous X-ray pulsar (ULP). Currently only a handful of ULPs are known. Swift J0243.6+6124 is the first Galactic ULP, and was observed with AstroSat during its 2017-2018 outburst at both sub- and super-Eddington levels of accretion with X-ray luminosities of LX ∼7×1037 and 6×1038 erg s-1, respectively. Our broadband timing and spectral observations show that X-ray pulsations at ∼ 9.85 s have been detected up to 150 keV when the source was accreting at the super-Eddington level. The pulse profiles are a strong function of both energy and source luminosity, showing a double-peaked profile with pulse fraction increasing from ∼ 10% at 1.65 keV to 40−80 % at 70 keV.The continuum X-ray spectra are well-modeled with a high energy cut-off power law (Γ∼ 0.6 − 0.7) and one or two blackbody components with temperatures of ∼ 0.35 keV and 1.2 keV, depending on the accretion level. No iron line emission is observed at sub-Eddington
level, while a broad emission feature at around 6.9 keV is observed at the super-Eddington level, along with a blackbody radius (121142 km) that indicates the presence of optically thick outflows.

This work has been done in collaboration with Sachindra Naik (PRL, India), K.P Singh (IISER Mohali), Gaurava K. Jaisawal (DTU, Denmark), Sudip Bhattacharyya (TIFR), Philip Charles, Wynn C. G. Ho (University of Southampton (UoS), U.K), Chandreyee Maitra (MPE, Germany), Dipankar Bhattacharya, Gulab C Dewangan (IUCAA), Matthew Middleton, Diego Altamirano, Poshak Gandhi (UoS), Harsha Raichur (Nordita, KTH Royal Institute of Technology and Stockholm University). The paper has been published in MNRAS with the following details.

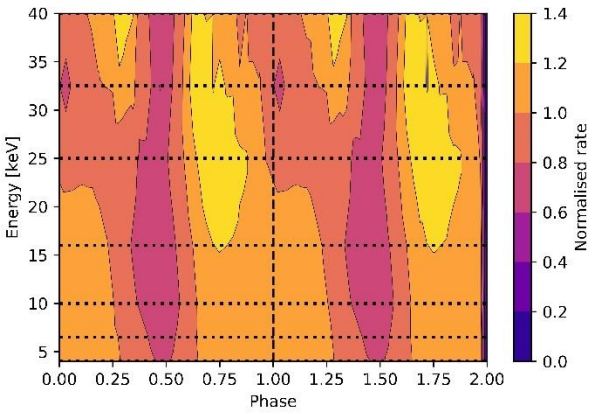
Aru Beri*, et al., "AstroSat Observations of the first Galactic Ultraluminous X-ray Pulsar Swift J0243.6+6124" MNRAS, 2021, 500, 565-575

This publication was also highlighted in phys.org (link below)
https://phys.org/news/2020-10-ultra-luminous-x-ray-pulsar-swift-j024366124.html?deviceType=desktop

iii) I along with my reasearch team have proposed several AstroSat/NICER/Optical observing proposals. With joint AstroSat-NICER observations of low-mass X-ray binaries (LMXBs) we aim at utilizing the unique capabilities of these two instruments in largely complementary energy ranges will be useful to probe the fundamental physics of dense matter and strong gravity by studying kilohertz quasi-periodic oscillations and thermonuclear burst oscillations. Such joint LAXPC/NICER observations will also characterize the X-ray spectral components with the heretofore largest area X-ray instruments in a very broad energy range, and will explore the source state evolution in a new regime. On the other hand, with joint optical/AstroSat proposals we aim to probe rapid, sub-second photometric variations and search for inter-band time delays to disentangle the jet/disc/coronal components using spectral-timing. The total observation time obtained is more than 350 kiloseconds.

iv) With my JRF, Mr. Pinaki Roy, appointed against ISRO research grant, I have been involved in studying thermonuclear X-ray bursts (Type-I X-ray bursts) observed in 4U 1636-536 with AstroSat and NuSTAR. These X-ray bursts are sudden eruption from the neutron star surface and offer a useful tool to measure neutron star parameters such as radius, spin and compactness. Using the AstroSat data we have found burst oscillations (BOs) at ~581 Hz were detected with 4-5 sigma confidence in three of the X-ray bursts during both hard and soft spectral states, during both rising and decay phase of bursts. BOs are considered to result from the stellar rotation induced modulation of a brightness asymmetry and are not straightforward to detect and constrain their properties. Currently, we are in the process of writing a manuscript to be submitted for publication.

v) During this period Vishal Gaur (MS16174) has worked with me for his MS thesis. Vishal has been actively involved in studying Galactic neutron star and black hole transients. These are X-ray binaries that exhibit huge week-to-year-long luminosity increases ("outbursts") with duty cycles on the order of years. Outbursts are thought to be the result of changes in the accretion rate and are accompanied by changes in the accretion geometry. For his thesis, we have carried out a comprehensive study using the multi-band data from Swift, NICER, NuSTAR and AstroSat observatories for two such systems viz. Swift J0840-3615 (J0840) and RX J0209.6-7427 (J0209). For the case of J0840, we have unveiled the nature of the accretor in the X-ray binary. Moreover, our UV and X-ray correlation studies suggested the presence of a viscous-heated accretion disc. For the latter source (J0209) our detailed timing study revealed the evolution of spin period of the neutron star during ∼2 days long observation. We found the presence complex structures in the pulse profiles that are strongly energy-dependent.
vi) I have also been regularly involved in scientific review process during this period. I served as a scientific Reviewer for the Monthly Notices of Royal Astronomical Society Journal (MNRAS), Journal of Astronomy and Astrophysics (JOAA). In addition, I was also a member of the time allocation committee of several space-based observing proposals.



[**Figure Caption:** Heat map of the pulse profile evolution as a function of the energy. This is a two-dimensional plot, showing color-coded flux for photon energy versus pulse phase.]

Arvind

The focus of my group in this period has been on continous variable quantum information processing, quantum contextuality, quantum neural networks and NMR quantum information processing. We found new optimal ways of carrying out tomography of Gaussian states and Gaussian channels and completed the work started by Parthasarthy et. al. We enlarged the concept of contextuality and developed a framework where the contextual non-contextual boundary can be more sharply defined. This new definition has implictions for foundational issue in quantum mechanics as well as on the application of quantum mechanics to quantum infomation processing and quantum communication.
Two of my PhD students, namely Chandan Kumar and Jaskaran Singh Nirankari submitted their theses in this period.

Charanjit Singh Aulakh

The analysis of symmetry breaking a large class of phenomenologically successful Supersymmetric Grand Unified Theories that are asymptotically strong rather than free was carried out using the the identities provided by the Generalized Konishi Anomaly. Using consistency requirements relating chiral condensates imposed by the so called Generalized Konishi Anomaly, we showed that dimensional transmutation via gaugino condensation in the ultraviolet drives gauge symmetry breaking in a large class of asymptotically strong Super Yang Mills Higgs theories. The gauge coupling at the perturbative unification scale M_X generates GUT symmetry breaking VEVs by non-perturbative dimensional transmutation. This obviates the need for large (or any) input mass scales in the superpotential. Rank reduction can be achieved by including pairs of chiral superfields that form trilinear matrix gauge invariants with the Adjoint type multiplet. Novel, robust and {\emph{ultraminimal}} Grand unification algorithms emerge from the analysis. We sketched the structure of a realistic Spin (10) model, with the 16-plet of Spin (10) as the base representation, which mimics the realistic Minimal Supersymmetric GUT but contains even fewer free parameters. We argued that our results point to a large extension of the dominant and normative paradigms of Asymptotic Freedom$/$IR colour confinement and potential driven spontaneous symmetry breaking that have long ruled gauge theories.

Dipanjan Chakraborty

The research activities of the group focused on the three specific themes of active matter, critical dynamics, non-isothermal Brownian motion and a class of non-equilibrium driven systems called pump models. In active matter, the research focused on the orientational dynamics of a Janus colloid which is heated with a laser. Using large scale molecular dynamics simulations, we investigated the orientational dynamics of a heated Janus particle which exhibits self-propulsion. The asymmetric interaction of the Janus colloid with the solvent leads to a different microscopic Kapitza resistance across the solid-fluid boundary of the two halves of the sphere. Consequently, a gradient across the poles of the symmetry axis of the sphere is created which drives the self-propulsion. At late times, the heated particle diffuses with an enhanced diffusivity. This subsequent enhancement of the diffusivity at late times is determined by the hot Brownian motion of the particle, the self-propulsion and the rotational dynamics of the particle. In the published article, we looked at the orientational dynamics of such a system, as well as the subsequent enhancement of the translational diffusivity of the heated Janus colloid at late times. The orientational correlation of the symmetry axis was measured from the simulation and provides a direct access to the rotational diffusion constant. The heating leads to an increase in the rotational diffusivity of the colloid.

On a similar but different topic, we revisited the problem of non-isothermal Brownian motion, where a metal colloidal particle is kept at an elevated temperature compared to the ambient fluid. Such a scenario occurs naturally in various experimental conditions, in particular on Photo-Correlation Spectroscopy, a promising candidate for single molecule tracking. In such a non-equilibrium steady state system, due to the time scale separation between heat diffusion and particle motion, a stationary halo of hot fluid is carried along with the particle resulting in a spatially varying comoving temperature and viscosity

profile. The resultant Brownian motion in the overdamped limit is well described by a Langevin equation with effective parameters. The more general picture of the motion is that of a generalized Langevin equation where the viscous dissipation is strongly correlated over time due to the hydrodynamic effect and the spatially inhomogeneous temperature field. The effective description of the overdamped Langevin equation was extended to incorporate a frequency dependent effective temperature and exact analytical expressions were obtained for a better comparison of experimental data with that from theoretical calculations.

In critical dynamics, the work focused on the static dynamic critical phenomena of a symmetric binary mixture. Using large scale simulations with home grown code on GPU's, a finite size scaling analysis was investigated for such a continuum model and an alternative scheme for extracting the critical temperature and the non-universal amplitudes were developed using the molecular dynamic trajectories. The scheme has the added advantage that no separate Monte Carlo simulations were required to extract these quantities, but in fact the same set of simulations give access to both the dynamic and static physical quantities, thus saving a considerable simulation time in investigating such complex systems.

Finally, the group was actively involved in investigating a class of non-equilibrium driven systems, called pump models which are particularly intriguing due to the property that they involve periodic forces that vanish on an average but still drives an averaged directed current. The model system was that of repulsively interacting two dimensional colloidal that was a driven by flashing ratchet potential which is commensurate with the underlying lattice. The "*flashing*" was implemented by stochastically switching "*On*" and switching "*Off*" the potential with a prescribed switching rate which we denote as the frequency of the drive. The directed current in the system shows a resonance behaviour as opposed to lower dimensional systems where the particle current saturates. The most promising finding was the structural changes in the system as function of the frequency of the drive. The system exhibits a re-entrant transition from soft-solid to a modulated liquid to again a solid as the frequency of the drive was increased. With such a feature, where the structure and the current can be controlled with an external parameter, the system has possible application in template assisted drug delivery. The complete characterization of the non-equilibrium phase diagram required large scale simulations and is currently being pursued.

Goutam Sheet

Our group has proposed a unique tunnelling setup that can help in direct and unambiguous detection of Majorana Fermions. The setup consists of an array of Rashba spin-orbit coupled semiconducting nanowires lying in close proximity to s-wave superconductor weakly coupled to each other. In the topological regime, turning individual nanowires ON or OFF by using mechanical switch (or local top gating) to make N either even or odd provides a provision to switch the zero bias conductance peak (ZBCP), one of the smoking gun signature of Majorana Fermions, OFF or ON respectively. Majorana Fermions are potential candidates for realising fault tolerant quantum computation, making our proposal an important one if realised experimentally. The manuscript is under review in Physical Review B[arXiv:2101.02413(2021)]. The group has also found evidences of strain induced pseudo-magnetic field in twisted graphene layers through scanning tunneling microscopy and scanning tunneling spectroscopic measurements performed at a temperature of 300 mK. The work provides a pathway in realising strain induced engineering using graphene-based devices.

Atomic force microscopy along with its modes such as Conducting Atomic Force Microscopy and Kelvin Probe Force Microscopy were perfomed on turbostratic graphene films to investigate charge transport in such layered films[arXiv: 2105.00308(2021)] We have performed Piezoresponse force spectroscopy and temperature dependent ferroelectric domain imaging on the surface of Ge doped SnTe. Piezoresponse force microscopy and spectroscopic measurements were also done on (GeSe)0.9 (AgBiTe2)0.1

Point Contact Andreev Reflection Spectroscopy: The group extensively researched the transport and magneto-transport properties of several materials by employing Andreev reflection spectroscopy. The details are as follows.
SnAs- SnAs is a NaCl type superconductor which undergoes a structural phase transition (to CsCl structure) at a pressure of 37 GPa. Spectroscopic investigation were carried out at low temperatures and in presence of high magnetic fields to probe the electron transport properties.
In-Co3Sn2S2- Co3Sn2S2 is a magnetic Weyl semimetal which was predicted to be a half metallic compound. Spectroscopic investigation of In-doped Co3Sn2S2 was carried out to determine the effect of SOC on spin transport properties.
ZrB12- ZrB12 is a superconductor. Previous investigations have hinted at existence of anisotropic superconductivity. Andreev reflection spectroscopic investigations were carried out on different facets to explore the possibility of anisotropic superconductivity.
SnTaS2- SnTaS2 is a centrosymmetric superconductor and is a candidate nodal line semimetal. Spectroscopic investigations were carried out to probe the superconducting properties.
Dilution Refrigerator was in the process of installation. The system was thoroughly leak checked by parts before the final assembly process. After the Dilution refrigerator was set up, pumping process of the lines and IVC was initiated. The He3- He4 mixture circulation was started. In parallel, we have been assembling our home built sample stage for DC/low frequency transport measurements. The system was pre-cooled with Liquid Nitrogen to 77 K. Measurement and data acquisition set up was prepared followed by sample mounting to the stage.

Harvinder Kaur Jassal
A non-canonical, scalar, tachyon field is a viable candidate for dark energy and it has been found to be in excellent agreement with observational data. Background data alone cannot completely rule out degeneracy between this model and others. To constrain the parameters beyond distance measurements, we studied perturbations in the tachyon scalar field and how they affect matter clustering. We considered two tachyon potentials for this study, an inverse square potential and an exponential potential. We studied the evolution of the gravitational potential, matter density contrast, and dark energy density contrast, and compare them with the evolution in the cosmological constant model. Although perturbations in dark energy at sub-Hubble scales are negligible in comparison with matter perturbations, they cannot be ignored at Hubble and super-Hubble scales. We also study the evolution of growth function and growth rate of matter, and find that the growth rate is significantly suppressed in dark energy dominated era with respect to the growth rate for the cosmological constant, cold dark matter model. A comparison of these models with Redshift Space Distortion growth rate data is presented by way of calculating the rootmean square fluctuations. There is a tension between growth rate data and Planck-2015 (Planck-2018) Cosmic Microwave Background Radiation data for the cosmological constant model. We present constraints on free parameters of these models and show that perturbations in the tachyon scalar field reduce this tension between different data sets by a significant amount.

Jasjeet Singh Bagla
Galaxies are distributed in the Universe along filaments and sheets with groups and clusters of galaxies situated at points where filaments join. We study properties of galaxies as a function of the environment in the large-scale structure. Out main focus is on the cold gas content of galaxies and the star formation rate. Our analysis suggests that the intrafilamentary gas condenses into the filament galaxies thus fuelling star formation in them, and, increased number density of galaxies closer to the central axis of the filament enhances the rate of gravitational interactions among filament galaxies closer to the spine. This work, done in collaboration with Dr. Smriti Mahajan, was part of the PhD thesis of Ankit Singh and has been published in the Monthly Notices of the Royal Astronomical Society.

We have studied the processes following formation of first proto-stars in the earliest star formation in the Universe. The proto-stars form in molecular clouds and it is expected that they accrete mass in the initial phase before radiative feedback from stars drives out the gas from the region. We ask whether any stars from this first generation of star formation, the so-called population III stars, can survive to the present day as main sequence stars that derive their energy from nuclear fusion with conversion of Hydrogen to Helium. For this to happen, the stars must remain low in mass, as stars more massive than 0.8 times the mass of the Sun tend to consume all the Hydrogen in the core before the present epoch. We develop an approximate method to follow this evolution over a longer time span than is possible with hydrodynamical simulations. We find that stars that escape the cloud in which they are formed remain low mass and hence may survive to the present day. This work was done with Jayanta Dutta, Sharanya Sur and Athena Stacy and has appeared in the Astrophysical Journal.

We have continued our study of perturbations in dark energy and have explored the possibility of using these to distinguish between different models of dark energy. We have generalized the code developed for studying perturbations in the canonical scalar field models of dark energy (quintessence) to study tachyon models of dark energy. We have studied evolution of perturbations in the tachyon model of dark energy where we find that at a qualitative level the evolution is similar to quintessence models. In order to carry out a comparison where the behaviour of perturbations in the model is the only distinguishing criterion, we work with reconstructed potentials such that the expansion history in quintessence and tachyon models is matched. We find that differences between tachyon and quintessence models for a given expansion history are significant only for cosmologies very different from the cosmological constant model. However, for expansion histories allowed by present observational constraints the differences are negligible. In particular, collapse and growth of dark matter halos depends only on the expansion history and it does not depend on the details of the dark energy model. This work is a part of PhD thesis work by Manvendra Pratap Rajvanshi and has been published in Classical and Quantum Gravity.

K P Yogendran

During this period, we have been engaged in several projects.

Ongoing collaboration with Prof. Chingangbam, IIA, Bangalore to study the mathematical properties of Minkowski Functionals and their application to astrophysical data (publication under preparation).

Construction of the CFT modular invariants of the BTZ black hole and Lens space geometries using ideas from String theory (publication under preparation). This work forms the MS thesis of two students from IISER Tirupati - Mr. O. Nippanikar and Mr. A Sharma which has been submitted to IISER Tirupati.

Studying the phase diagram of Holographic superfluids in four dimensions with a view towards the physics of Neutron stars (part of the PhD thesis of Mr. Akash Singh and in collaboration with a former student, Mr. R. Almeida).

Studying the possibilities of producing classical effects from highly excited quantum states. This work which is partly completed forms part of the MS thesis of Mr. Bhimsen (IISER Mohali student).

I am supervising Mr. Suraj Chopra (IISERM MS student) on a project on the quantum mechanical description of the Dzhabenikov effect. This project is currently nearing completion and is expected to lead to a publication.

I am also engaged in a project on Fluid mechanics with a potential postdoc candidate Ms. Debasmita Chatterjee whose objective to develop theoretical and numerical calculations to analyse the experimental data obtained by Ms. Chatterjee during her PhD at ISI, Kolkata.

Kavita Dorai

Our research activities were focused in the areas of NMR quantum computing, NMR metabolomics and NMR diffusion studies. We experimentally simulated the effect of a weak POVM on a nuclear magnetic resonance quantum information processor. We experimentally performed complete and optimized quantum process tomography of quantum gates implemented on superconducting qubit-based IBM QX2 quantum processor via two constrained convex optimization (CCO) techniques: least squares optimization and compressedsensing optimization. We studied the performance of these methods by comparing the experimental complexity involved and the experimental fidelities obtained. We use a constrained convex optimization method to experimentally characterize arbitrary quantum states and unknown quantum processes on a two-qubit NMR quantum information processor. We also reported the experimental implementation of a local measurement-based hierarchy on the nuclear magnetic resonance (NMR) hardware utilizing three nuclear spins as qubits. The protocol has been experimentally tested on tripartite pseudo-entangled states such as W state, GHZ state and a few graph states. We studied the relaxation dynamics of coherences of different orders present in a system of two coupled nuclear spins. We used a previously designed model for intrinsic noise present in such systems which considers the Lindblad master equation for Markovian relaxation. We studied the thermogelation of a triblock copolymer Pluronic F127 [poly(ethylene oxide)-poly(propylene oxide)-poly(ethylene oxide)] in an aqueous solvent in the presence of gold nanoparticles, using pulsed field gradient diffusion, NMR temperature experiments, relaxation measurements, and 2D heteronuclear NMR experiments. We have identified the differential distribution of phytomedicinally important metabolites in the pericarp, skin and seeds of M. charantia fruit via NMR spectroscopy.

Kinjalk Lochan

During this period the research group of Dr. Kinjalk Lochan was involved in carrying out various studies at the gravity and quantum field theory interface. With a PhD student Himanshu Swami, the effects of gravitation on neutrino oscillations and decoherence were studied, giving an insight that the neutrino mass hierarchy and absolute mass information may be extracted from such studies. With another PhD student Ankit Dhanuka, the effects of stochastic quantum fluctuations on the evolution of universe were studied, leading to a significant result that late time universe may be harbouring significant quantum noise, as a possible source of dark energy.

