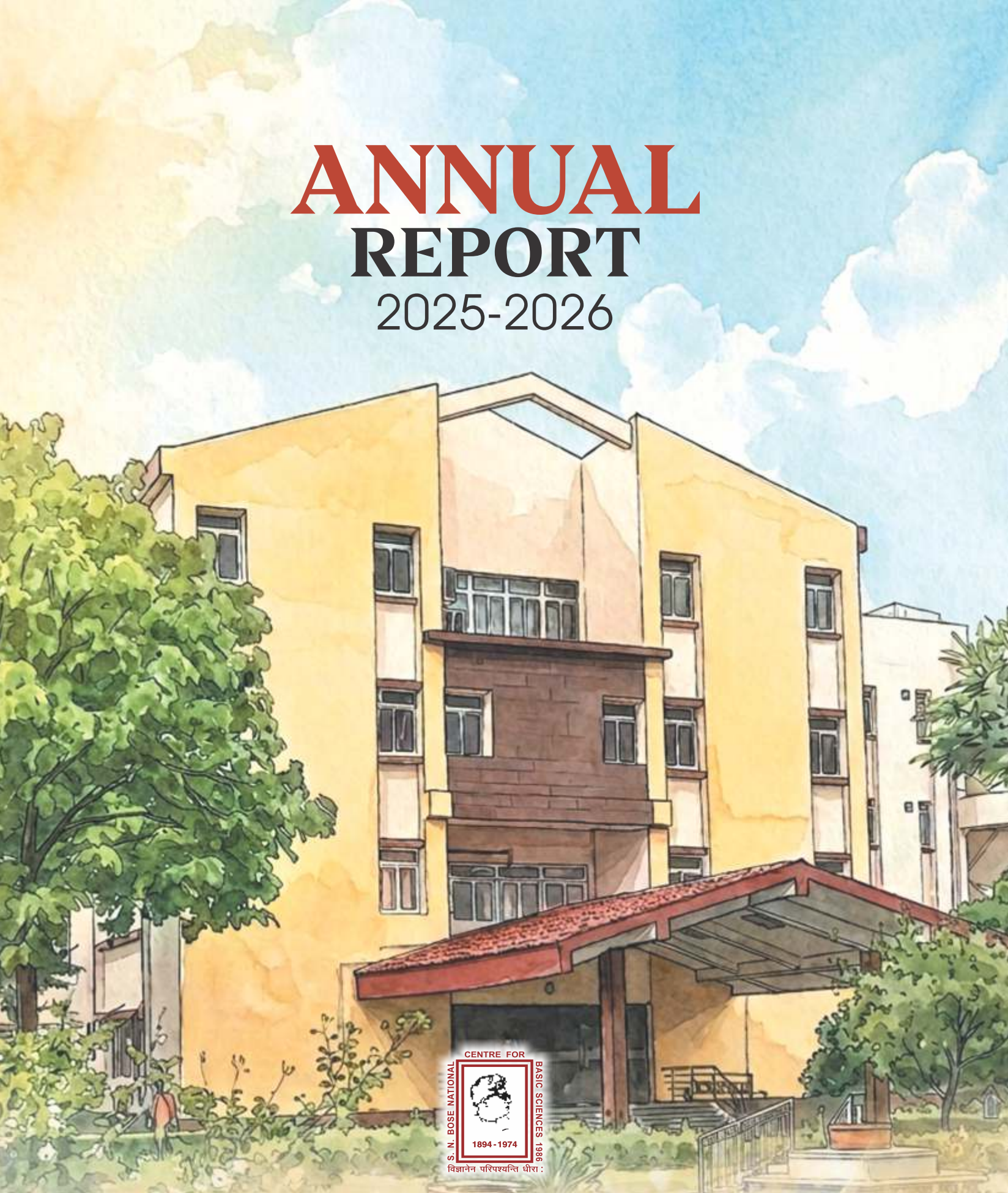
ANNUAL REPORT
2025-2026



SATYENDRA NATH BOSE
NATIONAL CENTRE FOR BASIC SCIENCES

ANNUAL REPORT