The research of Kinjalk Lochan also focussed on the study of Unruh deWitt detector, suggesting lab based experimental proposals for feasible realization of key theoretical ideas like Unruh radiation. Response of such detectors in de Sitter universes was also investigated in order to better understand the vacuum instability of such spacetimes.

Further with PhD student Harkirat Singh Sahota, Kinjalk Lochan is studiying the operator ordering ambiguity in quantum gravity ad its reflection in infrared regimes, whereas wth Dipayan Mukherjee, he is invetigateing the quintessence field based dark energy models from f(R) gravity perspective

Kulinder Pal Singh

I have continued my studies of UV and X-ray emission from stars with active corona, magnetic cataclysmic variables, novae, supernova remnants, active galactic nuclei, star clusters and clusters of galaxies, based on data collected from observations of such objects with AstroSat and other observatories. Some of the highlights of my research work in the last one year are:-

a) First detailed study of X-ray emission from the Hercules cluster of galaxies using the XMM-Newton and Chandra X-ray observatories. We identified several new X-ray bright clumps of hot gas in the cluster and produced thermodynamic maps of the hot gas components based on their X-ray spectra. We also studied the age and metallicity of galaxies in different environments (clusters, filaments and voids) of the Coma supercluster. These works are part of the Ph.D. thesis of my student Ms. Juhi Tiwari, and have been published in two refereed journals.

b) I lead the analysis and study of AstroSat Soft X-ray observations of a symbiotic recurrent nova, V3890 Sgr, that erupted after 28 years on August 28, 2019. AstroSat observed it in two very long observations each lasting a few days continuously in the densest possible monitoring of the event compared to all the other satellites that followed the rapid evolution of the nova. Several interesting new features observed are – fast evolution of super soft X-ray phase – its appearance, disappearance and reappearance, dips in X-ray emission were observed reflecting a complex interplay of black-body emission from the white dwarf surface and plasma emission ejected from its surface on time scales of hours, posing a challenge to the evolutionary models of novae.

c) Other studies that I have participated actively and which have been published are: Simultaneous multiwavelength observations of quiescent and flare emission from the nearest planet hosting star-Proxima Centauri using AstroSat, Chandra and HST; Radio emission of magnetic cataclysmic variables consisting of a late type star orbiting a white dwarf with high magnetic field.

I have continued my collaborations with other members (Smriti Mahajan, Aru Beri, Harvinder Kaur and J.S. Bagla) of the Physics faculty on several different projects, and also continued my collaborations with people in IUCAA, IIA, ISRO and elsewhere in the country and abroad (ref: publications). I am guiding Ms. Juhi Tiwari, for her Ph.D. work based on clusters of galaxies. I have guided or co-guided three students for their Master's thesis viz., Mr. Utkarsh Pathak, Mr. Anshuman Acharya and Mr. Dhruv Pandya. I also guided Mr. Abhinna Sundar (3rd year student) for a project on the recognition of X-ray sources seen with Scanning Sky Monitor aboard AstroSat, in a collaborative effort with Dr Ramadevi of ISRO.

I continue to participate in the science working group of the AstroSat, and assist the Payload Operation Centre at TIFR, Mumbai to improve the calibration of the soft X-ray telescope on board AstroSat. I chair the AstroSat Time Allocation Committee (since 2018) set up by ISRO. I continue to serve as member of Editorial Board of the Current Science. I am member of the Science Working Group for AstroSat since its inception by ISRO over a decade ago, and that meets regularly once a month.

Manabendra Nath Bera

In Quantum Information and Quantum Physics group, we have carried out research involving quantum thermodynamics and heat engines, quantum batteries, quantum a-causality and communications, quantum measurements, quasi-probabilities and metrology, and relativistic quantum information theory. In particular, we have:

• Developed a mathematically rigorous information-theoretic framework known as resource theory for quantum heat engines and quantum thermodynamics.
• Shown how a quantum heat engine can deliver maximum efficiency, i.e., Carnot efficiency at maximum power.
• Introduced fundamental bounds on the capacity and power in quantum batteries.
• Studied quantum a-causality and non-local superposition in evolution and shown how these can be used as a quantum resource to make arbitrary quantum channels transparent to make perfect quantum communications and perfect protection of quantum information against environmental noise.
• Explored the role of quantum quasi-probabilities and, based on them, derived bound for quantum advantages in post-selected metrologies.
• Studied the quantum thermodynamics of quantum switches.
• Explored the role of superposition in evolutions in quantum resetting.
• Studied how temporal superposition in evolutions can enhance the efficiency of entanglement harvesting from the quantum vacuum field.

Mandip Singh

Quantum entanglement is a counterintuitive concept of quantum mechanics that defies classical notion of reality and the principle of locality. In my lab, we are doing experiments to study the fundamental properties of quantum entanglement and its application in quantum imaging In 2020-, we have performed the quantum interference experiments of foundational significance. This research activity is a part of a DST project under the scheme “quantum enabled science and technology with photonics devices”. Further research on quantum information processing and quantum imaging with photons is in progress.

Rajeev Kapri

We study, using Monte Carlo simulations, the hysteresis in unzipping of a double stranded block copolymer DNA with -A_n B_n- repeat units. Here A and B represent two different types of base pairs having two- and three-bonds, respectively, and 2n represents the number of such base pairs in a unit. The end of the DNA are subjected to a time-dependent periodic force keeping the other end fixed. It is now well established that the DNA undergoes a dynamical phase transition either by changing the frequency of the force keeping the amplitude constant or by changing the amplitude keeping the frequency constant. We obtained the equilibrium force-temperature phase diagram for the static force, which was found to be independent of the DNA sequence. The results for the periodic force case are however found to be dependent on the block copolymer DNA sequence and also on the base pair type on which the periodic force is acting. The scaling of the hysteresis loop area both at low- and high-frequency regimes were also studied.

We study the driven translocation of flexible and semiflexible polymers through an interacting conical pore using Langevin dynamics simulations. For a fixed value of externally applied force and pore polymer interaction strength, it was found that the mean residence time of monomers inside the pore shows non-monotonic variations with pore apex angle. This behavior is explained by using a free energy argument which explicitly accounts for the pore-polymer interactions and external drive.

Ramandeep Singh Johal

The performance of a generic, cyclic heat engine between two heat reservoirs has been explored within a linear-irreversible framework. The Onsager reciprocal relation is derived as a consequence of the equivalence between quasi-static and reversible operations, under the tight-coupling condition. Onsager reciprocity must be violated when either the quasi-static cycle is not reversible, or the reversible cycle is not quasi-static. Explicit conditions achieving a reversible cycle in a finite duration, i.e., Carnot efficiency along with a finite power, are derived.

Thermoelectricity is traditionally explained via Onsager's irreversible, flux-force framework. The coupled flows of heat and electric charge are modelled as steady-state flows, driven by the thermodynamic forces defined in terms of the gradients of local, intensive parameters like temperature and electrochemical potential. A thermoelectric generator is a device with a finite extension, and its performance is measured in terms of total power output and total entropy generation. These global quantities are naturally expressed in terms of discrete or global forces derived from their local counterparts. We analyze the thermodynamics of thermoelectricity in terms of global flux-force relations. These relations clearly show the additional quadratic dependence of the driver flux on global forces, corresponding to the process of Joule heating. We discuss the global kinetic coefficients defined by these flux-force relations and prove that the equality of the global cross-coefficients is derived from a similar property of the local coefficients. Finally, we clarify the differences between the global framework for thermoelectric energy conversion and the recently proposed minimally nonlinear irreversible thermodynamic model.

We investigate generic heat engines and refrigerators operating between two heat reservoirs, for the condition when their efficiencies are equal to each other. It is shown that the corresponding value of efficiency is given as the inverse of the generalized golden mean that depends on a real parameter p measuring the degrees of irreversibility of both engine and refrigerator. The reversible case (p = 1) yields the efficiency in terms of the standard golden mean. We also extend the analysis to a three-heat-reservoir setup.

Efficiency at maximum power output of irreversible heat engines has attracted a lot of interest in recent years. Curzon-Ahlborn (CA) efficiency or the square-root formula is a well-known result in this field. A pedagogic article published in Resonance explores the occurence of this particularly simple and elegant formula in well-known as well as lesser-known models.

Sameer K. Biswas
During last year, we have worked on lens free 3D microscope development, high frequency ultrasound sensor development and focusing light in scattering medium for studying biosystem in real time.

Sandeep K. Goyal
My research group works on a number of problems such as quantum memory, quantum information theory, quantum optics, classical optics, and relativististic quantum mechanics. In the year 2020-21, we developed a method to detect the Unruh-like effecct, i.e., the effect of acceleration in a quantum system. We developed a new algorithm for quantum machine learning and we studied the persistence of topological phases in non-Hermitian Hamiltonians.

Sanjeev Kumar
During the last one year we focused on understanding the formation of topological textures in magnets known as Skyrmions and Antiferromagnetic Skyrmions. We have succesfully developed a framework that applies to all varieties of such textures in both metallic and insulating systems. The work involved analytical derivations of effective magnetic Hamiltonians and their numerical simulations.

Satyajit Jena
During 2020-21, our group focussed on the study of (a) characterisation quark gluon plasma, (b) estimation of the tau neutrino flux and study of sterile neutrinos, and (c) the development of machine learning techniques.

(a) Characterization of quark gluon plasma using thermal analysis of transverse momentum spectra in heavy ion collisions. (Two PhD Students: Rohit Gupta and Rutik Manikandan; One MS Student: Saurav Goyal; Four BSMS Students: Subhangi Jain, Vidisha Biswas, Aman Singh Katariya and Asrith Krishna R)

According to Big-Bang theory, at the earliest of its expansion, the universe existed as QGP. As it cools down, the deconfined-confined phase transition occurred, and hadrons were formed. Study about these kinds of stages can lead us to understand the early stages of universe formation. We have analysed the viscosity and pressure profile of QGP by estimating shear viscosity to entropy density ratio which is predicted as a lower bound with the help of Anti-de-Sitter space/Conformal Field (Ads/CFT). On the other hand, the phase transition is characterized by estimating the thermodynamic response functions such as specific heat, isothermal compressibility and speed of sound. We have investigated the transverse momentum spectra using the statistical models to calculate the thermodynamically quantities like temperature, volume, etc. Statistical models such as the Boltzmann-Gibbs, Tsallis, and unified model using the Pearson distribution are used to describe this spectrum. In a multi-source thermal model, it is essential to estimate the parameter as accurately as possible, for which a bin-width correlation must be properly understood. Thus, we have developed a strategy to optimize the bin width selection criteria for the momentum distribution. We define a cost function using the mean integrated

squared error function using the spike counts in each spectral bin separated by a defined bin-width and then minimize the cost function by changing the bin-width is performed. The estimation also involves geometrical fluctuation in initial energy density in the system which may lead to local temperature fluctuation. We have developed a technique based on wavelet analysis and machine learning to tap into such fluctuations. The outcomes of these works are presented in conferences and submitted for the publications. Published: Phys. Lett. B 807 (2020) 135551, Under review: arxiv:2012.08124, arxiv:2103.11185, arxiv:2103.13104, arxiv: 2103.14547, arxiv: 2103.15117.

(b) Investigation of sterile neutrino and estimation of the tau neutrino flux; (Two PhD Students: Kartik Joshi and Nishat Fiza)

The anomalies report by short baseline neutrino experiments point to the possible existence of a fourth neutrino, essentially sterile in nature. We investigated the possible presence of interference terms due to sterile neutrino and it is impact on the long baseline neutrino oscillation experiments. At the same time, we are also investigating the theoretical flavor conversion mechanism to calculate the neutrino oscillation in deformed spaces and the estimation of tau-neutrino flux. We are also participating in the data analysis and software development in MINERvA Experiment at Fermilab, USA.

(c) Development of Secure Machine Learning Protocol and Application of Machine Leaning Techniques in HEP. (Two BSMS Students: Bhavish Kumar and Yogesh Verma)

We investigate the novel techniques to analyze big-data produced in high energy physics experiments by developing new state of art algorithms inspired by underlying physics using machine learning techniques. We have explored the regime of modelling by fast event generators using Generative Adversarial Networks (GANs) and then transition to real experimental challenges of reconstruction and identification. These include track reconstruction, jet searches and shower identification in calorimeter. We also focused on implementing multi-party computation techniques in Machine Learning setting to improve privacy of sensitive data flow. We have investigated the existing neural network and improved the secure neural network (SecureNN) techniques via a three-party secure computation training framework. In our work, we extend the framework to other neural networks such as RNNs, GRU, and LSTMs. We also work on making SecureNN user friendly by integrating it with TensorFlow. For this, we make significant improvements to the CrypTFlow, a framework for secure inference in TensorFlow. We also explore ML algorithms that are computationally less expensive and enable parallel computations to reduce the overheads of SecureNN. The outcomes of these works are presented in conferences and submitted for the publications. Manuscripts under review: arxiv: 2012.08515, arxiv: 2103.14906 and arxiv: 2103.16247

Smriti Mahajan

During 2020-21, I have been working with the AstroSat UVIT data of the Coma cluster to study the properties of detected sources in the deepest UV image of the cluster. This project also involves archival data at other wavelengths and is being compiled into a publication to be submitted. I have also been compiling multi-wavelength data for a sample of red spiral galaxies, particularly where ever HI data are available, in order to study the cause of optical red colour of these galaxies.

Sudeshna Sinha

My research group has focussed on dynamics and pattern formation in complex systems. In particular, we investigated nonlinear systems and time-varying networks. We consider dynamics at the nodes, as well as dynamics of the links, and studied phenomena ranging from amplitude death and synchronization, to chimera states and spatiotemporal chaos. We have explored these systems from the point of view of local stability using linear stability analysis, as well as global stability using the new concept of multi-node basin stability. A range of interesting and counter-intuitive results pertaining to the collective dynamics of complex networks were obtained. In particular, my work on chimera states has been highlighted in Europhysics News. Chimera states have seen an enormous surge in research

interest, as evident in the recent explosion of papers on chimera. In my work I demonstrated the fragility of chimeras in the presence of a few time-varying random links, in wide-ranging examples. I showed that chimera states are often destroyed, yielding either steady states or spatiotemporal chaos, in the presence of even a single random link. I also showed that the basin size of chimera states rapidly shrinks under increasing random links, indicating its remarkable global impact. This extreme fragility of chimeras under the smallest degree of spatial randomness impacts the potential observability of such patterns in naturally occurring scenarios.

In another direction, we have explored physics enhanced neural networks that attempt to learn order and chaos. Artificial neural networks are universal function approximators. They can forecast dynamics, but they may need impractically many neurons to do so, especially if the dynamics is chaotic. We used neural networks that incorporated Hamiltonian dynamics to efficiently learn phase space orbits even as nonlinear systems transition from order to chaos. We demonstrated Hamiltonian neural networks on a widely-used dynamics benchmark, the Henon-Heiles potential, and on non-perturbative dynamical billiards. This recent work has now garnered a lot attention, and has been featured in: Phys.org, Science Alert, EurekAlert! ScienceDaily, Interesting Engineering, Nanotechnology Now and ScienMag.

Tripta Bhatia

I am setting up the Soft Matter and Biophysics Lab. The focus of my research is to establish minimal experimental model biosystems for selective active membrane processes, constituting the basis for building more complex life-imitating systems from their molecular components. Received Ramalingaswami Re-Entry Fellowship award of the DBT.

Vishal Bhardwaj

We worked on finding the bias coming in the up-down asymmetry measurement in $B \rightarrow K+ \pi+\pi0 \gamma$ and found the reason for the bias to come from the poorly reconstructed gammas. This bias has never been studied earlier by any group. In order to do that, a large sample was generated (which includes up-down asymmetry) for the first time. We improved the fitting procedure and pull study was done. We also work on the continuum background suppression for $B \rightarrow K \pi+\pi- l l$ (l is e or mu) in order to improve sensitivity for the $R(K\pi+\pi-)$ measurement (in order to perform a Lepton Flavor Universality test). We trained the neural network and transformed it so we can perform a multi-dimensional fit to extract the signal with high sensitivity. In our Lepton Flavour Violation in $Y(1S) \rightarrow e\mu$, $Y(1S) \rightarrow e$ tau, $Y(1S) \rightarrow$ tau μ and radiative modes were studied. Background identification and optimization was carried out during this time period.

Yogesh Singh

Yogesh Singh's group worked on the following topics:

1. Unexpected discovery of Chiral anomaly like magnetotransport in Bi1-xSbx: Conventional wisdom is that a Dirac semi-metal (DSM) can be turned into a Weyl semi-metal (WSM) by application of a magnetic field (breaking TRS). We have challenged this wisdom by discovering signatures of a magnetic field induced WSM in Bi1-xSbx at values of x far away from the DSM at x ~ 0.04.
2. Quantum disordered state in the J1−J2 square-lattice antiferromagnet Sr2Cu(Te0.95W0.05)O6: The B-site ordered double perovskites Sr2Cu(Te0.95W0.05)O6 provide an excellent arena for investigating exotic phases expected for the J1−J2 square-lattice Heisenberg antiferromagnet. Combining magnetic susceptibility and specific-heat measurements with electron spin resonance (ESR) and muon spin rotation/relaxation (μSR) techniques, we explore a spin-liquid-like state in the vicinity of the Néel critical end point (xc = 0.05–0.1). The specific heat, ESR and muon relaxation rates give evidence for an energy hierarchy of low-energy excitations, reminiscent of randomness-induced singlet states. In addition, the weak transverse μSR data show a fraction of frozen magnetic moments in the random-singlet background. The origin of a random-singlet-like state near the phase boundary is discussed in

terms of concomitant exchange randomness and local strain generated by the W6+−for−Te6+ substitution.

3. Anomalous phonon anomalies in the Kitaev magnet Cu2IrO3 : Coupling between phonons and novel excitations of a quantum spin liquid (QSL) grants exciting experimental routes to probe such long-range entangled phases of matter. We made a detailed temperature dependent Raman scattering study for the S = 1/2 honeycomb iridate Cu2IrO3, a candidate Kitaev QSL with fractionalised Majorana fermions and Ising flux excitations. Besides the typical broad magnetic continuum expected for a QSL, we observe anomalous softening and broadening of the Raman phonons below our estimated Kitaev temperature scale TK ∼120 K. A model including Majorana-phonon coupling was used to derive these observed features and can be naturally connected to the phonon decaying into itinerant Majoranas. The phonon anomalies below this temperature exhibit strong phonon-Majorana coupling evidencing spin fractionalisation in Cu2IrO3.
4. 2D weak anti-localization in thin films of the topological semimetal Pd3Bi2S2 : Pd3Bi2S2 (PBS) is a recently proposed topological semimetal candidate. However, evidence for topological surface states have not yet been revealed in transport measurements due to the large mobility of bulk carriers. We succeeded in growing the first thin films of PBS where the mobility of the bulk carriers is reduced by two orders of magnitude, revealing for the first time, contributions from the 2-dimensional (2D) topological surface states in the observation of the 2D weak anti-localization (WAL) effect in magnetic field and angle dependent conductivity measurements. The magnetotransport data is analysed within the 2D Hikami-Larkin-Nagaoka (HLN) theory. The analysis suggests that multiple conduction channels contribute to the transport. It is also found that the temperature dependence of the dephasing length can't be explained only by electron-electron scattering and that electron-phonon scattering also contributes to the phase relaxation mechanism in PBS films.

8.6.2. Visits of the faculty members

Aru Beri

— i) University of Southampton, United Kingdom (June 1-8, 2020)
— ii) Nehru Planetarium, New Delhi (18 September 2020)
— iii) ISRO, Bangalore (28 September 2020)
— iv) ISRO, Bangalore (19-21 January 2021)
— v) Nehru Planetarium, New Delhi (28 February 2020)
— vi) IUCAA (Neem Seminars every Tuesday starting from August until October 2020)

Please note due to COVID-19 pandemic all these visits and participations were executed virtually.

8.6.3. Talks delivered

Ambresh Shivaji

— Ms. Mandeep Kaur, QCD corrections to H →4ℓ decay, Shivalik HEPCATS meeting Winter 2020, January 30, 2021
— Mr. Pramod Sharma, probing anomalous HZZ coupling at ep collider, Shivalik HEPCATS meeting Winter 2020, January 30, 2021

Anosh Joseph and group members

— Anosh Joseph, Complex Langevin for Complex Actions: Some Recent Developments, Free Meson Seminar, Department of Theoretical Physics, TIFR Mumbai, October 22, 2020.
— Arpith Kumar, Complex Langevin simulations of low-dimensional supersymmetric QFTs, (Online) Asia-Pacific Symposium for Lattice Field Theory (APLAT 2020), KEK Theory Center, Japan & Asian Nuclear Physics Association (ANPhA), Japan, August 4-7, 2020.
— Arpith Kumar, Non-lattice complex Langevin simulations of supersymmetric QFTs, (Virtual) Shivalik HEPCATS Meeting — Winter 2020, IISER Mohali, India, January 30, 2021.

— Minati Biswal, Z_3 Metastable States in PNJL Model, (Virtual) Shivalik HEPCATS Meeting — Winter 2020, IISER Mohali, India, January 30, 2021.
— Navdeep Singh Dhindsa, Supersymmetric quantum mechanics on lattice using Hamiltonian Monte Carlo, (Virtual) Shivalik HEPCATS Meeting — Summer 2020, IISER Mohali, July 30-31, 2020.
— Navdeep Singh Dhindsa, Field Theory Matrix Models on Lattice: A Proem, (Virtual) Shivalik HEPCATS Meeting — Winter 2020, January 30, 2021.

Aru Beri

— Pinaki Roy, Talk on "AstroSat observations of Thermonuclear X-Ray bursts from LMXB 4U 1636-53" during the (Virtual) Shivalik HEPCATS Meeting organized by IISER Mohali in July 30-31, 2020
— Aru Beri, Invited talk on "X-ray Observations To probe regions of extreme gravity" during the eighth session of the series "Astro Adda" organized by the Nehru Planetarium, New Delhi on September 18, 2020
— Aru Beri, Invited talk on " Fast Timing and broadband look of X-ray binaries with AstroSat" during Celebrations of 5 years of AstroSat organized by ISRO, Bangalore on September 28, 2020
— Aru Beri, Invited talk on "Spectral and Temporal studies of NS LMXBs with the AstroSat" during the International seminar on AstroSat organized by ISRO, Bangalore in January 19-21,2021
— Rahul Sharma (postdoc) talk on "A broadband look of the accreting millisecond X-ray pulsar SAX J1748.9-2021" during the International seminar on AstroSat organized by ISRO, Bangalore in January 19-21, 2021
— Rahul Sharma (postdoc), Talk on "The AstroSat observation of accreting millisecond pulsar SAX J1808.4-3658" during the (Virtual) Shivalik HEPCATS Meeting - Winter 2020 organized by IISER Mohali on January 30, 2021
— Vishal Gaur (M16174) and Pinaki Roy (JRF) delivered lecture on "Coding with Python and prerequisites for X-ray Astronomy" during the Astronomy Code Camp for beginners organized by the Nehru Planetarium, New Delhi on February 21, 2021.
— Aru Beri, talk on "Observing neutron stars through X-ray eyes" during the National Science Day Celebrations through a half day workshop on Hands-On X-Ray Astronomy organized by IISER Mohali and the Nehru Planetarium, New Delhi on February 28, 2021

Charanjit Singh Aulakh

— Charanjit Singh Aulakh., GUT SSB Condensates via Generalized Konsishi Anomaly: Dimensional Transmutation and Ultraminimal GUTs.
— VIII AFUNALHUE "La Parte y el Todo" Online, Workshop on Advanced Topics on High-Energy Physics and Gravitation, Afunalhue, Villarrica, Chile. 4th - 8th January 2021 https://laparteyeltodo.wordpress.com/

Harvinder Kaur Jassal and group members

— Harvinder Kaur Jassal, Throwing Light on the Dark Universe, Advances in High Energy Physics, NIT Jalandhar, and September 22, 2020.
— Harvinder Kaur Jassal, The Dark Universe, Astro Adda organised by Nehru Planerarium, September 25, 2020
— Harvinder Kaur Jassal, Nobel Prize in Physics 2020, Society for Promotion of Science and Technology in India, November 28, 2020.

Jasjeet Singh Bagla and group members

— Jasjeet Singh Bagla. Gravitational Lensing 101. Astro-Adda, Nehru Planetarium, New Delhi. July 25, 2020.
— Jasjeet Singh Bagla. Conceptualizations of IISERs. In Memorium, Professor Govind Swarup, Chandigarh chapter of NASI, SPSTI & IISER Mohali. September 20, 2020.
— Jasjeet Singh Bagla. Gravitational Lensing: Of catastrophes and Wave effects. DTP-TIFR Colloquium. October 27, 2020.
— Jasjeet Singh Bagla. Nobel Prize in Physics 2020. Breakthrough Science Society. November 1, 2020.
— Swati Gavas. Fractal dimension- Scale of homogeneity. The 9th KIAS workshop on Cosmology and Structure Formation, South Korea. November 2-6, 2020.

— Manvendra Pratap Rajvanshi. Simulating scalar field perturbations in cosmology. CHALLENGES AND INNOVATIONS IN COMPUTATIONAL ASTROPHYSICS – II. November 18-21, 2020.
— Jasjeet Singh Bagla. Nobel Prize in Physics 2020: A supermassive black hole at the centre of the Galaxy. SPSTI. November 28, 2020.
— Jasjeet Singh Bagla. Gravitational Lensing 101. Department of Physics, DAV College, Jalandhar. December 18, 2020.
— Jasjeet Singh Bagla. Atomic gas in distant galaxies. Trends in Physics and Future Prospects. IIT Jammu. January 11-13, 2021.
— Jasjeet Singh Bagla. Nobel Prize in Physics 2020. Asteria, Dayanand Sagar University, Bengaluru. February 4, 2021.
— Jasjeet Singh Bagla. Generating realizations of distribution functions. Workshop on Generating realizations of distribution functions and mock catalogs. February 19, 2021.
— Jasjeet Singh Bagla. The significance of a mathematical model and the art of Approximation. Workshop on Computational Astrophysics. 39th Annual Meeting of the Astronomical Society of India. February 20, 2021.
— Jasjeet Singh Bagla. 39th Annual Meeting of the Astronomical Society of India. February 19-24, 2021. (Member of Scientific Organization Committee)
— Dipanweeta Bhattacharyya. Presented Thesis talk entitled "Cosmic evolution of black holes and the M - σ relation. 39th Annual Meeting of the Astronomical Society of India (ASI), 18 - 23 February 2021
— Jasjeet Singh Bagla. Exotic Image Formation in Strong Gravitational Lensing. Indo-French meeting: Galactic and Extragalactic universe in the era of new generation radio (SKA and pathfinders) / infrared / optical (MSE) facilities. March 22-26, 2021.

Kamal P. Singh and lab members

— M. S. Sidhu, “Ultrafast lasers, applications and their role in spectroscopy”, International Webinar on Recent trends in Physics (IWRT-2020), Department of Physics, Sourashtra College, Madurai TamilNadu, INDIA on 28th Nov 2020.
— M. S. Sidhu (2020) Online 3-days Short Term Course for B.Tech (Electronics), GNE College Ludhiana on LABVIEW organized by National Small Scale Industries Corporation(NSIC)-Technical Service Center (TSC), Rajpura Punjab. 23 – 25th July 2020
— M.S. Sidhu, (2021) Online 2-days Short Term Course for B.Tech (Electronics), GNE College Ludhiana on LABVIEW organized by National Small Scale Industries Corporation(NSIC)-Technical Service Center (TSC), Rajpura, Punjab. 4 –5th Feb 2021

Kavita Dorai

— Professor Kavita Dorai, Invited lecture (online platform), Detection and characterization of quantum correlations on an NMR quantum information processor. Quantum Computing Workshop, IIIT Kurnool, January 28, 2021.
— Professor Kavita Dorai, Invited lecture (online platform), NMR studies of the effects of infection, ageing, and environmental stress on insect and plant metabolism. NMRS-India Webinar Series, November 24, 2020.
— Professor Kavita Dorai, Invited lecture (online platform), Optimal control techniques to protect quantum correlations on an NMR quantum processor. IISER Tirupati Physics Day, Tirupati, November 21, 2020.
— Professor Kavita Dorai, Invited lecture (online platform). Nuclear Magnetic Resonance as a Testbed Quantum Processor. Symposium on Quantum Technology, 86th Annual Meeting of the Indian Academy of Sciences, Bengaluru Karnataka, November 06, 2020.
— Professor Kavita Dorai, Invited keynote lecture (online platform) Basics of NMR and Applications to Chemistry and Biology. Workshop on Spectroscopic Techniques and their Biological Applications, Mata Gurji College Fatehgarh Sahib, Punjab, November 03, 2020.

Kinjalk Lochan and group member

— Harkirat Singh Sahota. Infrared Signature of Quantum Bounce. IAGRG Meeting, IIT Gandhinagar, 19-20 December 2020.

— Himanshu Swami. Signature of neutrino mass hierarchy in gravitational lensing. Shivalik HEPCATS Meeting, IISER Mohali. 30-31 July 2020.

Kulinder Pal Singh

— Kulinder Pal Singh. Studies of Cataclysmic Variables with AstroSat. "Five years of AstroSat", at ISRO HQ. Bengaluru, January 19-21, 2021.

— Kulinder Pal Singh. Supermassive Black Holes. in "Advances in Relativistic Astrophysics and Cosmology (ARAC-2020)", at Sant Longowal Institute of Engineering and Technology, Longowal, Punjab, December 18, 2020.

— Kulinder Pal Singh. UV and X-ray Observations of Magnetic Cataclysmic Variables with AstroSat. "UVIT: 5 years of operation", IIA, Bengaluru, December 1-3, 2020.

— Kulinder Pal Singh. A Supermassive Black Hole in the centre of the Milky Way. "Lectures on Nobel Prize-2020 winning work in Physics, Chemistry and Physiology/Medicine", at Benaras Hindu University, Benaras, (Co-organised by Institute of Science, BHU; INSA, Delhi; and NASI, Allahabad, November 7, 2020

Manabendra Nath Bera

— Attaining Carnot Efficiency with Quantum Heat Engines, QTD2020 - Conference on Quantum Thermodynamics, organised, by ICFO-The Institute of Photonic Sciences, Barcelona, Spain. Dates: 19-23 OCT 2020.

Ramandeep Singh Johal

— R.S. Johal. Science and Technology. “Exploring Science and Technology Interconnections”, Faculty Development Program at U.I.E.T. Chandigarh. August 06, 2020.

— R.S. Johal. The Dream of Science. Outreach talk at Govt. Senior Secondary School, Sector 27, Chandigarh. February 10, 2021.

Sameer K Biswas

— S. K. Biswas. Photoacoustic and diagnosis of Rheumatoid Arthritis disease. Contemporary Trends in Physical Science, DR. MEGHNAD SAHA COLLEGE, 25-26th July 2020.

— S. K. Biswas. Photoacoustic and diagnosis of angiogenesis in human subjects under various disease models. Integrated Optics, PEC Chandigarh, 18-22 January, 2021.

Sandeep K. Goyal

— Sandeep K. Goyal. ‘Open quantum systems’, faculty Development Program on Quantum Information and Computation, 5th to 17th October 2020 at NIT Sikkim.

— Sandeep K. Goyal. ‘Optical quanutm memory: current status and practical limitations’, Space Application Centre (SAC).

Sanjeev Kumar

— Sanjeev Kumar. Skyrmions in spin-orbit coupled double exchange models. Current Trends in Condensed Matter Physics, online meeting organized by NIT Jalandhar. October 2020.

— Sanjeev Kumar. Skyrmions in spin-orbit coupled double exchange models. Online seminar at IFW Dresden. November 2020.

— Arnob Mukherjee. Antiferromagnetic Skyrmions and Skyrmion Density Wave in Rashba Hund’s Insulator. Quantum Matter Heterostructures 2 (QMH2-2020)/INST, Mohali and IIT, Roorkee, India. 18-20 February 2021.

— Arnob Mukherjee. Antiferromagnetic Skyrmions and Skyrmion Density Wave in Rashba Hund’s Insulator. Young Investigator Meet on Quantum Condensed Matter Theory

— (YIMQCMT-2020)/NISER, Bhuvneshwar, India. 15-18 December 2020.

— Arnob Mukherjee. Antiferromagnetic Skyrmions and Skyrmion Density Wave in Rashba Hund’s Insulator. APS March Meeting (2021)/Washington, DC, USA. 15-19 March 2021.

— Deepak S. Kathyat. Microscopic magnetic Hamiltonian for exotic spin textures in metals. Young Investigator Meet on Quantum Condensed Matter Theory (YIMQCMT-2020)/NISER, Bhuvneshwar, India. 15-18 December 2020.

— Deepak S. Kathyat. Microscopic magnetic Hamiltonian for exotic spin textures in metals. APS March Meeting (2021)/Washington, DC, USA. 15-19 March 2021

Satyajit Jena

— Rohit Gupta and S. Jena, A generalized approach to study low as well as the high pT regime of transverse momentum spectra, ICHEP 2020, Czech Republic (July 28, 2020 to August 6, 2020)
— Rohit Gupta and S. Jena, A unified formalism to study soft as well as hard part of the transverse momentum spectra, DAE-BRNS HEP Symposium 2020, India (Dec 14-18, 2020)
— Rohit Gupta and S. Jena, A comparison of thermodynamic properties in high multiplicity pp and heavy ion collision, Initial Stages 2021, Israel (Jan 10-15, 2021)
— Rutik Manikandan and S. Jena, Study of Net-charge fluctuation at SPS to LHC energies, DAE-BRNS HEP Symposium 2020, India (Dec 14-18, 2020)
— Yogesh Verma and S. Jena, Modelling and Tracking of Cosmic Ray Muons in a 3-D Scintillator Detector using Machine Learning, DAE-BRNS HEP Symposium 2020, India (Dec 14-18, 2020)
— Nishat Fiza, Exploring the new physics phases in 3+1 scenario in neutrino oscillation experiments, DAE-BRNS HEP Symposium 2020, India (Dec 14-18, 2020)

Smriti Mahajan

— Smriti Mahajan. The curious case of red spiral galaxies. Neem seminar, Inter-University Centre for Astronomy and Astrophysics (online). July 14, 2020

Sudeshna Sinha

— Sudeshna Sinha. Bose Colloquium. SN Bose National Center for Basic Science. 8 January 2021
— Sudeshna Sinha. Physics Colloquium. IIT Gandhinagar. 13 February 2021
— Sudeshna Sinha. DAE-C.V. Raman Lecture. Himachal Pradesh University, Shimla. 4 March 2021.

Vishal Bhardwaj

— Vishal Bhardwaj, “Charm Physics at the B-factories (Mini-review)”, XXIV DAE-BRNS High Energy Physics Symposium, NISER Bhubaneswar, December 14-18, 2020
— Sourav Patra, “Search for lepton flavour violation in bottomonium decays”, XXIV DAE-BRNS High Energy Physics Symposium, NISER Bhubaneswar, December 14-18, 2020
— Debjit Ghosh “Student’s flash talk on Belle II”, Belle II Summer Workshop, University of Hawaii, 6-10 July 2020.

Yogesh Singh

— Yogesh Singh, Field induced Quantum Critical Point in the Heavy Fermion Yb2Fe3Si5,“3rd QMAT”, SNBNCBS (Sept. 2020).

8.6.4. Conferences attended by the researchers

Ambresh Shivaji

— 8th Edition of the Large Hadron Collider Physics Conference (Online), May 25-30, 2020
— Recent Developments in S-matrix theory (Online), July 20-31 2020
— International Conference on "Anomalies-2020" at IIT Hyderabad (Online), September 11-13, 2020
— TOP 2020 (13th international workshop on top-quark physics) (Online), September 14-18, 2020
— HEPCATS meeting- winter (Online), IISER Mohali, January 30, 2021
— Unraveiling Hidden Physics Beyond the Standard Model at the LHC (Online), March 1-3, 2021
— BSM-2021 (BSM: From theory to experiment) (Online), 29-31 March, 2021
— DIS-2021 (Online), 12-16 April, 2021

Anosh Joseph and group members

— Anosh Joseph, (Virtual) Shivalik HEPCATS Meeting — Summer 2020, IISER Mohali, India, July 30-31, 2020.
— Anosh Joseph, (Online) Asia-Pacific Symposium for Lattice Field Theory (APLAT 2020), KEK Theory Center, Japan & Asian Nuclear Physics Association (ANPhA), Japan, August 04-07, 2020.
— Anosh Joseph, (Virtual) Shivalik HEPCATS Meeting — Winter 2020, IISER Mohali, India, January 30, 2021.
— Anosh Joseph, (Online) Nonperturbative and Numerical Approaches to Quantum Gravity, String Theory, and Holography, ICTS-TIFR, Bangalore, India, January 18-21, 2021.

— Arpith Kumar, (Virtual) Shivalik HEPCATS Meeting — Summer 2020, IISER Mohali, India, July 30-31, 2020.
— Arpith Kumar, (Online) Asia-Pacific Symposium for Lattice Field Theory (APLAT 2020), KEK Theory Center, Japan & Asian Nuclear Physics Association (ANPhA), Japan, August 04-07, 2020
— Arpith Kumar, (Virtual) Shivalik HEPCATS Meeting — Winter 2020, IISER Mohali, India, January 30, 2021.
— Arpith Kumar, (Online) Nonperturbative and Numerical Approaches to Quantum Gravity, String Theory, and Holography, ICTS-TIFR, Bangalore, India, January 18-21, 2021.
— Minati Biswal, (Online) Nonperturbative and Numerical Approaches to Quantum Gravity, String Theory, and Holography, ICTS-TIFR, Bangalore, India, January 18-21, 2021.
— Minati Biswal, (Virtual) Shivalik HEPCATS Meeting — Winter 2020, IISER Mohali, India, January 30, 2021.
— Navdeep Singh Dhindsa, (Virtual) Shivalik HEPCATS Meeting — Summer 2020, IISER Mohali, India, July 30-31, 2020.
— Navdeep Singh Dhindsa, (Online) Asia-Pacific Symposium for Lattice Field Theory (APLAT 2020), KEK Theory Center, Japan & Asian Nuclear Physics Association (ANPhA), Japan, August 04-07, 2020
— Navdeep Singh Dhindsa, (Virtual) Shivalik HEPCATS Meeting — Winter 2020, IISER Mohali, India, January 30, 2021.
— Navdeep Singh Dhindsa, (Online) Nonperturbative and Numerical Approaches to Quantum Gravity, String Theory, and Holography, ICTS-TIFR, Bangalore, India, January 18-21, 2021.
— Vamika Longia, (Online) Asia-Pacific Symposium for Lattice Field Theory (APLAT 2020), KEK Theory Center, Japan & Asian Nuclear Physics Association (ANPhA), Japan, August 04-07, 2020
— Vamika Longia, (Virtual) Shivalik HEPCATS Meeting — Winter 2020, IISER Mohali, India, January 30, 2021.
— Vamika Longia, (Online) Nonperturbative and Numerical Approaches to Quantum Gravity, String Theory, and Holography, ICTS-TIFR, Bangalore, India, January 18-21, 2021.

Aru Beri

— Pinaki Roy, Talk on “AstroSat observations of Thermonuclear X-Ray bursts from LMXB 4U 1636-53” during the (Virtual) Shivalik HEPCATS Meeting organized by IISER Mohali in July 30-31, 2020
— Aru Beri, Invited talk on "X-ray Observations To probe regions of extreme gravity” during the eighth session of the series “Astro Adda” organized by the Nehru Planetarium, New Delhi on September 18, 2020
— Aru Beri, Invited talk on “Fast Timing and broadband look of X-ray binaries with AstroSat” during Celebrations of 5 years of AstroSat organized by ISRO, Bangalore on September 28, 2020
— Aru Beri, Invited talk on “Spectral and Temporal studies of NS LMXBs with the AstroSat” during the International seminar on AstroSat organized by ISRO, Bangalore in January 19-21,2021
— Rahul Sharma (postdoc) talk on “A broadband look of the accreting millisecond X-ray pulsar SAX J1748.9-2021” during the international seminar on AstroSat organized by ISRO, Bangalore in January 19-21, 2021
— Rahul Sharma (postdoc), Talk on “The AstroSat observation of accreting millisecond pulsar SAX J1808.4-3658” during the (Virtual) Shivalik HEPCATS Meeting - Winter 2020 organized by IISER Mohali on January 30, 2021
— Vishal Gaur (M16174) and Pinaki Roy (JRF) delivered lecture on “Coding with Python and prerequisites for X-ray Astronomy” during the Astronomy Code Camp for beginners organized by the Nehru Planetarium, New Delhi on February 21, 2021.
— Aru Beri, talk on “Observing neutron stars through X-ray eyes” during the National Science Day Celebrations through a half day workshop on Hands-On X-Ray Astronomy organized by IISER Mohali and the Nehru Planetarium, New Delhi on February 28, 2021

Harvinder Kaur Jassal and group members

— Harvinder Kaur Jassal, Chair, Virtual Organising Committee, 39th meeting of the Astronomical Society of India, February 18-23, 2021.