2025-2026



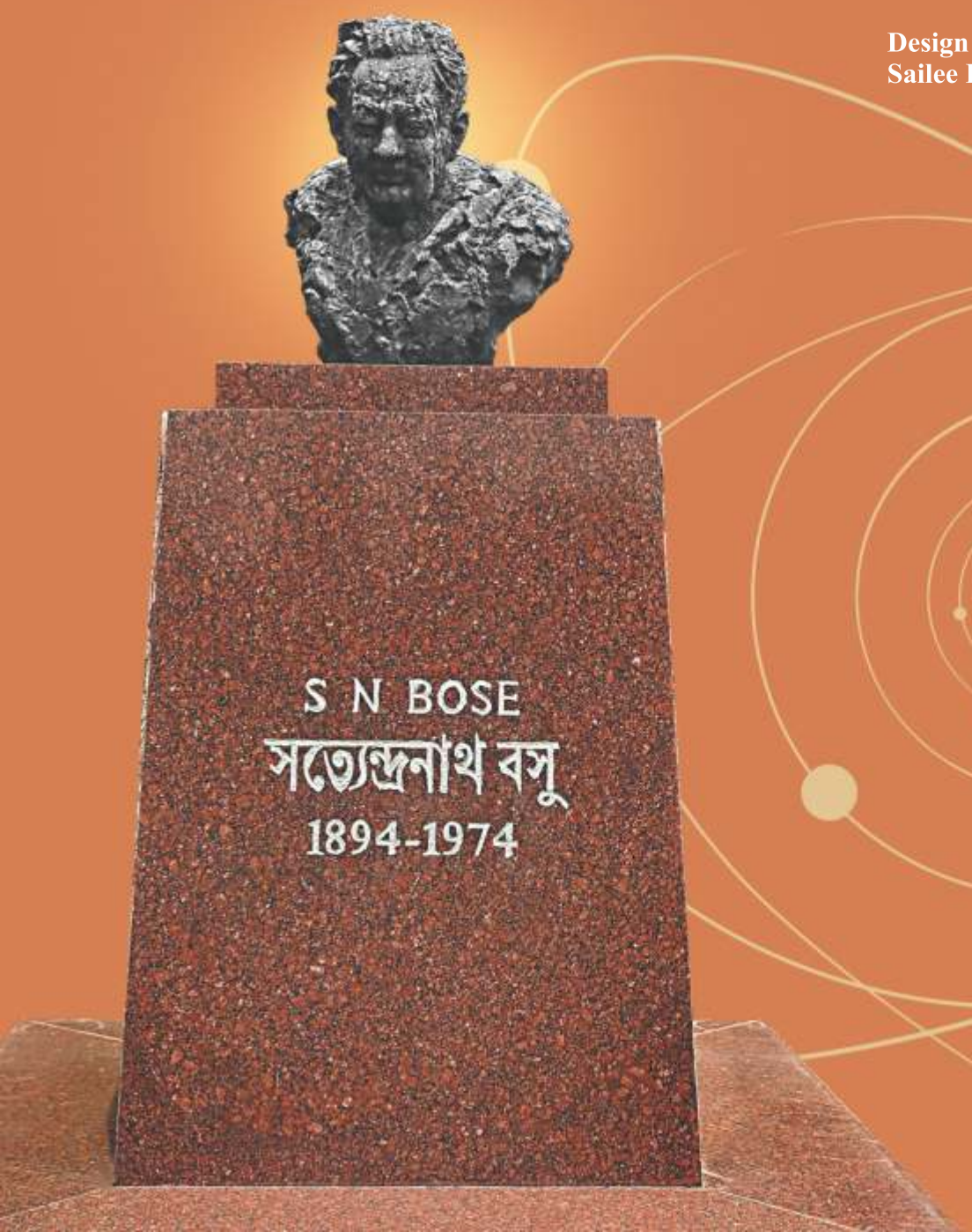
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ANNUAL REPORT 2025-26