Jasjeet Singh Bagla and group members

- Swati Gavas. Fractal dimension- Scale of homogeneity. The 9th KIAS workshop on Cosmology and Structure Formation, South Korea. November 2-6, 2020.
- Manvendra Pratap Rajvanshi. Simulating scalar field perturbations in cosmology. CHALLENGES AND INNOVATIONS IN COMPUTATIONAL ASTROPHYSICS – II. November 18-21, 2020.
- Jasjeet Singh Bagla. Atomic gas in distant galaxies. Trends in Physics and Future Prospects. IIT Jammu. January 11-13, 2021.
- Jasjeet Singh Bagla. Generating realizations of distribution functions. Workshop on Generating realizations of distribution functions and mock catalogs. February 19, 2021.
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- Jasjeet Singh Bagla. 39th Annual Meeting of the Astronomical Society of India. February 19-24, 2021. (Member of Scientific Organization Committee)
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Kamal P. Singh and lab members

- Sidhu M.S. and K P. Singh (2020) Spin based magneto-mechanical coupling of nanoscale glass cantilevers for quantum sensing, Nanophotonics (STu3D), Optical Sensors and Sensing Congress, 22 – 26 June 2020 OSA, UBC Vancouver Canada. Invited Talk https://www.osapublishing.org/abstract.cfm?uri=sensors-2020-STu3D.3&origin=search
- Sidhu M. S. and K. P. Singh (2020) Nanoscale ultrathin glass cantilevers for quantum sensing, Invited Talk in Quantum Sensing and Enabling Instrumentation (AF3K), CLEO 2020, Laser Science to Photonics Applications, 11-15 May 2020 https://doi.org/10.1364/CLEO_AT.2020.AF3K.7
- P. Munjal. Poster on Noise self-cancellation twisted interferometer, International Conference on Nanoscience and Nanotechnology, 1-3 February 2021.
- P. Munjal. Talk on Universal single-lens interferometry unveils ultra-precise devices from scrap, SPIE Optics + Photonics 2020 Digital Forum, 24-28 August 2020.
- P. Munjal. Talk on Picometer-resolved universal single-lens interferometer unveiling ultraprecise frugal devices, Workshop on Interferometric Scattering Microscopy, 26-28 May 2020.
- P. Munjal. Talk on Picometer-resolved universal single-lens interferometer unveiling ultraprecise frugal devices, SPIE Photonics Europe Digital Forum 2020, 6-10 April 2020.
- Mandal. Impact of the bound state dynamics on the high harmonic generation with a bichromatic driver near plasmonic nanostructure. Time-resolved imaging of photo-induced dynamics Faraday Discussion, organized by the Royal Society of Chemistry on their online platform. February 01-03, 2021. (Poster)

Kinjalk Lochan

- Harkirat Singh Sahota. Infrared Signature of Quantum Bounce. IAGRG Meeting, IIT Gandhinagar, 19-20 December 2020.
- Himanshu Swami. Signature of neutrino mass hierarchy in gravitational lensing. Shivalik HEPCATS Meeting, IISER Mohali. 30-31 July 2020.

Kulinder Pal Singh

- Kulinder Pal Singh. Studies of Cataclysmic Variables with AstroSat. "Five years of AstroSat", at ISRO HQ. Bengaluru, January 19-21, 2021.
- Kulinder Pal Singh. Supermassive Black Holes. in "Advances in Relativistic Astrophysics and Cosmology (ARAC-2020)", at Sant Longowal Institute of Engineering and Technology, Longowal, Punjab, December 18, 2020.

— Kulinder Pal Singh. UV and X-ray Observations of Magnetic Cataclysmic Variables with AstroSat. "UVIT: 5 years of operation", IIA, Bengaluru, December 1-3, 2020.
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Ramandeep Singh Johal and group members

— Quantum Foundations, Technologies and Applications' QFTA-2020, online conference organized by IISER Mohali.Dec. 04-09,2020.

Sandeep K. Goyal

— Vikash Mittal (APS March Meeting).

Sanjeev Kumar

— Arnob Mukherjee. Theory Winter School (TWS-2021)/National High Magnetic Field lab, Florida, USA. 11-15 January 2021.
— Arnob Mukherjee. Quantum Matter Heterostructures 2 (QMH2-2020)/INST, Mohali and IIT, Roorkee, India. 18-20 February 2021.
— Arnob Mukherjee. APS March Meeting. Washington, DC, USA. 15-19 March 2021.
— Ayushi Singhania. Theory Winter School (TWS-2021)/National High Magnetic Field lab, Florida, USA. 11-15 January 2021.
— Deepak S. Kathyat. APS March Meeting. Washington, DC, USA. 15-19 March 2021.
— Deepak S. Kathyat. Young Investigator Meet on Quantum Condensed Matter Theory (YIMQCMT-2020)/NISER, Bhuvneshwar, India. 15-18 December 2020.

Satyajit Jena

— The XXIX International Conference on Neutrino Physics and Astrophysics was an entirely online conference from June 22 to July 2, 2020
— The MINERvA Collaboration meeting, Fermilab, 6-10 July 2020,
— The MINERvA Collaboration meeting, Fermilab, 12-14 November 2020,
— The MINERvA Collaboration meeting, Fermilab, 11-13 March 2021

Smriti Mahajan

— Smriti Mahajan. An insight into multi-wavelength star formation rates. Astronomical Society of India, Annual meeting (online). February 20, 2021

Sudeshna Sinha

— Sudeshna Sinha. Harnessing Chaos. Trends in Physics and Future Prospects, IIT Jammu. 11 January 2021

Yogesh Singh

— 3rd Conference on Quantum Condensed Matter Physics (QMAT-2020), 7-11 Sept. 2020.

9. Awards and Honours

9.1. Awards won by the faculty

Anand Kumar Bachhawat

— Bires Chandra Guha Memorial Lecture (2020) from INSA

Indrajit Lahiri

— DBT/Wellcome Trust India Alliance Intermediate Fellowship

Jogender Singh

— DBT Ramalingaswami Re-entry Fellowship (2020-21)

Lolitika Mandal

— FNASc: Fellow of National Academy of Sciences, Allahabad

N G Prasad

— Elected as Fellow of Indian Academy of Sciences, Bangalore in December 2020.

— Appointed as Associate Editor of the journal Evolution in January 2021.

Rajesh Ramachandran

— Extra mural research grant from STARS, MHRD, Govt. of India (2020-22) INR-50 lakhs. Understanding the molecular dynamics of Ying yang1 (Yy1) during retina regeneration. (Role: Principal Investigator)

Samarjit Bhattacharyya

— Dr. Samarjit Bhattacharyya has been appointed to the Editorial Board of the Journal of Neurochemistry

— Dr. Samarjit Bhattacharyya has been appointed to the Editorial Board of the Frontiers in Molecular Neuroscience

Samrat Mukhopadhyay

— Appointed to the editorial board of Journal of Cellular Biochemistry

Santosh B. Satbhai

— Invited to join Editorial Board of BMC Plant Biology as an Associate Editor (11/2020)

— Joined as Review Editor on the Editorial Board of Plant Proteomics and Protein Structural Biology (specialty section of Frontiers in Plant Science) (12/2020)

— Invited to join Editorial Board of Frontiers in Genetics as an Associate Editor (06/2020)

— Invited to join as a Review Editor on the Editorial Board of Plant Nutrition (specialty section of Frontiers in Plant Science) (03/2020)

Debashis Adhilari

— Debashis Adhilari has been selected as a member of th Editorial Advisory Board of Chemistry Open (a journal of Weily and Chemistry-Europe).

R Vijaya Anand

— Appointed to the Editorial Board of Resonance journal (IAS) – 2021

— Appointed as one of the Local Chapter Coordinators for the Chemical Research Society of India (CRSI), Chandigarh/Amritsar region - 2020.

S. S. V. Ramasastry

— S. S. V. Ramasastry was awarded the 'RSC Research Fund' grant 2020

Sabyasachi Rakshit

— Received Core-research Grant from SERB for three years of 69 Lakhs

Baerbel Sinha

— Dr. Baerbel Sinha has been elected to the Editorial Advisory Board of Environmental Science and Technology (ES&T) an ACS journal

Sunil A. Patil

— Elected board member, International Society of Microbial Electrochemistry and Technology (ISMET) (since Oct 2020)

— Associate Editor, Microbiotechnology specialty section of Frontiers in Microbiology, Frontiers in Bioengineering and Biotechnology and Frontiers in Environmental Science journals

— Applied Energy – 2020 highly cited paper award: Strategies for optimizing the power output of microbial fuel cells: Transitioning from fundamental studies to practical implementation.

Vinayak Sinha

— Co-chair of Integrated Land Ecosystem-Atmosphere Processes Study), an ICSU, WCRP and Future Earth Global Research Project

— Scientific Steering Committee Member of the International Commission on Global Atmospheric Chemistry and Air Pollution (iCACGP) under the International Science Council.

Adrene Freeda Dcruz

— Best Teacher Award (2020, IISER Mohali)

Anu Sabhlok

— Dr. Anu Sabhlok serves on the Editorial Board of the following international journals: Geoforum (https://www.journals.elsevier.com/geoforum/editorial-board) Dialogues in Human Geography (https://journals.sagepub.com/editorial-board/dhg)Geopolitics (https://www.tandfonline.com/action/journalInformation?show=editorialBoard&journalCode=fgeo20)

Kapil Hari Paranjape

— Council Member, Indian National Science Academy, New Delhi
— Council Member, Indian Academy of Sciences, Bangalore
— Member, Governing Council, Indian Association for the Cultivation of Science, Kolkata
— Member, Editorial Board, "Resonance: A Journal of Science Education"

Sugandha Maheshwary

— Awarded the position of Core-committee member (Secretary) for Indian National Young Academy of Sciences (INYAS), a young academy under aegis of INSA, New Delhi, w.e.f. February 2021, for a tenure of two years.

Aru Beri

— Awarded Royal Society Newton International Alumni Fellowship in October 2020
— Included as a Female Scientist of Athena Science Working group on the International Day of Women and Girls in Science in February
— https://www.the-athena-x-ray-observatory.eu/70-outreach/videos/1121-2021-international-day-of-women-and-girls-in-science.html

Jasjeet Singh Bagla

— Member of the working group and drafting group for the Astronomy and Astrophysics component of the Mega Science Vision-2035 Exercise for India.
— Member of the editorial board of Resonance as an Associate Editor for the period Jan.2021 – Dec.2023.

Smriti Mahajan

— AWSAR award (post-doctoral category), Department of Science and Technology, Government of India, 2020
— Visiting Associateship, Inter-University Centre for Astronomy and Astrophysics, Pune (2020-23)

Sudeshna Sinha

— J.C. Bose National Fellowship, renewed for another 5 years
— Member of SERB Expert Committee in the area of Physical & Mathematical Sciences
— Member of the Sectional Committee (Physics), INSA
— Chair, Membership Advisory Committee (Physics) of the World Academy of Sciences (TWAS), Trieste

Tripta Bhatia

— 2021: DBT Ramalingaswami Re-entry Fellowship

Deblulal saha

Associate Editor, The Indian Economic Journal (SAGE).

9.2. Awards won by the students, post-docs, and other group members

1. **Subhash Chander**, DSK Postdoctoral Fellowship by the UGC, New Delhi. June 23, 2020
2. **Subhash Chander**, ACS Bridge Fellow by the American Chemical Society (ACS). October 27, 2020
3. **Ayanangshu Biswas** has been awarded with Prime Minister's Research Fellowship (*PMRF*) for 2021.
4. **Shallu Dhingra** (MP18001) received PMRF-2020
5. **Jay Prakash Maurya** was selected for the Prime Minister's Research Fellowship (PMRF) 2020

6. **Siddheshwar K. Bankar** received the 'SaiLife-NOST best thesis award 2020'
7. **Mayank Saraswat** Awarded FP-RESOMUS postdoctoral fellowship
8. **Srishti** (PhD scholar), Prime Ministers' Research Fellowship (PMRF) 2020
9. **Ankur Prashar** received the 'Writing Urban India' Fellowship by Centre for Policy Research, Delhi
10. **Manisha Kushwaha** received the 'Writing Urban India' Fellowship by Centre for Policy Research, Delhi
11. **Manisha Kushwaha** received the International Geographical Union's Gender and Geography Commission grant
12. **Jayashree Mazumder** ISF Fellow, First Runner-up at India Science Festival, Talk Your Thesis Competition, 2021
13. **Swati Garas** received 3rd prize in the INYAS-International Sci-Art Image competition under the modelling and simulation category.
14. **Debjit Ghosh** (MS thesis student), 3rd prize in flash-talks by students (Ph.D. and M.S. students) at Belle II Summer Workshop (organized by University of Hawaii, US)

10. Major facilities procured

Rajesh Ramachandran

— Ultrasound sonicator (Q800R) from Qsonica-21 lakhs INR

Samrat Mukhopadhyay

— Super-resolution microscopy facility for the Department of Biological Sciences under the DST-FIST scheme

S. S. V. Ramasastry

— Nanalysis NMReady 60Pro (60 MHz Benchtop NMR)

Sugumar Venkataramani

— Cary 60 UV-Vis spectrophotometer with Peltier accessory for temperature controller (part of a SERB project)

A. Venkatesan

— Department of Physical Sciences has obtained a FIST grant to set up a Microwave facility. The team included Dr A. Venkatesan (convener) Prof K. Dorai, Dr K.P. Singh, Dr S.K. Biswas Dr S. Jena and Head Physics as official member.

11. Current Project and Fellowships

Sr. No.	Project No.	Name of project	Principal Investigator	Funding Agency	Duration	Total Sanctioned Cost
1	MHRD-14-0064	ESTABLISHMENT OF CENTRES OF EXCELLANCE FOR TRAINING AND RESEARCH IN FRONTIER AREAS OF SCIENCE AND TECHNOLOGY (FAST)	PROF. PURNANANDA GUPTASARMA	MHRD	2014-2018	400,00,000.00
2	INSPIRE-15-0075	INSPIRE FACULTY AWARD	DR. MONIKA SHARMA	DST	2015-2020	19,00,000.00
3	DST-15-0081	PHENOMENLOGY COSMOLOGY OF THE NEW MINIMAL SUPERSYMUNETRIC SO(10) GUT	PROF. C S AULAKH	DST	2015-2018	28,57,920.00
4	DBT-15-0086	DECIPHERING THE MECHANO-RESPONSIVE BEHAVIOR OF CADHERINS IN HEARING	DR. SABYASACHI RAKSHIT	DBT ALL	2015-2020	327,32,260.00
5	INSPIRE-15-0087	INSPIRE FACULTY AWARD	DR. ANOOP AMBILI	DST	2015-2020	35,00,000.00
6	INSPIRE-15-0095	INSPIRE FACULTY AWARD	DR. VISHAL BHARDWAJ	DST	2016-2021	83,00,000.00
7	MAX-16-0108	INVESTIGATING SUB-FS ELECTRONIC PROCESS WITH SHAPED XUV AND IR PULSES	DR. KAMAL P SINGH	MAX PLANC/DST	2016-2021	20000 Euro
8	DST-16-0110	HIGH FILED MAGNETO-TRANSPORT & SPECTROSCOPIC STUDIES ON TOPOLOGICALLY NON-TRIVIAL SYSTEMS AT KELVIN TEMPERATURES	DR. GOUTAM SHEET	DST-SERB	2016-2019	435,64,573.00
9	DST-16-0111	MODERN PROBLEM IN LOW DIMENSIONAL TOPOLOGY IN CROSSROAD WITH GEOMETRY AND ALGEBRA	DR. MAHENDER SINGH	DST	2016-2019	40,88,040.00
10	DBT-16-0112	EXPLORING AN EVOLUTIONARILY CONSERVED FORM OF CELL-KILLING MECHANISM EMPLOYED BY THE PORE-FORMING TOXINS: IMPLICATIONS FOR THE HOST-PATHOGEN INTERACTION PROCESS AND IMMUNITY	DR. KAUSIK CHATTOPADHYAY	DBT	2016-2019	1500000

11	DST-16-0115	CENTRAL SIMPLE ALGEBRAS WITH DERIVATIONS	DR. VARADHARAJ R SRINIVASAN & DR. AMIT KULSHRESTHA	DST	2016-2019	7,59,000.00
12	DST-16-0116	MOLECULAR STRUCTURE AND SUPRAMOLECULAR PACKING OF MISFOLDED PROTEINS WITHIN THE AMYLOID NANOSTRUCTURES	DR. S. MUKHOPADHYAY	DST	2016-2019	95,86,790.00
13	DBT-16-0117	INVESTIGATING THE ROLE OF LOCAL AUXIN BIOSYNTHESIS IN STEM CELL DIFFERENTIATION	DR. RAM KISHORE YADAV	DBT	2016-2019	60,23,200.00
14	UGC-16-0118	THE FIRST GLOBAL CULTURE LOWER PALEOLIHIC ACHEULEAN ADAPTATIONS AT THE TWO ENDS OF ASIA	DR. PARTH R CHAUHAN	UGC	2016-2019	208,95,700.00
15	DSTCC-16-0120	THE ATMOSPHERIC CHEMISTRY OF CLIMATE CHANGE	DR VINAYAK SINHA & DR BAERBEL SINHA	DST	2016-2019	150,13,724.00
16	MEFC-16-0121	NATIONAL CARBONACEOUS AEROSOLS PROGRAMME (NCAP) WORKING GROUP-III PROJECT	DR BAERBEL SINHA	MOEF-CC	2016-2020	106,00,000.00
17	INSPIRE-16-0122	INSPIRE FACULTY AWARD	DR. KINJALK LOCHAN	DST	2016-2020	83,00,000.00
18	ICAR-17-0123	UNDERSTANDING THE MOLECULAR BASIS OF PESTEDES-PETITS RUMINANTS VIRUS (PPRV) MEDIATED HOST IMMUNE MODULATION FOR THE DEVELOPMENT OF NEXT GENERATION VACCINE	DR SHARVAN SEHRAWAT	ICAR	2017-2020	210,55,280.00
19	DST-17-0127	MODULAR WEIGHTS AND SERRE WEIGHTS OF CERTAIN MOD P GALOIS REPRESENTATIONS	DR. ABHIK GANGULI	DST-SERB	2017-2020	2,42,000.00
20	DBT-17-0128	UNDERSTANDING THE EVOLUTION OF IMMUNE RESPONSE: AN EXPERIMENTAL EVOLUTION APPROACH	DR. N. G. PRASAD	DBT	2017-2020	60,68,200.00

21	ICMR-17-0130	LIGHT BASED ULTRASOUND ARRAY DETECTOR DEVELOPMENT FOR DIAGNOSING RBC UNDER VARIOUS DISWASE MODEL IN INFANT	DR. SAMIR KUMAR BISWAS & DR. KAMAL P SINGH	ICMR	2017-2020	143,00,000.00
22	DST-17-0132	NOVEL QUANTUM GROUND STATES IN NORWSTRUTURED DEVICES (Swarnajayanti)	DR. GOUTAM SHEET	DST	2017-2021	356,79,600.00
23	INSPIRE-17-0133	INSPIRE FACULTY AWARD	DR. ANIRBAN BOSE	DST	2017-2021	83,00,000.00
24	DBT-17-0134	DEVELOPING A PLATFORM FOR GENERATING DIAGNOSTIC AND THERAPEUTIC SINGLE DOMAIN ANTIBODIES FOR VIRAL INFECTIONS EMPLOYING PHAGE DISPLAY TECHNOLOGY	DR. SHARVAN SEHRAWAT	DBT	2017-2020	64,52,200.00
25	INSPIRE-17-0135	INSPIRE FACULTY AWARD	DR. SANJIB DEY	DST	2017-2021	83,00,000.00
26	DBT-17-0136	EPIGENETICS OF GENS REGULATION IN MULLER GLIA DEDIFFERENTIATION AND STEM CELLS INDUCTION DURING RETINA REGENERATION IN ZEBRAFISH	DR. RAJESH RAMACHANDRAN/ DR. K S SANDHU	DBT	2017-2020	64,59,600.00
27	DBT-17-0141	DBT ALLIANCE	DR. LOLITIKA MANDAL	DBT ALL	2017-2022	441,32,492.00
28	DBT-17-0142	DDEVELOPMENT OF 3D GENOME BROWSER	DR KULJEET SINGH SANDHU/ DR. SHASHI B PANDIT	DBT	2017-2020	13,40,000.00
29	INSPIRE-17-0143	INSPIRE FACULTY AWARD	DR. SUGANDHA MAHESHWARY	DST	2017-2022	83,00,000.00
30	INSPIRE-17-0144	INSPIRE FACULTY AWARD	DR. NEERAJA SAHASRABUDHE	DST	2017-2022	35,00,000.00
31	DST-17-0145	INVESTIGATION OF THE ROLE OF TAMALIN IN GROUP IMGLUR TRAFFICKING AND MGLUR-DEPENDENT AMPA RECEPTOR ENDOCYTOSIS	DR. SAMARJIT BHATTACHARYA	DST-SERB	2017-2020	45,23,200.00
32	FIST-17-0147	FIST PROGRAM-2017	DR. ANAND K. BACHHAWAT	DST	2018-	460,00,000.00