Satyendra Nath Bose
National Centre for Basic Sciences

Publisher
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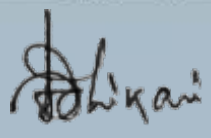
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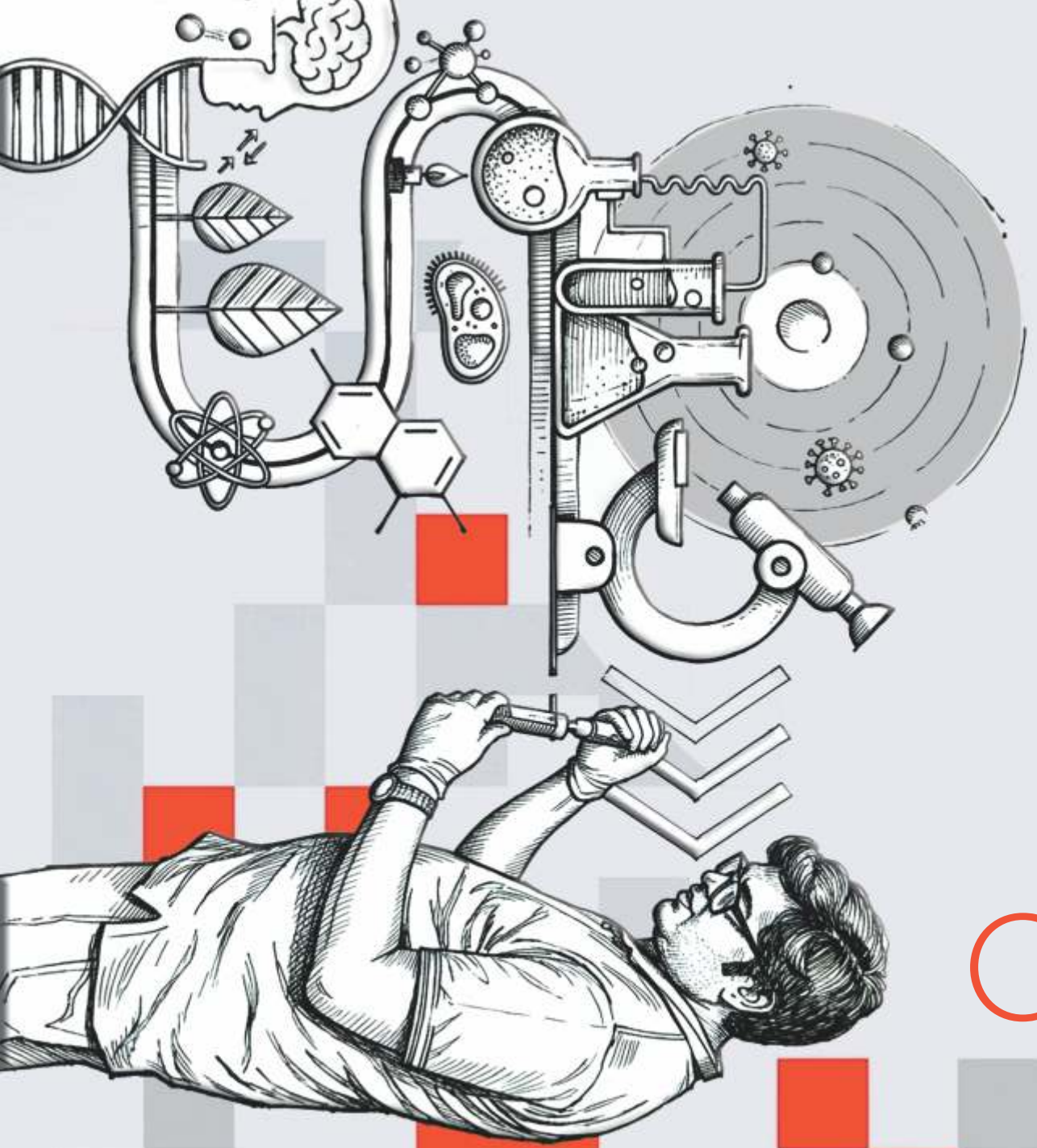
ACKNOWLEDGEMENT