33	INSPIRE-18-0149	INSPIRE FACULTY AWARD	DR. SHARMILA BHATTACHARYA	DST	2018-2023	83,00,000.00
34	DST-18-0150	BRAIDS, QUANDLES AND GROUP ACTIONS	DR. MAHENDER SINGH	DST-SERB	2018-2021	6,60,000.00
35	DST-18-0151	FUNCTIONAL CHARACTERIZATION OF THE SALMONELLA TYPHIMURIUM EFFECTOR PROTEIN STEA	DR. ARUNIKA MUKHOPADHAYA	DST-SERB	2018-2021	48,35,000.00
36	DST-18-0152	SURFACE GROUP REPRESENTATIONS AND GEOMETRIC STRUCTURES	DR. KRISHNENDU GONGOPADHYAY	DST-SERB	2018-2021	6,60,000.00
37	UGC-18-0153	ASSESSING THE POSSIBLE ROLE OF CRIEGEE INTERMEDIATES (CI) AS ATMOSPHERIC OXIDANTS IN THE NORTHWEST INDO-GANGETIC PLAIN	DR. VINAYAK SINHA	UGC	2018-2021	141,93,380.00
38	DAE-18-0154	STATICS AND DYNAMICS OF A BINARY SOLVENT NEAR ITS CONSOLUTE POINT	DR. DIPANJAN CHAKRABORTY	DAE-BRNS	2018-2021	25,76,250.00
39	DST-18-0155	DEFORMATION OF TORSORS UNDER PARAHORIC GROUP SCHEMES ON THE PROJECTIVE LINE	DR. YASHONIDHI PANDEY	DST-SERB	2018-2021	6,60,000.00
40	DST-18-0156	A1-HOMOTOPY AND BIRATIONAL GEOMETRY	DR. CHETAN TUKARAM BALWE	DST-SERB	2018-2021	6,60,000.00
41	DST-18-0157	UNDERSTANDING THE MOLECULAR OF THE CALAYNTENIN GENE CASY-1 IN REGULATING GABAERGIC AND GLUTAMATERGIC NEUROTRANSMISSION	DR. KAVITA BABU	DST-SERB	2018-2021	25,58,000.00
42	INSPIRE-18-0158	INSPIRE FACULTY AWARD	DR. SOMA MAITY	DST	2018-2021	35,00,000.00
43	DST-18-0159	NEGATIVE CURVATURE IN GROUP AND COMBINATION THEOREMS	DR. PRANAB SARDAR	DST-SERB	2018-2021	6,60,000.00
44	DST-18-0160	CHEMISTRY UNDER STRONG COUPLING	DR. JINO GEORGE	DST-SERB	2018-2021	58,30,000.00

45	DST-18-0161	DEVELOPMENT OF BASE-METAL CATALYSTS EMPLOYING REDOX ACTIVITY OF CONJUGATED NON-INNOCENT LIGAND BACKBONES	DR. DEBASHIS ADHIKARI	DST-SERB	2018-2021	18,70,000.00
46	DST-18-0162	UNDERSTANDING THE TGF BETA/MMP REGULATORY NETWORK AND COMPARATIVE ANALYSIS OF THE PROTEOME DURING RETINA HEART AND FIN REGENERATION USING LESSONS FROM ZEBRAFISH	DR. RAJESH RAMACHANDRAN	DST-SERB	2018-2021	48,48,000.00
47	DST-18-0163	ROLE OF HOOK2 AS DYNEIN ADAPTOR DURING CELL CYCLE	DR. MAHAK SHARMA	DST-SERB	2018-2021	25,85,000.00
48	DST-18-0164	PHOTONIC QUANTUM INFORMATION PROCESSING CLASSICAL IMPLEMENTATION AND QUANTUM MEMORY	DR. SANDEEP KUMAR GOYAL	DST-SERB	2018-2021	24,08,807.00
49	DST-18-0165	ROLE OF HUMAN HOST FACTORS IN ENDOCYTIC UPTAKE OF INFLUENZA A VIRUS	DR. INDRANIL BANERJEE	DST-SERB	2018-2021	25,85,000.00
50	DST-18-0166	DEVELOPMENT OF A HYBRID APPROACH TO PREDICT TERTIARY STRUCTURE OF MULTI-DOMAIN PROTEINS	DR. SHASHI BHUSHAN PANDIT	DST-SERB	2018-2021	15,85,200.00
51	DST-18-0167	STUDIES ON THE CONSTRUCTION OF ENANTIOMERICALLY ENRICHED MEDIUM-SIZED RING BASED DIBENZOAZEPINE, DIBENZOAZOCINE AND ALLOCOLCHICINE BIARYL ALKALOID MOTIFS CONTAINING AMINO ACID AND AMINO ALCOHOL BACKBONE VIA C-H FUNCTIONALIZATION ROUTE AND THEIR BIOLOGICAL ACTIVITIES	DR. A S BABU	DST-SERB	2018-2021	38,69,668.00
52	NMHS-18-0168	DISTRIBUTION AND QUANTIFICATION OF ORGANIC CONTAMINANTS AND MICRO-PLASTIC CONCENTRATIONS IN LAKE SYSTEMS FROM HIMACHAL PRADESH INDIA	DR. ANOOP AMBILI	NMHS	2018-2021	38,50,000.00

53	DBT-18-0169	CO2 ELECTRO-BIOREFINERY: INDUSTRIAL CARBON DIOXIDE CONVERSION INTO MULTICARBON CHEMICALS THROUGH INTEGRATED BIOELECTROCHEMICAL AND BIOLOGICAL PROCESSES	DR. SUNIL ANIL PATIL	DBT	2018-2021	50,62,000.00
54	INSPIRE-18-0170	INSPIRE FACULTY AWARD	DR. ARU BERI	DST	2018-2023	83,00,000.00
55	DST-18-0171	UNDERSTANDING THE NEUROPROTECTIVE MECHANISM OF C. ELEGANS MANF MESENCEPHALIC, ASTROCYTE DERIVED NEUROTROPHIC FACTOR PROTEIN IN AN -IN-VIVO MODEL OF PARKINSON', DISEASE	DR. PRATIMA PANDEY	DST	2018-2021	31,60,000.00
56	DST-18-0172	ONE-POT CASCADE APPROACHES FOR THE SYNTHESIS OF CARBZOLES, INCLUDING ATROPSELECTIVE STRATEGIES	DR. S. S. V. RAMASASTRY	DST-SERB	2018-2021	39,18,200.00
57	DST-18-0173	NATURAL VARIATION OF PLANT ROOT DEVELOPMENT UNDER HIGH TEMPERATURE STRESS IN ARABIDOPSIS	DR. SANTOSH B. SATBHAI	DST-SERB	2018-2021	38,79,832.00
58	DST-19-0174	KNOT INVARIANTS ARISING FROM QUANDLES	DR. SHANE D'MELLO	DST-SERB	2019-2022	6,60,000.00
59	DST-19-0175	STUDY OF PORE FORMATION INDEPENDENT CELL DEATH MECHANISM ELICITED BY THE BACTERIAL PORE FORMING TOXIN VIBRIO CHOLERAE CYTOLYSIN	DR. KAUSIK CHATTOPADHYAY	DST-SERB	2019-2022	43,57,120.00
60	DBT-19-0176	CHARACTERIZING THE ROLE OF TBC- DOMAIN CONTAINING PROTEIN-TBC1D9A IN MEMBRANE TRAFFICKING	DR. MAHAK SHARMA	DBT	2019-2024	25,00,000.00
61	DST-19-0177	A RATIONAL DESIGN OF CHARGE-TRANSFER MEDIATED PLASTIC FERROELECTRIC POLYMERS	DR. RAJ KUMAR ROY	DST-SERB	2019-2022	33,22,000.00
62	DST-19-0178	QUANTUM INFORMATION TECHNOLOGIES WITH PHOTONIC DEVICES	PROF. ARVIND	DST	2019.2022	5864,63,000.00

63	DST-19-0179	A GENETIC SCREEN FOR THE IDENTIFICATION AND CHARACTERIZATION OF GENES THAT AFFECT NADPH HOMEOSTASIS IN YEAST	DR. ANAND K. BACHHAWAT	DST-SERB	2019-2022	54,37,360.00
64	DST-19-0180	UNDERSTANDING THE INTERCONNECTION BETWEEN LONG CHAIN FATTY ACID METABOLISM, REDUCTIVE STRESS AND ENVELOPE STRESS RESPONSES IN ESCHERICHIA COLI	DR. RACHNA CHABA	DST-SERB	2019-2022	62,06,288.00
65	QUST-19-0181	QUANTUM IMAGING AND QUANTUM PROCESSING WITH PHOTONICS	DR. MANDIP SINGH	DST	2019-2022	565,02,000.00
66	QUST-19-0182	HIGH TEMPUERATURE PHOTONIC QUANTUM MEMORY	DR. SANDEEP KUMAR GOYAL & PROF. ARVIND	DST	2019-2022	73,92,000.00
67	QUST-19-0183	QUANTUM CONTEXTUALITY ITS ROLE IN QUANTUM COMPUTATION AND Q & D PROTOCOLS	PROF. ARVIND & SANDEEP GOYAL	DST	2019-2022	72,52,000.00
68	DBT-19-0184	NATURAL VARIATION OF ROOT DEVELOPMENT UNDER ABIOTIC STRESS RESPONSES IN ARABIDOPSIS AND PIGEON PEA (TOOR DAL) (RAMALINGASWAMI FELLOSHIP)	DR. SANTOSH B. SATBHAI	DBT	2019-2024	42,50,000.00
69	BIRAC-19-0185	AN IMPROVED YEAST PROCESS FOR THE PRODUCTION OF SCLAREOL	DR. ANAND K. BACHHAWAT	DST-BIRAC	2019-2021	49,00,000.00
70	DST-19-0186	NEW HYPOTHESIS DRIVEN PHARMACEUTICALLY IMPORTANT COMPONDS	DR. S.S.V. RAMSASTRY	DST	2019-2020	203,00,000.00
71	DST-19-0187	GLOBAL KNOT THEORY INVARIANTS AND CLASSIFICATION	DR. K. GONGOPADHYAY	DST	2019-2022	37,79,400.00

72	DBT-19-0188	ROLE OF HUMAN LENS CRYSTALLINS IN THE DEVELOPMENT AND VASCULAR REMODELING OF THE EYE	DR. RAJESH RAMACHANDRAN	DBT	2019-2021	27,00,000.00
73	ISRO-19-0189	PROBING THE REGIONS OF STRONG GRAVITY AROUND NEUTRON STARS	DR. ARU BERI	ISRO	2019-2023	24,12,000.00
74	DBT-19-0190	HYPERTHERMOPHILE ENZYME HYDROLASE RESEARCH CENTRE (HEHRC): A MICRO CENTRE FOR RESEARCH AND DEVELOPMENT RELATING TO THERMOPHILE AND HYPERTHERMOPHILE MICROBE-DERIVED HYPER THERMOSTABLE HYDROLASE ENZYMES RELEVANT TO BIOFUELS AND THE ENERGY BIOSCIENCES	PROF. PURNANANDA GUPTASARMA	DBT	2019-2024	215,25,988.00
75	DBT-19-0191	GOLGI-TO-NUCLEUS COMMUNICATION VIA INTRON SPECIFIC PRE-MRNA SPLICING	DR. SHRAVAN K. MISHRA	DBT ALL	2019-2024	334,40,000.00
76	DST-19-0192	EXPLORING CHEMOTACTIC AND CATALYTIC PROPERTIES OF OLIGONUCLEOTIDES FOR DESIGNING OF SELF POWERED NANOMOTORS	DR. SUBHABRATA MAITI	DST-SERB	2019-2021	27,80,000.00
77	TIFR-19-0193	VIGYAN PRATIBHA	DR. AMBRESH SHIVAJI & DR. N G PRASAD	TIFR-HBCSE	2019-2020	11,50,000.00
78	DST-19-0194	ELECTROACTIVE HALOALKALIPHILES ENRICHMENT AND CHARACTERIZATION OF ELECTROCHEMICALLY ACTIVE MICROORGANISMS FROM THE EXTREME SALINE ALKALINE HABITAT	DR. SUNIL ANIL PATIL	DST-SERB	2019-2021	32,27,951.00
79	RSC-19-0195	RAPID VARIABILITY AS A PROBE OF ASSOCIATED ACCRETION FLOWS IN BLACK HOLE BINARIES	DR. ARU BERI	ROYAL SOCIETY	01/07/2019 TO 30/06/2020	4,71,123.00
80	INSPIRE-19-0196	INSPIRE FACULTY AWARD	DR. VAIBHAV VAISH	DST	UP 28/08/2019	17,68,208.00

81	DST-19-0197	ASPECTS OF QUANTUM INFORMATION IN QFT OVER CURVED GEOMETRIES: STUDY THROUGH QUANTUM DETECTORS AND ANALOGUE SYSTEMS	DR. KINJALK LOCHAN	DST-SERB	2019-2021	7,26,000.00
82	DST-19-0198	QUANTUM INFORMATION THEORETIC FORMULATIONS OF QUANTUM THERMODYNAMICS WITH MULTIPLE CONSERVED QUANTITIES, AND THEIR APPLICATIONS IN QUANTUM HEAT ENGINES AND QUANTUM TECHNOLOGIES	DR. M N BERA	DST-SERB	2019-2022	6,55,160.00
83	DST-19-0199	LATTICE SUPERSYMMETRY AND HOLOGRAPHY	DR. ANOSH JOSEPH	DST-SERB	2019-2022	19,44,488.00
84	DBT-19-0200	MECHANISMS REGULATING MEMBRANE FUSION WITH LYSOSOMES AND LYSOSOME REFORMATION	DR. MAHAK SHARMA	DBT ALL	2019-2024	445,50,000.00
85	DST-19-0201	PENTACARBOXYCYCLOPENTADIENE(PCCP) BASED CHIRAL BRONSTED ACID AND BIFUNCTIONAL ORGANOCATALYSTS FOR ENANTIOSELECTIVE TRANSFORMATIONS	DR. R VIJAYA ANAND	DST-SERB	2019-2022	43,08,150.00
86	DST-19-0202	RADICALS OF HETEROCYCLIC COMPOUNDS AND POLYCYCLIC AROMATIC HYDROCARBONS (PAHS) – PHOTOCHEMISTRY AND THERMOCHEMISTRY USING MATRIX ISOLATION IR AND UV-VIS SPECTROSCOPY AND COMPUTATIONS	DR. SUGUMAR VENKATARAMANI	DST-SERB	2019-2022	43,08,150.00
87	DST-19-0203	DESIGN AND SYNTHESIS OF NOVEL LUMINESCENT DISCOTIC LIQUID CRYSTALS FOR APPLICATION AS EMITTERS IN ORGANIC LIGHT EMITTING DIODES	DR. SANTANU KUMAR PAL	DST-SERB	2019-2022	39,24,470.00
88	STARS-19-0204	STUDY OF THE MECHANISMS OF CELL DEATH AND IMMUNOMODULATORY RESPONSES TRIGGERED BY THERMOSTABLE DIRECT HEMOLYSIN A MAJOR VIRULENCE FACTOR OF VIBRIO PARAHAEMOLYTICUS	DR. KAUSIK CHATTOPADHYAY	STARS-MHRD	2019-2022	78,09,000.00

89	STARS-19-0205	SINGLE DOMAIN ANTIBODIES AS NOVEL THERAPEUTICS FOR SNAKEBITES	DR SHARVAN SEHRAWAT	STARS-MHRD	2019-2022	49,57,000.00
90	STARS-19-0206	CAVITY CATALYSIS (CAVCAT) ACCELERATING CHEMICAL REACTIONS BY COUPLING TO VACUUM FIELD	DR. JINO GEORGE	STARS-MHRD	2019-2022	49,92,000.00
91	STARS-19-0207	A SYSTEMS APPROACH TO DECIPHER THE MECHANISMS OF ACTIVATION OF CPXAR TWO COMPONENT SYSTEM BY LONG CHAIN FATTY ACIDS, A PATHWAY IMPLICATED IN ANTIBIOTIC RESISTANCE AND VIRULENCE OF GRAM-NEGATIVE BACTERIA	DR. RACHNA CHABA	STARS-MHRD	2019-2022	49,97,000.00
92	DST-19-0208	KNOTS, GROUPS AND ACTIONS	DR. MAHENDER SINGH	SJF-SERB	2020-2024	55,36,128.00
93	DST-19-0209	SWARNAJAYANTI FELLOWSHIP	DR. MAHENDER SINGH	SJF-DST	2020-2024	40,00,000.00
94	DST-19-0210	INTERACTING URN PROCESSES AND THEIR APPLICATION TO OPINION DYNAMICS	DR. NEERAJA SAHASRABUDHE	DST-SERB	2019-2022	6,60,000.00
95	DST-20-0211	INVESTIGATING THE ROLE OF SHOOT CELL TYPE-SPECIFIC TRANSCRIPTION FACTORS IN REGULATION OF CYTOKININ BIOSYNTHESIS, SIGNALLING, AND HOMEOSTASIS IN APICAL MERISTEM OF ARABIDOPSIS THALIANA	DR. RAM KISHORE YADAV	DST-SERB	2020-2023	43,10,839.00
96	DST-20-0212	QUANTUM COMPUTING, CONTROLLING DECOHERENCE AND QUANTUM SIMULATIONS ON AN NMR QUANTUM COMPUTER	DR. KAVITA DORAI & PROF. ARVIND	DST	2020-2023	911,14,000.00
97	STARS-20-0213	SYSTEMATIC EVALUATION OF THE ROLE OF CELLULAR CATHEPSINS IN INFLEUNZA INFECTION AND IDENTIFICATION OF NOVAL ANTI-INFLUENZA DRUG TARGETS	DR. INDRANIL BANERJEE	STARS-MHRD	2020-2023	49,49,000.00
98	STARS-20-0214	STUDYING THE MARRIAGE OF QUANTUM SPIN LIQUIDS WITH OTHER NOVEL STATES OF ELECTRONIC MATTER TO DISCOVER NEW FUNCTIONALITIES	DR. YOGESH SINGH	STARS-MHRD	2020-2023	49,88,000.00

99	STARS-20-0215	FEMTOSECOND LASER PROCESSED SPIDER SILK AS N NOVEL 3D-SCAFFOLD AND BIOSENSOR	DR. KAMAL P SINGH	STARS-MHRD	2020-2023	49,97,080.00
100	STARS-20-0216	BIO-CATALYSIS DRIVEN MICROSCALE FLOW AT FUNCTIONAL ORGANIC INTERFACES FOR HEALTHCARE APPLICATIONS	DR SUBHABRATA MAITI & DR. SANTANU K. PAL	STARS-MHRD	2020-2023	77,00,000.00
101	STARS-20-0217	SUBSISTENCE AND SYMBOLISM IN PREHISTORIC INDIA UNDERSTANDING ENVIRONMENTAL CONTEXTS IN RELATION TO HOMO SAPIENS DISPERSALS AND ADAPTATIONS	DR. PARTH R CHAUHAN	STARS-MHRD	2020-2023	99,39,000.00
102	STARS-20-0218	BENCHMARKING HERBAL AYURVEDIC MEDICINES USING NMR METABOLOMICS TECHNIQUES	DR. KAVITA DORAI	STARS-MHRD	2020-2023	49,51,000.00
103	STARS-20-0219	UNDERSTANDING THE MOLECULAR DYNAMICS OF YING YANG1 (YY1) DURING RETINA REGENERATION	DR. RAJESH RAMACHANDRAN	STARS-MHRD	2020-2023	49,59,000.00
104	DST-20-0220	AWARD RESEARCH SCIENTIST SCHEME	DR. MONIKA SHARMA	DST-SERB	2020-2022	46,00,000.00
105	DST-20-0221	GENERATION OF ISOLATED ATTOSECOND PULSE OF LIGHT AND ITS APPLICATION INVESTIGATING ATTOSECOND DYNAMICS OF SMALL QUANTUM SYSTES	DR. KAMAL P SINGH	DST-SERB	2020-2023	73,67,800.00
106	DAE-20-0222	DEVELOPMENT OF A UREA DERIVATIVE COMPOUND (D27) AS A POTENTIAL DRUG AGAINST SARS-COV-2	DR. INDRANIL BANERJEE	DAE-BRNS	2020-2022	33,20,000.00
107	DST-20-0223	MECHANISMS FOR PREVENTION OF ABERRANT ORIC INDEPENDENT CHROMOSOMAL REPLICATION IN BACTERIA	PROF. J. GOWRISHANKAR	DST-SERB	2020-2023	56,18,080.00
108	DST-20-0224	SYNTHETIC RECONSTRUCTION OF AN ATTENUATED SARS-COV-2 VIRUS FOR VACCINE DEVELOPMENT AND A HIGH CONTENT INHIBITOR SCREEN	DR. ANAND K. BACHHAWAT, DR. SHARVAN SEHRAWAT, DR. INDRANIL BANERJEE, DR. SSV RAMASASTRY	DST-SERB	2020-2023	95,50,000.00

109	FIST-20-0225	FIST PROGRAM-2019	DR. S.A. BABU	DST FIST	2020	244,00,000.00
110	DST-20-0226	AN INNOVATIVE SPIN TO THE EXISTING WATER CHALLENGES: WASTEWATER TO ENERGY, CLEAN WATER AND FERTILIZER THROUGH THE INTEGRATION OF TRADITIONAL BIOLOGICAL AND ADVANCED BIOELECTROCHEMICAL APPROACHES	DR. SUNIL ANIL PATIL	DST	2020-2023	33,64,460.00
111	DST-20-0227	PHOTOSWITCHABLE AND MAGNETIC PHOTOSWITCHABLE IONIC LIQUIDS THEORY AND EXPERIMENTS	DR. SUGUMAR VENKATARAMANI	DST	2020-2023	27,25,150.00
112	DBT-20-0228	MECHANISTIC STUDY OF PLASMODIUM APICOPLAST REPLICATION	DR. INDRAJIT LAHIRI	DBT ALL	2020-2025	350,79,000.00
113	DST-20-0229	MOLECULAR GENETIC DISSECTION OF THE MECHANISM BY WHICH TRANSFORMED BLOOD CELLS INFLUENCE THE LARVAL HEMATOPOIETIC NICHE IN DROSOPHILA MELANOGASTER	DR. SUDIP MANDAL & LOLITIKA MANDAL	DST-SERB	2020-2023	50,83,516.00
114	DST-20-0230	ABELDYN: DEVELOPMENT OF AN AB-INITIO ELECTRONIC DYNAMICS (ABELDYN) PACKAGE FOR MOLECULAR PROPERTIES IN THE PRESENCE OF TIME VARYING STRONG FIELDS IN MULTIPLE TIME SCALES	DR. P. BALANARAYAN	DST-SERB	2020-2023	46,86,000.00
115	DST-20-0231	ANALYSIS OF WINTER SEASONAL MEANS AND EXTREME RAINFALL EVENTS OVER NORTHERN INDIA USING OBSERVATIONS AND HIGH RESOLUTION MODELLING FRAMEWORK	DR. RAJU ATTADA	DST-SERB	2020-2022	32,15,040.00
116	DST-20-0232	BICYCLIC (ALKYL) (AMINO) CARBENE AS LIGAND TO SUPPORTED LOW VALENT COMPLEXES FEOM MAIN GROUP AND TRANSITION ELEMENTS AND APPLICATION THEREOF IN CATALYSIS	DR. SANJAY SINGH	DST-SERB	2020-2023	27,62,100.00
117	DBT-20-0233	TRANSCRIPT FATES IN ESCHERICHIA COLI AND OTHER BACTERIA WITH RESPECT TO R-LOOPS AND TO RNASE E	PROF. J. GOWRISHANKAR	DBT	2020-2023	103,75,440.00

118	RSC-20-0234	ASYMMETRIC DESYMMETRIZATION VIA PHOSPHINE CATALYSIS	DR. S. S. V. RAMASASTRY	ROYAL SOCIETY	2021-22022	3,86,000.00
119	DST-20-0235	UNDERSTANDING THE IMPACT OF MICROBIAL GENETIC COMPOSITION ON HOST ENDOPLASMIC RETICULUM UNFOLDED PROTEIN RESPONSE	DR. JOGENDER SINGH	DST-SERB	2020-2022	19,84,276.00
120	DBT-20-0236	MOLECULAR AND FUNCTIONAL INSIGHT INTO LIGAND BINDING BY DGOR, A TRANSCRIPTIONAL REPRESSOR OF D-GALACTONATE METABOLISM IN ESCHERICHIA COLI	DR. RACHNA CHABA	DBT	2020-2023	83,37,116.00
121	FIST-20-0237	FIST PROGRAM-2019	DR. SANJEEV KUMAR	DST FIST	2020-2025	270,00,000.00
122	DST-20-0238	DELINEATING THE MOLECULAR MECHANISM OF AGE-RELATED HEARING LOSS	DR. SABYASACHI RAKSHIT	DST-SERB	2020-2023	66,73,832.00

12. Institute Library

Situated in the Informatics Centre, IISER Mohali library epitomizes the spirit of the institute, i.e., the pursuit of knowledge. The library houses rich collection of electronic and print versions of books (general, text, and reference books) for UG & PG, Print and e-journals, Online databases from various fields of study, namely, Mathematics, Physics, Chemistry, Biology, Computer Science, Earth/Environmental Sciences and Humanities and Social Sciences etc.,

The library provides unfailing access to essential and specialized library resources which aid teaching, learning, and research activities. In tune with the recent advancement in the field of Information and Communication Technology (ICT), IISER Mohali has set up a library with state-of-the-art technology and world class infrastructure. The library space of IISER Mohali is applauded not only for its aesthetic ambience but also for its astonishing infrastructure. IISER Mohali is proud to introduce the first library in India to implement the theme, "Learning Commons". The whole library furniture, facilities and services have been designed to the aforesaid central theme.

MISSION:
The library's mission is to provide access to rich, relevant and high-quality resources in all available formats to the IISERM community. In doing so, the library aligns itself to teaching, learning, and research missions of the institute which is committed to excellence and innovation.

Library Timings: Library works all 365 days except 3 National holidays and 4 Gazetted holidays.

Monday - Saturday:
Reference: 9.00 am - 6.00 am
Circulation (Check-In and Check-Out): 9.00 am - 8.00 pm (Opens during LUNCH & DINNER)

Sunday:
Reference: 10.00 am - 6.00 pm (No Circulation – Only Reference). Closes during LUNCH i.e 1.00 pm – 2.00 pm

However due to CoVID-19, the library timings were changed from time to time. The library opened for readers with strict compliance of CoVID-19 protocols

Library Services: The house keeping activities of Library like cataloguing, circulation, Patron profile Information etc, is being operated through Open-Source Library Management Software 'Koha'. The library creates and maintains the Repository of thesis, Dissertations, Institute articles, Institute Publications, Institute event images, News clipping and films published by ISER Mohali as well as published on IISER Mohali by using Open-source digital Software 'DSpace'.

It is a hub of information services like Online catalogue (Web OPAC) of Books, e-Journals, On-line Full text Databases, Online Bibliographic Service, Abstracting Databases, e-mail Alert Service, Anti-Plagiarism Software, Grammerly tool, Current Awareness service, Document Delivery Service, Inter-Library Loan facility, DELNET Services, Photocopying facilities, Reference Service, New Paper Clipping S&T News Services, Institutional Repository and so on.

Library Resources: Being IISER Mohali is one of the core members of e-Shodsindh (MHRD Project) and IISER Library Consortium, it has seamless access to thousands of renowned electronic journals in the field of basic and applied sciences. (Paid by e-Shodsindhu) such as APS, AIP, Annual Reviews, EPW, JSTOR, MathScinet, OUP, Project MUSE, SIAM, SpringerNature and many more.

Library subscribed the following e-resources (Journals Packages) through various Consortia with maximum discounted prices. Some of the Online full text journals / databases available under the period report are Science On-line, American Chemical Society(ACS - Web Edition), American Physical Society (APS), American Institute of Physics (AIP), American Mathematical Sciences (AMS),

Mathematical Association of America, Royal Society of Chemistry (RSC), The Royal Soc. Publishing, Institute of Physics (IOP), , Nature main title and 39 subtitles of Nature Publishing Group, Project Euclid, Sciencedirect, SciFinder, Thieme, Springer-online , Taylor &Francis , Wiley,WorldScientific etc. And Bibliographical & Abstracts Databases are MathSciNet, Grammerly tool, Scopus, Turnitin/ etc, INFLIBNET has provided access to anti-plagiarism software URKUND.

Activites of Library as Nodal Centre of the following MHRD Projects:

1. Indian Research Information Network System (IRINS): On behalf of Institute, the library has implimented Indian Research Information Network System (IRINS) in IISER Mohali successfully and coordinated with INFLIBNET, the Project Coordinator on regular basis for smooth functiong and up-gradation of project.

As a Nodal Centre of Institute, the library has created the profile of faculties, creating ORCIDs for some faculties, collecting, compiling information from Institutes and their personal website, SCOPUS Id, ORCIDs, Google Scholar, Web of Science Id etc and also from various websites related to their Professional career, research works, Publications, Projects handled, Funds received etc and uploading to IRINS site.

IRINS is web-based Research Information Management (RIM) service developed by the Information and Library Network (INFLIBNET) Centre under aegis of MHRD. The portal facilitates the academic, R&D organizations and faculty members, scientists to collect, curate and showcase the scholarly communication activities and provide an opportunity to create the scholarly network.

2. National Digital Library of India (NDLI): On behalf of Institute, the library has updated the information on regular basis to National Digital Library of India (NDLI), being coordinated by Indian Institute of Technology (IIT), Khargpur. It also provided and updated the profiles of new faculty and students of IISER Mohali in NDLI for registering their Ids and also the metadata of BS-MS Thesis/ PhD Thesis of students passed out with Abstracts and giving access to full text of records on request etc.,

The National Digital library of India (NDLI) is a project under Ministry of Human Resource Development, India. The objective is to integrate several National and International digital libraries in one single web-portal. The NDLI provides free access to many books in English and the Indian languages.

3. e-Shodsindhu: Library, IISER Mohali has acted as coordinator between all seven IISERs and e-Shodsindhu (eSS), to meet information / e-Resources' requirement of IISERs to get them funded by ESS and also best possible Terms & conditions and negotiated prices for the resources subscribed by IISERs.

Based on the recommendation of an Expert Committee, the MHRD has formed e-ShodhSindhu by merging three consortia initiatives, namely UGC-INFONET Digital Library Consortium, NLIST and INDEST-AICTE Consortium. The eSS will continue to provide current as well as archival access to more than 15,000 core and Peer-reviewed journals and a number of bibliographic, citation and factual databases in Different disciplines from a large number of publishers and Aggregators to its member Institutions including centrally-funded technical Institutions, universities and colleges that are covered under 12(B) and 2(f) Sections of the UGC Act.

4. Institutional Archives and Walk-through Institute: Library as Archival Cell updated the data to preserve the knowledge generated by IISER Mohali research community to provide access to Institute Community within campus for Academic and Research purpose. This Institutional Repository covers full-text of articles / links published by faculty and students, PhD Thesis, MS dissertations, Academic projects, Speeches delivered on important events, Films on IISER Mohali, Annual Reports, conference

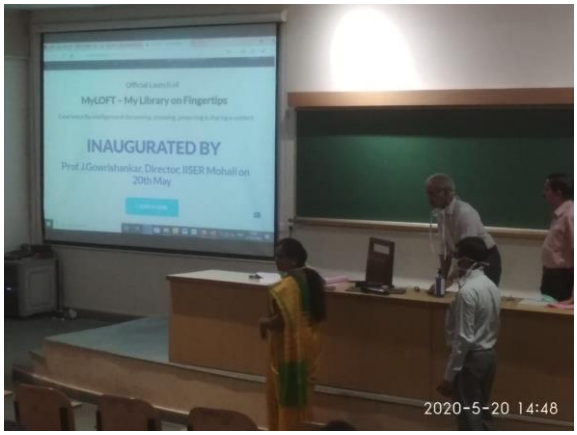
Reports, Reports on Foreign tours, audio and video clippings, events photographs, newspaper clippings and many more.

5. MyLOFT (My Library on Finger Tips"): A Remote Access tool: Due to COVID-19 pandemic, the country was under Lockdown and library readers were away from campus for longer period. Since the subscription of e-Resources is through Institute's IP address to access across the campus, the faculty, students and staff (Readers) who were away from campus were not able to access the subscribed e-Journals, e-Books and databases. So, the Institute has subscribed a „Remote Access Tool -MyLOFT " to give Off Campus access to its readers with the following features:

- Library readers can access on Mobile Web App Platform to library digital resources any time, from anywhere through Browser extension

➢- One time user login for through Mobile and Web App with Chrome Extension
- Using voice-command, user can search the content
- Save and Sync content between mobile and PC from Library e-Resources or favourite websites, blogs, news feeds
- Find saved articles and research papers by tagging and organizing them into collections
- The built-in article viewer allows clutter free text reading, highlighting, listening and more
- Changing font size of the articles and color theme for HTML articles for night mode viewing
– Offline Reading: Can read without Internet

Prof. J. Gowrishankar, Director, Indian Institute of Science Education and Research (IISER) Mohali launched this tool in 39th Senate Meeting held on 20.05.2020



THE BEST LIBRARY USER AWARD 2019 - 20: The Library has conceived an idea of giving a Best user of Library award and initiated the process to identify a student who has a good track record - highest user of library, no adverse record of his behaviour either with library users and staff etc. Accordingly, Mr. James Watt (MS 19117) was selected by Committee as winner of this Award for 2019-20. This award was given to him online by Chief Guest of Institute Foundation Day on 27th Sept. 2020 with "THE BEST USER of LIBRARY (2019-20) AWARD".

OUTREACH PROGRAMMES: Library organized hands-on training programmes to its users every year after renewal subscription to e-Resources. But this year due to CoVID-19, library organized the following Webinars as follows: online

1. Organized two webinars on "SCiFINDER" during 28th and 30th April 2020.

2. Organized multiple webinars on "SCOPUS" during 6th May, 20th May, 3rd June, 17th June, 1st July, 14th July, 29th July, 12th Aug, 26th Aug 2020.

3. Organized webinar on "GRAMMARLY "Writing Tool on 9th May 2020

4. Organized webinar on "Project MUSE "on 22nd May 2020.

5. Organized a webinar on "Empowering Research across IISERs" by Elsevier across all IISERs. IISER Mohali library has coordinated the programme. The webinar covers the following themes:
-Mendley Research Management Tool
- SCOPUS- Citation databse
- Scimago- Journals and country ranking tool
- Sciencedirect
- Cell Press

6. Organized a webinar on "JoVE- Journal of Visualized Experiments" on 4th June 2020.

Publications:

1. P. Visakhi, B. D. Kumbar, J. Shivarama (2020). RESEARCH ON DIGITAL LIBRARIES: A SCIENTOMETRIC ASSESSMENT OF INDIA'S PUBLICATIONS DURING 2000-19: JOURNAL OF INDIAN LIBRARY ASSOCIATION, VOL. 55 (2), APRIL – JUNE, 2020 (The Special issue of ILA on Scientometrics)
2. B.M. Gupta*, K.K. Mueen Ahmed, and P. Visakhi (2020). E-Cigarettes: A Scientometric Assessment of Global Publications Output during 2001-18. J Young Pharm, 2020; 12(1):29-36. (A multifaceted peer reviewed journal in the field of Pharmacy www.jyoungpharm.org | www.phcog.net)

13. Computer Centre

Computer centre manages three computer teaching labs, two of which double up as a general computer lab, and one as a centre for NKN activities. In the last two semesters during 2020-21, computer labs were not used physically for teaching activities due to Covid-19 pandemic. However, computer labs were kept open for the use of students staying on campus after following proper social distancing with appropriate Covid-19 behavior.

Computer centre manages the campus wide Wi-Fi network and connectivity to the Wide Area Network ("Internet"). Computers in any part of the institute connect with each other with high-speed data transfer rates. Due to Covid-19 pandemic, the internet became the most essential service and its usage in the institute increased many folds. All teaching activities and meetings of the institute during this period were online. Therefore, the internet connectivity for the BSNL network was upgraded from previously available 100 Mbps to 1Gbps. This along with an existing 1 Gbps NKN network has taken care of the internet needs of the institute. The computer center initiated the LAN networking project to provide LAN connections in each hostel room. It surveyed the hostels to identify the equipment requirements and submitted a proposal. The initial phase work in two hostels has been assigned.

One new module was added to the existing ERP system used for booking services for the Visitor's Hostel. Other than this, a few enhancements based on end user requests were done in other existing modules that are already in use.

In order to conduct online teaching smoothly, the institute purchased G-Suite license. The email service of the institute is migrated to G-Suite. The computer center upgraded the LDAP server to provide a single sign-on facility for the Email, Moodle, and Complaints Portal services.

The computer centre had provided the necessary logistics and network support for the 9th Convocation held online on August 20, 2020, which was presided over by Prof. Gagandeep Kang, FRS, Professor at the Christian Medical College, Vellore, India. A live webcasting of the event was also made available.

14. National Institutional Ranking Framework (NIRF) rank

In 2021, IISER Mohali participated in the Overall as well as the newly formulated Research category of NIRF. The institute was ranked 40 in the Overall category of National Institutional Ranking Framework and 44 in the Research category of NIRF. The results were announced online on September 9, 2021 based on the data submitted to the Ministry of Education (MoE) in November 2020. The ranking required the submission of an enormous amount of data that related to the faculty and student strength, expenditures on infrastructure, equipment and library and various other operational expenditures, external funding received, placement of students and fellowship drawn by students. The collation of the data from the different sections of the institute and its submission to the NIRF was done by Dr. Dipanjan Chakraborty, the Nodal Officer in consultation with the Director, Heads of the Departments and the Deans of the institute.

The assessment process of ranking is heterogenous for different categories and considers different time frames for which we had to submit our data. For student strength, the data required was for the period of last five years, whereas for the publication details, external funding and financial resource utilization, the time frame was three years.

The NIRF ranks are the outcome of the National Ranking system established by the Ministry of Human Resource Development (MHRD) in September, 2015. In 2016, during the first rounds of ranking, IISER Mohali was ranked 43 amongst institutes in the engineering category, along with other institutes such as IISc, IITs, NITs, IISERs and other Engineering Universities/Institutes/Colleges in the country. In 2017, IISER Mohali was considered under the overall category, which included all Universities/Institutes/Colleges and was ranked 52. In 2018, IISER Mohali was ranked 55 in the overall category. In 2019 and 2020, IISER Mohali was ranked 66 and 59, respectively in the overall category.

15. Lectures by Visitors

15.1 Public Lectures

1. 27 Sep 2020 - 03:00PM: What is curvature, and how to mold it?: Foundation Day Lecture (Online) of IISER Mohali by Dr. Nitin Nitsure
2. 20 Aug 2020 - 03:00PM: 9th Convocation of IISER Mohali on YouTube Chief Guest - Professor Gagandeep Kang, FNA, FASc., FRS, Professor Gastrointestinal Sciences, Christian Medical College, Vellore IISER Mohali Official Channel

15.2 Institute Colloquia: None

15.3 Institute Seminars

1. 30 Mar 2021 - 04:00PM: Dr. Babu Rao, University of Hyderabad, Exchange rate and the Economic Growth in India: An empirical analysis

2. 30 Mar 2021 - 04:00PM: Dr. Kathiresan Natarajan, Mayo Clinic, Rochester, USA, Structural determinants of Tubulin Glutamylation and Mechanism of Calcium potentiation in α7 nicotinic acetylcholine receptor

3. 26 Mar 2021 - 04:00PM: Dr. Yashpal Murhari Banshelkika, Department of English, Central University of Orissa, The God of Small Things: A Critique of the Caste System

4. 25 Mar 2021 - 05:00PM: Ajay Gudavarthy, Centre for Political Studies, Jawaharlal Nehru University (JNU), Age of Emotions, Crisis of Ethics

6. 25 Mar 2021 - 04:00PM: Dr. Sucharita Dey, Weizmann Institute of Science, Israel, Harnessing protein structure to understand macromolecular interactions, mutational robustness, and allostery

7. 24 Mar 2021 - 03:00PM: Dr. Devinder Sharma, Food & Trade Policy Analyst, Farm Bills and Current State of Indian Agriculture

8. 23 Mar 2021 - 04:00PM: Dr. Suraj Beri, University of Delhi, The Structure of the Field of Power: An Empirical exploration of Elite Differentiation in Bikaner City

9. 22 Mar 2021 - 04:00PM: Dr. Subhra Mandal, University of Nebraska-Lincoln, USA, Nanomedicine (polymeric and polymer-based nano-tools) for disease diagnosis

10. 18 Mar 2021 - 04:00PM: Dr. Prem Prakash, Nanyang Technological University, Singapore Protein-Protein Interaction and Host Cell Signalling: Inevitable Targets to Prevent Pathogenic Disease Progression

11. 15 Mar 2021 - 04:00PM: Dr. Ratheeshkumar T, Sushruta Innovations, Cochin, Kerala, Elucidating the exosome-mediated cellular reprograming during pancreatic carcinogenesis using patient-derived pancreatic organoid cultures and cancer associated fibroblasts

12. 12 Mar 2021 - 05:00PM: Kajal Das (ISI Bangalore), Box spaces, quasi-isometry and uniform measured equivalence.