Annual Report of the 'Satyendra Nath Bose National Centre for Basic Sciences' is a brief representation of its activities of a financial year. The report reflects research activities, administrative activities, academic progress and achievement of young research scholars, development of infrastructure and facilities, and establishment of network with advanced research groups around the world. It's the 16th time I have been assigned the job of compiling the Annual Report of the Centre. To prepare the Annual Report, all the faculty members and sections of the Centre have spent their valuable time to provide respective data. It is a time bound work to be completed within a short span of time. This is the 9th time the Annual Report has been translated and typed in Hindi within the Centre. The Office Assistant (Hindi), Tanya Chaturvedi, has given sincere and fatigueless effort to translate the entire Annual Report in Hindi. The library staff - Ananya Sarkar and Gurudas Ghosh typed some portions of the Annual Report in Hindi within a short time. Words won't be suffice to describe the painstaking labour of Hindi translation team. I would like to acknowledge the sincere efforts and labour of the Library staff - Gurudas Ghosh, Ananya Sarkar and Amit Roy, without whom the work could not be completed within the stipulated time. Finally, I would like to thank all the members of the Centre for their cooperation in preparation of the Annual Report of the Centre.





Saumen Adhikari
Librarian – cum – Information Officer



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MESSAGE FROM THE DIRECTOR



I am happy to present the Annual Report of the Satyendra Nath Bose National Centre for Basic Sciences for the year 2025-2026.

This year has been a landmark for the Centre, marking its 40th anniversary. The Centre was established in 1986 under the Department of Science and Technology, Government of India, to honour the life and work of Satyendra Nath Bose - a colossal figure in conceptual contributions in the development of Quantum Mechanics and Quantum Statistics.

Over the last four decades, the Centre has grown into a major Hub of scientific research and learning by bringing together theoretical, computational, experimental, and translational research within a single intellectual ecosystem. I am proud to share that, as per the Nature ranking, the S N Bose Centre ranks as the top 2 among DST autonomous Institutes in Physical Sciences and top 4 in Chemical Sciences. The Centre has advanced as a regional high-performance computing hub with the PARAM Rudra supercomputer, developed under the National Supercomputing Mission, and inaugurated by the Hon'ble PM. Our laboratories offer modern facilities for femtosecond pump–probe spectroscopy, time-resolved magneto-optic Kerr effect, Brillouin light scattering, terahertz and cavity ring-down spectroscopy, break-junction measurements, and low-temperature experiments. A major milestone is the Panchet Observatory project in Purulia, envisioned as a one-metre-class telescope facility for advanced research and training. Supported by a mobile observatory, this initiative reflects the Centre's commitment to expanding the frontiers of observational science.

Over the decades, the Centre has attracted generations of students, postdoctoral researchers, and visiting scientists to sustain a culture where deep questions remain at the heart of scientific progress. From student strength of 26 in its first decade of existence, it has reached strength of 372 in its fourth decade. During these forty years, the Centre has produced nearly four hundred PhDs, many of whom have gone on to be leaders in their fields of research.

Today, the Centre successfully runs Integrated PhD and PhD programmes. It also hosts international students through collaborations with institutions such as the World Academy of Sciences and IFW Dresden, Germany. Networking being one of the mandates of SNBNCBS, the Centre has made its global presence felt through national and international research programmes. International collaboration spans countries such as Germany, the United States, Sweden, Japan, France, Austria, Taiwan, etc. Important MoUs have been signed with IFW Dresden and the University of Davis, IIA, Bangalore, IIT Bombay, NPL, Delhi, SKBU. Beyond laboratories and publications, SNBNCBS has also built a strong culture of scientific communication and public engagement through Bangiyo Vigyan Praishad, the Indian Physics Association and its own outreach programs.

For forty years, S. N. Bose National Centre for Basic Sciences has carried forward a powerful vision: to pursue fundamental questions with depth, to build advanced scientific capability, to train future generations, and to connect knowledge with society. From the legacy of Satyendra Nath Bose to the frontiers of modern science, from blackboards and laboratories to supercomputers and observatories, the journey of SNBNCBS is a story of curiosity, courage, and commitment.

As part of celebrating 40 years of the Centre, a dedicated Archive was inaugurated on 13th June 2026 by Dr Sukanta Majumdar, Hon'ble Union Minister of State for Education, Government of India, to pay tribute to the visionaries and members of the Centre whose collective efforts have shaped the Centre into an institute of international repute.

As the Centre enters its next chapter, it continues to stand for a timeless promise that the pursuit of basic science is not only a search for knowledge, but a foundation for the future. I congratulate all my academic and administrative colleagues, students and staff members for their relentless effort and sincerity in reaching this height. I thank the members of the review committee, governing body and academic programme committee for their unconditional support and guidance.