13 Mar 2021 - 04:00PM: Dr. Vidya D Negi, Host-pathogen interaction of Salmonella: a long journey that still continue

14. 10 Mar 2021 - 06:00PM: Abha Sur, Women's and Gender Studies, MIT, Caste-distance, Affinities, and Anxieties in Indian Anthropometry, 1920-1960

15. 09 Mar 2021 - 04:00PM: Dr. Ramesh Pothuraju, Mucins: beyond protective role in colorectal cancer pathogenesis

16. 02 Mar 2021 - 12:00PM: Dr. Alok Laddha, Chennai Mathematical Institute (CMI), Chennai, (Positive) Geometry of the S-matrix

17. 25 Feb 2021 - 05:00PM: Prof. Apoorva Khare (IISc, Bangalore), Total positivity: history, basics, and modern connections

18. 24 Feb 2021 - 05:00PM: Sudeshna Sen (University College Dublin), The Mott-Hubbard metal-insulator transition: new insights into a classic problem

19. 24 Feb 2021 - 05:00PM: Parameswaranan Sankaran (Chennai Mathematical Institute), Geometric cycles in compact locally symmetric spaces

20. 19 Feb 2021 - 05:00PM: Dr. Rajbir Singh, Rutgers University Newark, New Jersey, USA, Cementing the Gut Barrier using Gut Microbial Metabolite

21. 19 Feb 2021 - 04:00PM: Dr. Jonathan Shock, University of Cape Town, South Africa, A brief introduction to Reinforcement Learning

22. 16 Feb 2021 - 12:00PM: Dr. L. Sriramkumar, IIT Madras, Observational probes of inflation on small scales

23. 08 Feb 2021 - 05:00PM: Dr. Smrutisanjita Behera, CSIR-Indian Institute of Chemical Biology, Kolkata, Calcium signaling in plants: Follow the signals to decipher their function

24. 02 Feb 2021 - 05:00PM: IISER Mohali Analysis seminar

25. 28 Jan 2021 - 05:00PM: IISER Mohali Geometry and Topology Seminar

26. 22 Jan 2021 - 05:00PM: Dr. Divyum Sharma (BITS Pilani), initeness results in Diophantine equations

27. 20 Jan 2021 - 04:00PM: Dr. Ratna Pal (IISER Berhampore), Dynamics of polynomial automorphisms in higher dimensions

28. 20 Jan 2021 - 12:00PM: Dr. Haripada Sau (TIFR CAM, Bangalore), Multivariable Operator Theory: Rational Dilation, Realization Formula, and Distinguished Varieties.

29. 15 Jan 2021 - 04:00PM: Mahesh Rangarajan, Professor of History and Environmental Studies, Ashoka University, Sonepat & Honorary Professor, IISER Mohali., Making Spaces for Nature, State, Science and Ecology in India

30. 06 Jan 2021 - 04:00PM: Dr. Raj Narayan Dhara (Masaryk University, Brno, Czech Republic), Waves of maximal height for a class of nonlocal equations with homogeneous symbol

31. 21 Dec 2020 - 03:00PM: Dr. Tapas Chatterjee (IIT Ropar), Arithmetic nature of Euler's constant and a conjecture of Murty-Saradha

32. 16 Dec 2020 - 04:00PM: Gautam Neelakantan (IISER Mohali), Uniform Poincare inequality on measured metric spaces Google meet link: https://meet.google.com/eqo-azzo-eiz

33. 22 Oct 2020 - 04:00PM: Mr. Neeraj Kumar Dhanwani (IISER Bhopal), Commutativity of periodic mapping classes and their representations as words in Dehn twists

34. 20 Oct 2020 - 04:00PM: Dr. Aditi Sen De, HRI Allahabad, Quantum Technologies with many-body systems

35. 19 Oct 2020 - 03:00PM: Dr. Renny Thomas, Assistant Professor of Sociology and Social Anthropology at Jesus and Mary College, University of Delhi, New Delhi., ‘Distinctly Religious’: Towards an Anthropology of ‘Science and Religion’ in India

36. 17 Oct 2020 - 09:30AM: Live on IISER Mohali Official Channel, Chem Day 2020

37. 13 Oct 2020 - 04:00PM: Dr. Vijay Shenoy, IISc Bangalore, Fractons: From Field to Plate

38. 12 Oct 2020 - 03:00PM: Dr. Anushyama Mukherjee (School of Habitat Studies, TISS Mumbai), Social Remittances and the Idea of Homeland/s: A Study of Transnational Migrants in Hyderabad

39. 06 Oct 2020 - 03:00PM: Dr. Gurpreet Singh, Policy Analyst, Centre for Budget and Governance Accountability (CBGA, New Delhi), Rural Non-farm Employment in Contemporary Punjab: Heterogeneity and Accessibility

40. 05 Oct 2020 - 03:00PM: Dr. Poonam Pandey, Post-doctoral Fellow at the Department of Science and Technology-Centre for Policy Research (DST-CPR) at Indian Institute of Science, Bangalore, Straw Burning, Agriculture and Bioenergy Futures in India

41. 28 Sep 2020 - 03:00PM: Dr. Mayank Bora, Dept of Philosophy, University of North Bengal, Fregean Identity without Fregean Contents: The Promise and Limitations of the Causal-Historical Approach to the Identity of Fregean Content

42. 25 Sep 2020 - 03:00PM: Dr. Paul Mathew, Christ (Deemed to be University), Bengaluru, Co-option of Graffiti and the Persona of the Artist in the Neoliberal Age

43. 24 Sep 2020 - 03:00PM: Dr. Arfat Ahmad Sofi, Dept of Economics, BITS Pilani, Goa Campus, Economic Growth - Urbanization - Inequality Interface: Are Countries Spatially Interactive?

44. 23 Sep 2020 - 03:00PM: Dr. Anirban Kumar, School of Arts & Aesthetics, JNU, New Delhi, Affective Ecology: Presenting ‘Tragedy’ in the Performance of Zindagi Ne Ek Din Kaha

45. 20 Sep 2020 - 11:00AM: In Memoriam: Professor Govind Swarup A program in honour of Professor Govind Swarup (1929-2020)

46. 16 Sep 2020 - 03:00PM: Virtual seminar by Prof. N. Mukunda, E C G Sudarshan Sudarshan 's Life and Work - An Appreciation

47. 25 Aug 2020 - 05:00PM: Prof. Ashwani K. Tiwari, IISER Kolkata, Dynamical Insights into Metal Surface-Molecule and Laser-Molecule Interactions

48. 20 Aug 2020 - 10:30AM: Dr. Sandip B. Bharate, Medicinal Chemistry Division, Indian Institute of Integrative Medicine (CSIR), Jammu, Kinase Targeted Medicinal Chemistry of Natural Products: Discovery and Preclinical Development of IIIM-290, a Clinical Candidate for Metastatic Pancreatic Cancer

49. 20 Aug 2020 - 10:30AM: Dr. Sandip B. Bharate, Medicinal Chemistry Division, Indian Institute of Integrative Medicine (CSIR), Jammu, Kinase Targeted Medicinal Chemistry of Natural Products: Discovery and Preclinical Development of IIIM-290, a Clinical Candidate for Metastatic Pancreatic Cancer

50. 03 Aug 2020 - 02:30PM: Dr. Monika Sharma, IISER Mohali, Molecular dynamics simulations to understand biomolecular structure-to-function relationships

51. 03 Aug 2020 - 11:30AM: Dr. Debrina Jana, IISER Mohali, Exploring noble metals and halide perovskites at nano regime

52. 30 Jul 2020 - 04:00PM: Dr. Monika Sharma, Department of Chemical Sciences, IISER Mohali, Mechanistic studies to investigate biomolecular associations/recognitions by multiscale simulation methods

53. 28 Jul 2020 - 03:00PM: Dr. Chamkor Singh, Complex flows of soft condensed matter: cases of charged granular gases, magnetic liquids, and active nematics

54. 27 Jul 2020 - 03:00PM: Dr. Hitesh Raundal (Postdoc, IISER Mohali), Hecke algebra trace algorithm and some conjectures on weaving knots

55. 27 Jul 2020 - 11:00AM: Dr. Sugandha Maheshwary, IISER Mohali, The structure of group algebras and related applications

56. 21 Jul 2020 - 04:00PM: Dr. Mathew Thomas, Novel scenarios in extra dimensions

57. 13 Jul 2020 - 08:00AM: 13th-17th July 2020 - Click for more details, IISER-NISER Mathematics Webmeet 2020

58. 19 May 2020 - 04:00PM: Rajesh Sundaresan, Indian Institute of Science, A city-scale agent-based epidemic simulator and its use in unlocking the lockdown in India

Live stream on IISER Mohali Youtube channel

59. 12 May 2020 - 11:30AM: Professor Gautam Menon, Ashoka University COVID-19 in India: A perspective from models, Live stream on IISER Mohali Youtube channel

16. Postdoctoral fellows at the Institute

1. Anjali Joshi (Biology)
2. Anjali Yadav (Biology)
3. Apuratha Pandiyan (Biology)
4. Banani Chattopadhyay (Biology)
5. Gagandeep Kaur (Biology)
6. Ishan Agarwal (Biology)
7. Nidhi Kumari (Biology)
8. Mahua Ghara (Biology
9. Parul Bai (Biology))
10. Pooja Badotra (Bology)
11. Poonam Sharma (Biology)
12. Prakash Kumar Sinha (Biology)
13. Pratima Pandey (Biology)
14. Priyanka Singh (Biology)
15. Rochishun Dutta (Biology)
16. Sujata Saini (Biology)
17. Yogesh Dahiya (Biology)
18. Neeraj Dhaunta (Biology)
19. Anita Yadav (Chemistry)
20. Akshi Tyagi (Chemistry)
21. Arshad Jamal Ansari (Chemistry)
22. Gaganpreet (Chemistry)
23. Narendra Nath Dutta (Chemistry)
24. Neelam Yadav (Chemistry)
25. Jhuma Dutta (Chemistry)
26. Mandeep Kaur (Chemistry)
27. Manisha Devi (Chemistry)
28. Mrinal Kanti Adak (Chemistry)
29. Sujan Mondal (Chemistry)
30. Surinder Kaur Brar (Chemistry)
31. Varinder Singh (Chemistry)
32. Anita Sharma (EES)
33. Bhadur Singh (EES)
34. Krishna K Shukla (EES)
35. Deepasri Baul (Humanities & Social Science)
36. Kanchan Gandhi (Humanities & Social Science)
37. Shaheen K. Thodika (Humanities & Social Science)
38. Tushar Kanta Naik (Mathematics)
39. Rakesh Pawar (Mathematics)
40. Dishari Chaudhuri (Mathematics)
41. Kalachand Shuin (Mathematics)
42. S P Murugen (Mathematics)
43. Chandan Maity (Mathematics)
44. Mukund Madhav Mishra (Mathematics)
45. Neeraj Kumar Dhanwani (Mathematics)
46. Sushil Bhunia (Mathematics)
47. Gurleen Kaur (Mathematics)
48. Akhilesh K.S (Physics)
49. AmeenYasir PA (Physics)
50. Ankur Mandalc (Physics)
51. Dipanweeta Bhattacharyya (Physics)
52. Iyyappan (Physics)
53. Jaffino Stargen (Physics)
54. Kirandeep Kaur (Physics)
55. M. Suman Kalyan (Physics)
56. Mehra Singh Sidhu (Physics)
57. Saumyakant Bose (Physics)
58. Radhikesh Ravendra Nair (Physics)
59. Sriram Krishnan (Physics)
60. Sreemoyee Chakraborti (Physics)
61. Subhadip Ghosh (Physics)
62. Ankur Mandal (Physics)
63. Maguni Mahakhud (Physics)
64. Minati Biswal (Physics)
65. Moutushi Dutta Choudhury (Physics)
66. Chamkor Singh (Physics)
67. Monkia Moun (Physics)
68. Bindiya Arora (Physics)
69. Yogyata Pathania (Physics)

17. Graduates of 2020

17.1. BS Graduate

S. No.	Name	Reg. No.
1	Sayan Biswas	MS14075

17.2. BS-MS Graduates

11	Name	Reg. No.	Subject
1	Vandana Kumari	MS13141	Biology
2	Harsh Pruthi	MS14003	Mathematics
3	Jai Khatri	MS14004	Chemistry
4	Kakade Kunal Madhukar	MS14009	Mathematics
5	Kapil Yadav	MS14037	Chemistry
6	Santanu Katiyar	MS14039	Chemistry
7	Manish Kumar Yadav	MS14055	Chemistry
8	Vandana Verma	MS14068	Biology
9	Ankuj Kumar	MS14080	Chemistry
10	Ravi Kumar	MS14087	Chemistry
11	Ajay Kumar	MS14091	Chemistry
12	Mohit Kumar	MS14092	Chemistry
13	Sukhpal	MS14094	Chemistry
14	Neeraj Meena	MS14096	Biology
15	Arundhati Dev J R	MS14117	Biology
16	Renu Meena	MS14126	Mathematics
17	Prabhat Singh Rana	MS14140	Chemistry
18	Greeshma P Bose	MS14155	Biology
19	Goverdhan Gouri Laxmikant	MS14165	Physics
20	Shubham Gajrani	MS14168	Biology
21	Shakshi	MS14179	Chemistry
22	Gitanjali	MS15001	Biology
23	Divecha Deesha Hemant	MS15003	Physics
24	Debanjan Chowdhury	MS15004	Chemistry
25	Sahil Kamboj	MS15006	Biology
26	Abhishek Meena	MS15008	Biology
27	Ankit Kumar	MS15009	Physics
28	Nihal Muhammed Habeeb	MS15010	Physics
29	Vishnu K P	MS15011	Physics
30	Aaditya Narasimhan	MS15013	Biology
31	Ziyaurrahman M S	MS15014	Biology
32	Riya Joseph	MS15016	Biology
33	Parmeet Kaur Dhindsa	Ms15017	Chemistry
34	Anees Rahman P	MS15018	Chemistry
35	Yateendra Sihag	MS15019	Physics

36	Misha Gupta	Ms15020	Physics
37	Anjana R Kammath	MS15021	Chemistry
38	Inayat	MS15022	Biology
39	Jithin. R	MS15023	Biology
40	Afham	MS15024	Physics
41	Jahanvi	MS15025	Physics
42	Ashitha P P	Ms15026	Chemistry
43	Abhay. P. S	Ms15027	Mathematics
44	Aiswarya A S	Ms15028	Biology
45	Sudha Yadav	Ms15029	Chemistry
46	Rahul Babu	MS15030	Biology
47	Surendra Yadav	Ms15031	Biology
48	Srishti	MS15032	Biology
49	Ahina Nandy	MS15033	Mathematics
50	Adarsh R	MS15036	Chemistry
51	Ajay Kumar	MS15039	Biology
52	Nahas K	MS15040	Chemistry
53	Parkar Vidit Suryakant	MS15041	Chemistry
54	Yash Rana	MS15042	Physics
55	Shreya D Kumar	MS15043	Biology
56	Joshi Pranav Vijay	MS15044	Biology
57	Rohit Negi	MS15045	Biology
58	Preeti	MS15048	Chemistry
59	Raj Kumar	MS15049	Chemistry
60	P Prathibha	MS15050	Biology
61	Vaibhav Pal	MS15051	Chemistry
62	Amisha Agarwala	MS15052	Biology
63	Amit Suthar	MS15053	Physics
64	Nimrat Kaur	MS15054	Physics
65	Aditya Krishna	MS15055	Biology
66	Athul R Ramesh	MS15056	Biology
67	Harikrishnan R	MS15057	Chemistry
68	Adeeb Mev	MS15058	Physics
69	Ramandeep Singh	MS15061	Biology
70	Jaskaran Singh	MS15062	Biology
71	Saurabh Nandkumar Ramteke	MS15063	Chemistry
72	Jasmeet Singh	MS15064	Physics
73	Nevil U Shah	MS15067	Physics
74	Ravinder Dhayal	MS15068	Physics
75	Deepu S	MS15069	Physics
76	Pushpinder Singh	MS15070	Physics
77	Ramsi Nilopher	MS15071	Biology
78	Mannathu Gopikrishnan	MS15074	Physics
79	Dhruv Mittal	MS15075	Physics

80	Lincoln	MS15076	Chemistry
81	Ankur	MS15078	Physics
82	Vivek Ashok Jadhav	MS15080	Physics
83	Asif Mohammed L	MS15081	Physics
84	Himanshu	MS15082	Chemistry
85	Satyam Prakash	MS15083	Physics
86	Shweta Mishra	MS15084	Biology
87	Rutik Manikandhan	MS15086	Physics
88	Megha	MS15087	Chemistry
89	Sandra Sajan	MS15088	Physics
90	Nitheesh S Pillai	MS15089	Physics
91	Amit Kumar	MS15090	Biology
92	Mohit Barsain	MS15091	Biology
93	Anargha Sai. K. K	MS15092	Biology
94	Ishan Sarkar	MS15094	Chemistry
95	Saurabh Bedi	MS15095	Physics
96	Piyush Sakrikar	MS15096	Physics
97	Ananya Ashim	MS15098	Biology
98	Jude Ann Vishnu	MS15099	Physics
99	R. Lakshmi	MS15100	Mathematics
100	Abhimanyu Bhardwaj	MS15101	Biology
101	Gokhul N	MS15102	Mathematics
102	Vidur Sury	MS15103	Mathematics
103	R. Ranjani	MS15104	Physics
104	Khushmeet Kaur Dhaliwal	MS15105	Physics
105	Sahil Kaushal	MS15106	Chemistry
106	Bhavya	MS15107	Biology
107	Deokate Nilesh Vilasrao	MS15108	Biology
108	Sreelekshmi S R	MS15109	Biology
109	Nikhil Tanwar	MS15111	Physics
110	Dharm Singh Yadav	MS15112	Chemistry
111	Prashant Kumar	MS15114	Mathematics
112	Bhargesh Patel	MS15115	Biology
113	Himanshu Dev	MS15116	Physics
114	Athul Vijay V C	MS15117	Chemistry
115	Himanshu Yadav	MS15119	Mathematics
116	Raunak Dhar	MS15120	Biology
117	Jigisha	MS15124	Biology
118	Hayman Gosain	MS15125	Physics
119	Lipika Pradeepkumar Taneja	MS15126	Biology
120	Yogesh	MS15127	Mathematics
121	Manujith K Michel	MS15129	Mathematics
122	Arghadip Koner	MS15131	Chemistry
123	Apoorv Gaurav	MS15133	Physics

124	Sourabh Kumar Soni	MS15135	Physics
125	Sayyed Imran Rashid	MS15139	Biology
126	Sunandini Ramnarayanan	MS15143	Biology
127	Ashish Varghese George	MS15144	Mathematics
128	Farzana N	MS15145	Biology
129	Ankita	MS15146	Physics
130	Krishna Kanth T.G	MS15147	Physics
131	Deepak Potyan Negi	MS15148	Biology
132	Pankhuri Singhal	MS15149	Biology
133	Kabeer Manali Rahul	MS15152	Mathematics
134	Sapna Kumari Meena	MS15154	Biology
135	Sohit Chobhiyal	MS15155	Biology
136	Sveekruth Sheshagiri Pai	MS15156	Biology
137	Prashant	MS15157	Chemistry
138	Ajit Kumar Sahoo	MS15158	Biology
139	Fidha Nazreen K M	MS15159	Physics
140	Aakanksha Meena	MS15161	Chemistry
141	Akshay P	MS15162	Biology
142	Shubham Ramle	MS15163	Chemistry
143	Sheetal Rani	MS15164	Chemistry
144	Sidharth Sh	MS15165	Chemistry
145	Bharadwaj Varma P K	MS15166	Physics
146	Lopamudra Das	MS15167	Chemistry
147	Sreelekshmi S A	MS15168	Biology
148	Nilangshu Bhattacharyya	MS15169	Mathematics
149	Karthik T	MS15170	Biology
150	Sumith K K	MS15171	Physics
151	Rajesh Kumar Bajiya	MS15173	Mathematics
152	Asish Kumar Swain	MS15174	Biology
153	Paresh Nath Das	MS15175	Biology
154	Meghna Thakur	MS15176	Biology
155	Gaurav Singh	MS15177	Physics
156	Tinku	MS15178	Physics
157	Harpreet Kaur	MS15179	Chemistry
158	Himanshu Aggarwal	MS15180	Biology
159	Tisya Banerjee	MS15181	Biology
160	Simran Panda	MS15184	Biology
161	Akshay Menon P	MS15185	Physics
162	Dhanvin M Koundinya	MS15186	Chemistry
163	Nikhil S Sivakumar	MS15187	Physics
164	Sujata	MS15188	Biology
165	Manu. M	MS15190	Mathematics
166	Balashankar R	MS15192	Biology
167	Sandita Das	MS15193	Chemistry