Tanusri Saha-Dasgupta
Director
Satyendra Nath Bose National Centre for Basic Sciences

DEAN FACULTY



During the year 2025-26, the Centre was involved in several academic activities related to scientific collaborations, hosting various national conferences, workshops, schools, organizing outreach programmes, signing of MOU with various Universities / Institutes. Our faculty members continued to publish in top quality international journals and delivered lectures/seminars in national and international conferences/schools. In this fiscal year, the total number of publications is 218.

Throughout the year, the centre organized numerous seminars as **4** nos. of Bose Colloquium, **3** nos. Institute Colloquium and **70** nos. various departmental seminars / special lectures and early career talks.

Our ongoing collaborations with various institutions in India and abroad in terms of academic visits and exchange programmes including collaborations in conferences, as well as involvement in projects supported by extramural funding further bolstered the research activities of the Centre. During the F.Y. 2025-26, the total number of externally funded projects were **33** which includes **14** no of newly sanctioned projects in that financial year.

Awards / Recognitions received by Faculty members (Alphabetically)

1. **Prof. Anjan Barman, Senior Professor** –
   - i. Elected Fellow of the Indian National Science Academy (INSA) in 2026.
   - ii. Featured in top 2% most cited scientists' list released by Stanford-Elsevier in 2025.
   - iii. Associate Editor of npj Spintronics (Springer-Nature).
   - iv. Elected as Editorial Board Member of Nanotechnology (IOP science).
2. **Prof. Archan S Majumdar, Senior Professor –**
   - i. Participated in the TV Show "Bigyan Prasange" on DD Bangla.
3. **Dr. Arijit Haldar, Assistant Professor –**
   - i. His work "Hidden magnon Berry curvature drives vertical magnon transport" has been selected as an Editor's Suggestion in Physical Review B.

ii. His another work "Multiple Dirac spin-orbital liquids in SU(4) Heisenberg antiferromagnets on the honeycomb lattice" has been accepted as a letter in Physical Review B.

4. Prof. Manik Pradhan, Senior Professor --

i. His research work on Evanescent-wave Cavity Ring-down Spectroscopy has been highlighted by the Analytical Chemistry, American Chemical Society (ACS) Journal

ii. His another research work has been highlighted and press released on "A tug of war in gold nanoscale assembly can help produce better biosensors" by the Ministry of Science & Technology, DST

5. Prof. Manoranjan Kumar, Professor --

i. Elected as Editorial Board member of Journal of Physics: Condensed Matter.

6. Dr. Nitesh Kumar, Associate Professor --

i. His work on the altermagnetic CrSb was highlighted by DST media cell "Duality discovered in magnetic material could revolutionize design of electronic devices".

7. Prof. Priya Mahadevan, Senior Professor --

i. Elected as Editorial Board member of Pramana Journal of Physics

ii. Recipient of JC Bose fellow (2025-2030)

iii. Elected as Editorial Board member of J. Solid State Chemistry

8. Prof. Sakuntala Chatterjee, Professor --

i. Elected as Co-editor of the journal Euro Physics Letters

ii. Elected as Member of C6 commission of IUPAP

iii. Elected as Member of Editorial Board of Journal of Biosciences

9. **Dr. Saquib Shamim, Assistant Professor** --

i. Selected as Member of the Early Career Advisory Board of the journal Physical Review B by the American Physical Society

10. Prof. Suman Chakrabarty, Professor --

i. Recipient of Bronze Medal from The Chemical Research Society of India (CRSI), 2025

ii. Recipient of Dr. APJ Abdul Kalam HPC & AI Award - 2025 under the category Researcher in R&D in HPC Applications in India

11. Dr. Shubhasish Haldar, Associate Professor --

i. Participated in the TV Show: "Cancer Gabeshonay Kritim Buddhimatta" on DD Bangla.

ii. Recipient of Cancer Biology Oration Award from the Gujarat Cancer and Research Institute (2026)

12. Prof. Tanusri Saha Dasgupta, Senior Professor --

i. Recipient of D.Sc. (Honoris Causa) by the University of Engineering and Management (UEM) January 2026

ii. Participated as panelist in the TV show "Bigyan Prasonge" on DD Bangla.