168	Abhijith. K. B	MS15195	Biology
169	Pritam Saha	MS15196	Biology
170	Kale Milind Sanjay	MS15197	Chemistry
171	Debjit Ghosh	MS15199	Physics
172	Anubhav Jindal	MS15200	Physics
173	Ayush Tyagi	MS15202	Physics
174	Trirupa Tapas Chakraborty	MS15204	Biology
175	Chithra P. R	MS15205	Chemistry
176	Nimisha Krishnan	MS15206	Physics
177	Shubham Anand	MS15208	Physics
178	Swastik P G	MS15209	Biology

17.3. PhD Graduate

S. No.	Name	Reg. No.	Dept.	Title of the Thesis
1	Rituraj Marwaha	MP12002	BIO	Role of small GTP-binding protein Arl8b and its RUN domain- containing interaction partners in regulating cargo trafficking to lysosomes
2	Pankaj Dubey	MP12008	CHM	Restricted backbone preference in the conformational landscape of amino acids: Do they have a role to play in the peptide structure?
3	Manaoj Aravind V	MP12011	PHY	Utilizing noise to implement logical operations in Bistable Systems
4	Promit Moitra	MP12012	PHY	Dynamics on Spatially Extended Systems
5	Anita Devi	MP13001	PHY	Nonlinear Optical Effects in Laser Trapping of Dielectric and Metallic Particles under Femtosecond Pulsed Excitation: Theory and Experiment
6	Pooja Munjal	MP13014	PHY	Unraveling universal interferometers for ultra-precise probing of matter and realization of a new class of frugal photonic devices
7	Samridhi Gambhir	MP13015	PHY	Experimental Studies on Quantum Diffraction and Phase Space Imaging
8	Swati	PH10056	BIO	Investigating the role of ROS in eliciting mitochondrial retrograde response during Drosophila cardiogenic mesoderm specification events
9	Satyam Ravi	PH11080	CHM	Studies on Structural and Dynamical Aspects of Non-adiabatic Effects in Small Polyatomic Molecules

10	Swagatam Nayak	PH11097	PHY	Unconventional Superconductivity in the Extended Attractive Hubbard Model
11	Bhupinder Singh	PH12106	BIO	Molecular and functional insights into the regulation of D-galactonate metabolism by a GntR family transcriptional regulator, DgoR in Escherichia coli
12	G.V.R. Krishna Prasad	PH12110	BIO	Vibrio cholerae OmpU activates distinct signalling cascades in innate immune cells
13	Varinder Singh	PH12114	PHY	Optimization analysis of classical, mesoscopic andquantum heat engines in finite-time thermodynamics
14	Devashish Dwivedi	PH12115	BIO	Hook2 mediates dynein-dynactin association to regulate mitotic progression and cytokinesis
15	Rohan Sharma	PH12127	BIO	Role of Sorting Nexin 1 (SNX1) in the group I metabotropic glutamate receptor trafficking
16	Prince Saini	PH12140	BIO	Protein-protein interaction network study of shoot stem cell niche derived transcription factors revealed the contrasting role of ELONGATED HYPOCOTYL5 and DEWAX in UV-B stress in Arabidopsis thaliana
17	Nagesh kadam	PH12142	BIO	Study of reversal behaviour and chemotaxis in Caenorhabditis elegans
18	Aakanksha Gulati	PH12149	BIO	Unravelling the host immunomodulation by two gram-negative enteric bacterial ligands
19	Sandeep Kumar Rana	PH13002	PHY	Foregrounds in intensity mapping of redshifted 21 cm radiation
20	Rajendra Shirke	PH13014	CHM	New Approaches Toward the Synthesis of Furotropones, Benzofurans, Triazoles and Axially Chiral Styrenes
21	Nisha Gupta	PH13017	PHY	Cytoskeletal filament and intracellular cargo dynamics facilitated by motor proteins: role of activity and a catch-bonded dynein

22	Shubhendu Shekhar Khali	PH13018	PHY	A Study of Equilibrium and Non-Equilibrium Phase Transition In Two Dimensional Colloidal Suspension
23	Manpreet Kaur	PH13025	BIO	Galectin-3 as a regulator of γ-herpesvirus specific CD8+ T cell immunity and the utility of single domain antibodies
24	Narendra Bisht	PH13027	CHM	Studies on the Synthesis of Functionalized Arenes and Heteroarenes via Directing Group-Assisted C-H Functionalization
25	Bhishem	PH13030	BIO	Role of the bacterial nucleoid associated protein "HU" in cell-cell and cell-DNA interactions through the binding of HU with eDNA and Lipopolysaccharide
26	Gayathri Sindhuri Singaraju	PH13032	CHM	Molecular mechanism of the cell-cell adhesion by atypical cadherin-23
27	Bankar Siddheshwar Kisan	PH13034	CHM	Novel Cascade Approaches for the Synthesis of Carbo- and Heterocycles
28	K. Kiran Kumar	PH13037	BIO	Function and mechanism of the unconventional ubiquitin-like protein Hub1
29	Arashdeep Singh	PH13038	BIO	Principles underlying the organization and function of yeast genome
30	Bishnupada Satpathi	PH13045	CHM	Phosphine-Mediated Cyclopentannulation of Arenes and Heteroarnes
31	Anup Kumar Srivastava	PH13046	INS	Hybrid Nanostructure Mediated, Epigenetically Controlled neurotherapeutics and Their Biosensing Application in neurodegenerative Diseases
32	Harpreet Singh	PH13049	CHM	Design and Synthesis of Porous Organic Polymers for Sensing and Visible Light Photocatalytic Applications
33	Anzar Ali	PH14006	PHY	A Study of Critical Behavior and Magnetocaloric Effect in Rare Earth Double Perovskites, 3d-Metal Chromites and the Ferromagnetic Weyl Semimetal Co3Sn2S2

34	Richa Singh	PH14008	BIO	Examining the effect of environmental factors on acoustic signalling of a nocturnal ensiferan insect, Acanthogryllus Asiaticus
35	Shekhar Das	PH14012	PHY	Scanning tunnelling microscopy and transport spectroscopy on candidate topological systems
36	Sudhanshu Shekhar Chaurasia	PH14015	PHY	Suppression and Revival of Oscillations and Control of Chaos in Nonlinear Systems
37	Neha Kwatra	PH14017	MTH	Galois Cohomology for Lubin-Tate (φq, Γ LT)-modules
38	Swathi Krishna	PH14020	MTH	Hyperbolicity, Complexes of Groups and Cannon-Thurston Maps
39	Anshu Sirohi	PH14021	PHY	Probing Conventional and Unconventional Superconductivity by Ultra-Low-Temperature Scanning Tunneling Spectroscopy
40	Priyanka Dogra	PH14030	CHM	Phase Behavior of An Intrinsically Disordered Domain of A Melanosomal Protein: Conformational Characteristics, Amyloid Formation, And Liquid-Liquid Phase Separation
41	Ankit Singh	PH14036	PHY	Galaxies and their environment
42	Preetika Sharma	PH14043	HSS	Queering the Urban: An Ethnographic study of Kothi subcultures in Chandigarh
43	Indu Verma	PH14045	CHM	Design of Aqueous-Liquid Crystal Interfaces for Biosensing Applications
44	Shambhu Yadav	PH14051	BIO	Studies on altered glutathione metabolism in Zebrafish and the yeast Saccharomyces cerevisiae
45	Kalane Sagar Balasaheb	PH14071	MTH	Classification of pairs of quaternionic hyperbolic isometries
46	Pinka Dey	PH14072	MTH	Group actions on Dold and Milnor manifolds
47	Rashmi Jain	PH14203	INS	Development of bio-inspired hydrogels for tissue regeneration
48	Dimple	PH14209	INS	Atomic-scale insights into energy conversion in two-dimensional transition metal dichalcogenide monolayers from ab-initio studies

49	Naimat Kalim Bari	PH14210	INS	Structural and functional studies of an All-protein prokaryotic Nano Bioreactor
50	Swati Tanwar	PH14212	INS	DNA origami directed self- assembled hybrid nanoantennas for single molecule spectroscopic applications
51	Rajinder Kumar	PH14214	INS	Nano-structured Materials Synthesized from Transition Metal Carbides / Nitrides for Electrocatalytic Applications
52	Nityasagar Jena	PH14216	INS	2D transition-metal dichalcogenide monolayers and their Janus structures for next-generation electronics and energy conversion: an ab-initio study
53	Km Ruchi Tomar	PH14226	INS	Electronic Properties of Interfaces and Surfaces of Perovskite oxides
54	Manleen Kaur	PH15024	HSS	Catastrophe of the Great Economic Depression of 1929: The Case of India
55	Prabhjot Kaur	PH15209	INS	Effect of alloying and nanostructuring on thermoelectric properties

17.4. MS Graduates

S. No.	Name	Reg. No.
1	Shubham Mittal	MP16003
2	Subhankar Pal	MP17006
3	Jnanajyoti Bhaumik	MP17008
4	George Shaji	MP17009
5	Shikha Bhutani	MP17011
6	Shreya Sharma	MP17013

18. Publications

18.1. Publication During the Calendar year 2020:

18.1.1. Department of Mathematical Sciences

1. Amit Kulshrestha and Anupam Singh **(2020**). Computing n-th roots in SL2 and Fibonacci polynomials. ***Proc. Indian Acad. Sci. (Math. Sci.)***, 130(1), 31. https://doi.org/10.1007/s12044-020-0559-8
2. Anuj Jakhar and Sudesh K. Khanduja (**2020**). A note on Dedekind Criterion. ***Journal of Algebra and its Applications,*** 20(4), 2150066.
3. Anuj Jakhar and Sudesh K. Khanduja (**2020**). On the index of an algebraic integer and beyond. ***Journal of Pure and Applied Algebra***, 224(7), 106281.
4. Anuj Jakhar, Sudesh K. Khanduja and Neeraj Sangwand **(2020)**. On prolongations of valuations to the composite field. ***Journal of Pure and Applied Algebra***, 224(2): 551-558. https://doi.org/10.1016/j.jpaa.2019.05.021 (Corrigendum in: Volume 224, Issue 10, October 2020, Pages 106397).
5. Arpan Dutta and Franz-Viktor Kuhlmann **(2020)**. Eliminating tame ramification generalizations of abhyankar's lemma. ***Pacific Journal of Mathematics,*** 307(1):121-136.
6. D. Chaudhuri **(2020)**. Skew-symmetric elements of rational group algebras. ***Beitrage zur Algebra und Geometrie,*** 31(4): 719-729.
7. Diganta Borah and Debaprasanna Kar **(2020)**. Boundary behavior of the Carathéodory and Kobayashi-Eisenman volume elements. ***Illinois J. Math.,*** 64(2): 151-168. DOI: 10.1215/00192082-8303461
8. Jotsaroop Kaur and Saurabh Shrivastava **(2020)**. Unimodular bilinear Fourier multipliers on L-p spaces. ***Monatshefte für Mathematik,*** 193: 87–103. (Correction in *Monatshefte für Mathematik* (2021). https://doi.org/10.1007/s00605-021-01527-7
9. Jotsaroop Kaur, Saurabh Shrivastava and Kalachand Shuin **(2020)**. Weighted Estimates for Bilinear Bochner-Riesz Means at the Critical Index. ***Potential Analysis.*** https://doi.org/10.1007/s11118-020-09870-4
10. Kapil Hari Paranjape **(2020)**. Classroom: Euler's Summation Method. ***Resonance: Journal of Science Education,*** 25(7): 1045-1053.
11. Krishnendu Gongopadhyay and Swathi Krishna **(2020)**. Palindromic width of graph of groups. ***Proceedings of the Indian Academy of Sciences: Mathematical Sciences,***130(1), 22.
12. Krishnendu Gongopadhyay, Mukund Madhav Mishra and devendra Tiwari (**2020**). On discreteness of subgroups of quaternionic hyperbolic isometries. ***Bulletin of the Australian Mathematical Society,***101(2): 283-293.
13. Krishnendu Gongopadhyay, Tatyana A. Kozlovskaya and Oleg V. Mamonov **(2020)**. On some decompositions of the 3-strand singular braid group. ***Topology and its Applications,*** 283, 107398. 10.1016/j.topol.2020.107398
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6. A. Beri, Tinku, N. Iyer, C. Maitra **(2021)**. Evolution of timing and spectral characteristics of 4U 1901+03 during its 2019 outburst using the Swift and NuSTAR observatories. ***Monthly Notices ofthe Royal Astronomical Society,*** 500(1): 1350-1365.
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19. Patents

K. P. Singh

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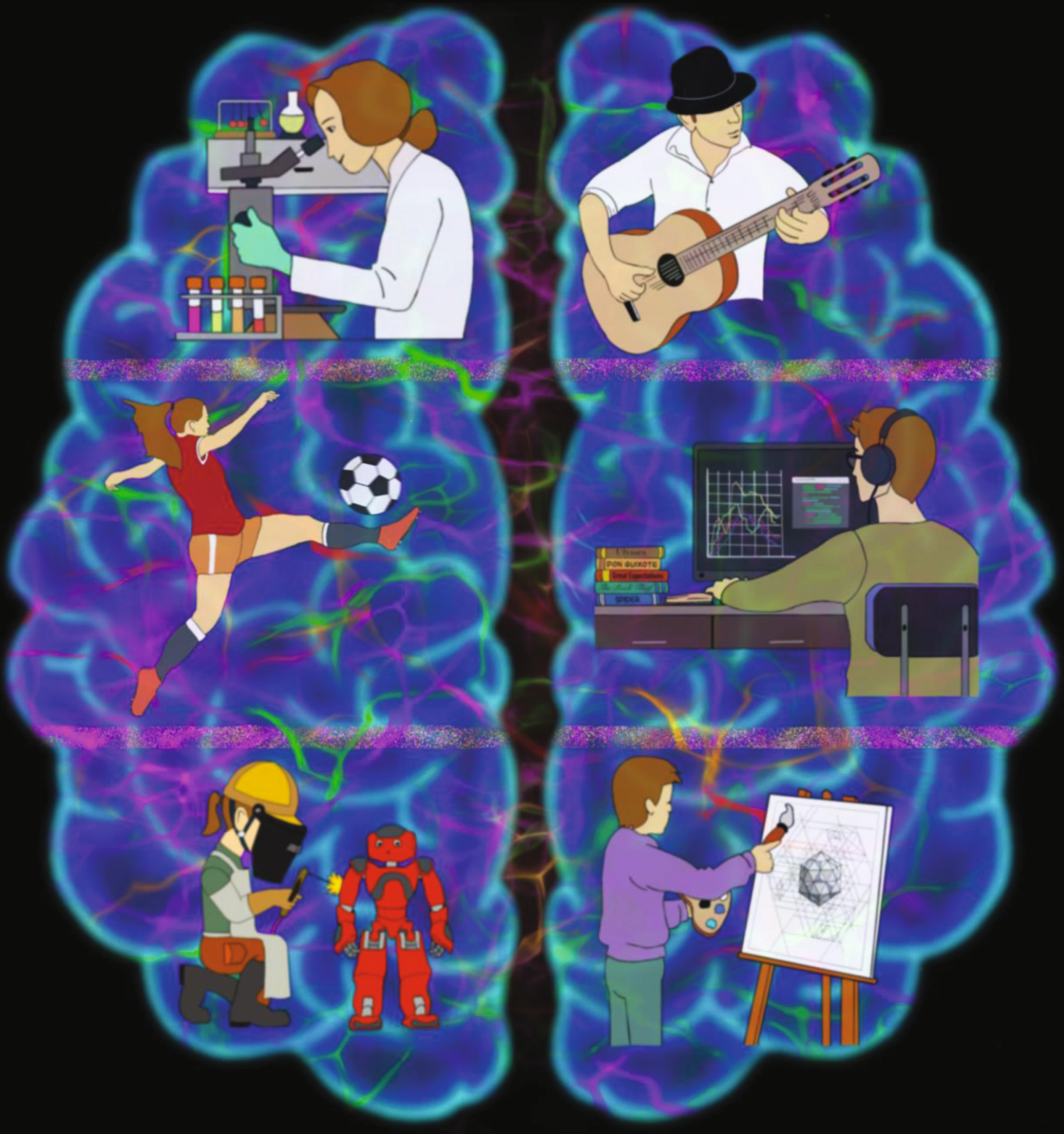

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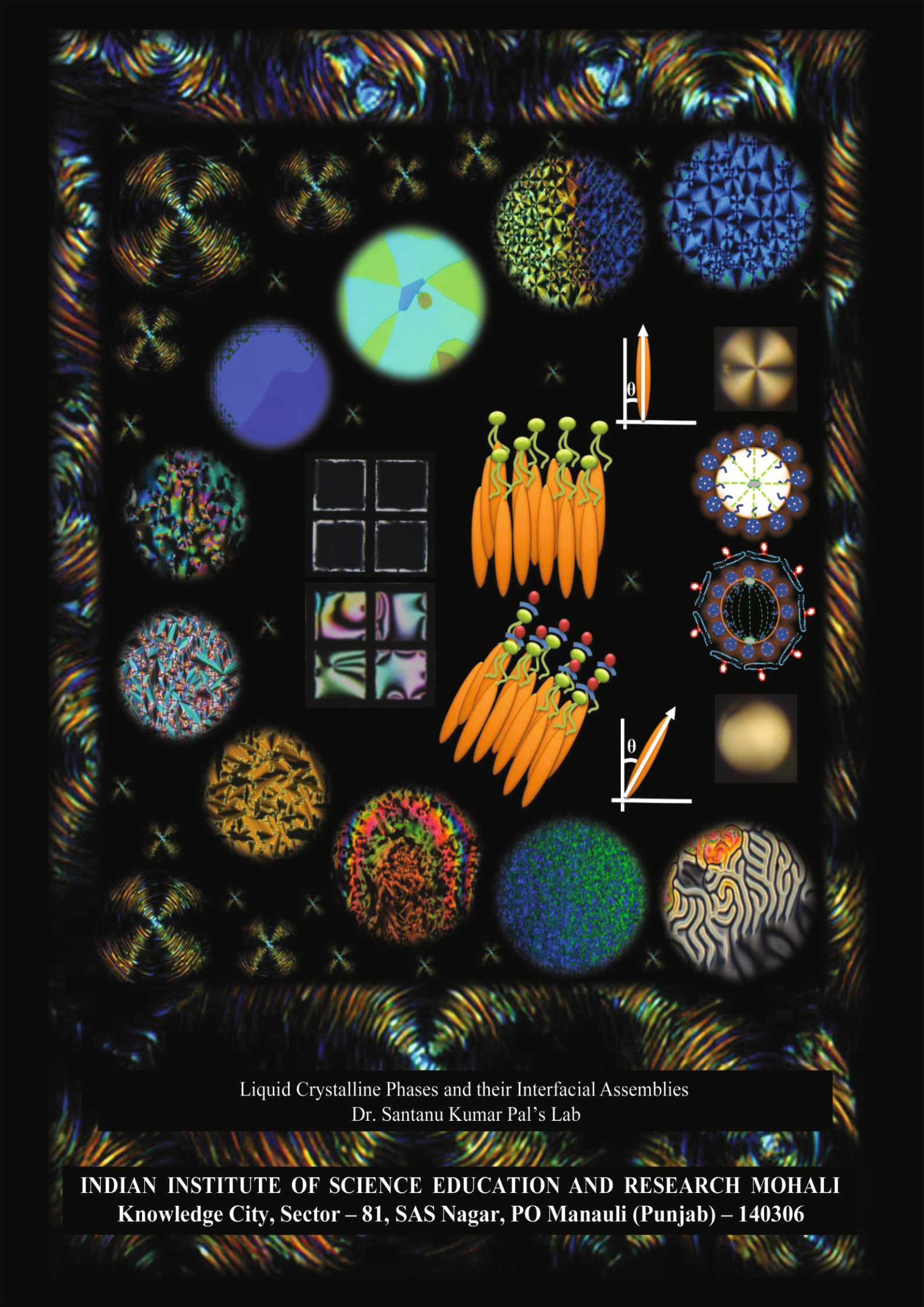

Liquid Crystalline Phases and their Interfacial Assemblies

Dr. Santanu Kumar Pal's Lab

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