- **Faculty Members promoted during last year (Alphabetically)**

1. Prof. Manik Pradhan from Professor to Senior Professor.
2. Dr. Nitesh Kumar from Assistant Professor to Associate Professor.
3. Dr. Ramkrishna Das from Associate Professor to Professor.
4. Dr. Suman Chakrabarty from Associate Professor to Professor.
5. Prof. Soumen Mondal from Professor to Senior Professor

- **New Faculty members joined last year (including Inspire, Ramanujan etc.)**

1. Mr. Arghya Sardar, Scientist F, Dept. of CBS (on supernumerary post) – 18.06.2025.
2. Dr. Chayan Mondal, Assistant Professor, Dept. of AHEP – 08.09.2025.
3. Dr. Sujit Deshmukh, Ramanujan Fellow, Dept. of CMMP – 06.01.2026.

- **Faculty members left / superannuated last year (including Inspire, Ramanujan etc.)**

1. Prof. Jaydeb Chakrabarti, Sr. Professor, PCS – 31.12.2025 (Superannuated).
2. Dr. Jiban Kangasabanik, DST Inspire Faculty, CMMP – 22.04.2025 (Resigned).

3. Dr. Bhaskar Mukherjee, DST Inspire Faculty, CMMP – 31.03.2026 (Resigned).
4. Dr. Ali Hossain Khan, Ramanujan Fellow, CBS – 31.03.2026 (Termination of Contract)

- **Total numbers of Regular / Inspire / Ramanujan / Visiting / Emeritus Faculty etc as on date [30.06.2026]-**

1. Regular Faculty – 32
2. Emeritus Professor – 1
3. DST Inspire Faculty – 1
4. Ramanujan Fellow – 1
5. Visiting Hon. Faculty – 2
6. CSIR Emeritus Scientist-1
7. WIDUSHI Scientist A – 1
8. DAE Raja Ramanna Chair – 1
9. Adjunct Faculty / Fellow – 2

- **Total no of PDRA / RA / Project Scientists etc. as on date [30.06.2026]-**

1. PDRA (SNB Funded including TWAS BOSE PDF) – 24
2. RA / NPDF / SRA etc. under extramural fund – 14
3. Bridge Fellow (SNB Funded) – 12



Anjan Barman
Dean (Faculty)

DEAN ACADEMIC PROGRAMME



Ranjit Biswas
Dean, Academic Programme



Manoranjan Kumar
Coordinator, IPhD Programme

Nurturing and preparing young scientists for high-quality research is the central mission of the S. N. Bose National Centre for Basic Sciences. The Centre provides a vibrant and stimulating research environment that has produced many distinguished alumni who are contributing significantly to research, teaching, and various other professional fields in India and abroad.

Students seeking admission to the **PhD programme** are required to complete their MSc with excellent academic performance in the relevant subject, qualify through a national-level eligibility examination such as **CSIR-UGC-NET** or an equivalent national level test, or secure a high rank in **JEST or GATE**, followed by a successful interview conducted by the Centre. Candidates provisionally selected for the **DST-INSPIRE Fellowship** may also appear for the interview if they satisfy the required academic criteria; however, they must subsequently obtain the Fellowship and qualify in a national-level test to continue in the PhD programme. Students wishing to join the **Integrated PhD programme** after their BSc degree must qualify through **JEST/ JAM** or **NGPE** and then clear the interview process of the Centre.

In recent academic years, the Centre has continued to attract talented students from across the country. During this academic session, a total of 13 scholars were admitted directly to the PhD programme, with admissions distributed among Astrophysics and High Energy Physics (1), Chemical and Biological Sciences (5), Condensed Matter and Materials Physics (4), and Physics of Complex Systems (3). In addition, 8 students joined the PhD programme from the Centre's own Integrated PhD programme, highlighting the strength and effectiveness of its internal academic training. Furthermore, 14 students were admitted directly to the Integrated PhD programme, thereby further enriching and strengthening the Centre's research community. **Twenty Six (26) numbers of students were awarded their PhD degrees, while sixteen (16) numbers of students successfully submitted their doctoral theses,** demonstrating the steady progress and productivity of the Centre's research programmes.

During the year, the Centre successfully hosted a number of important national and international conferences and memorial lectures. It also continued to organize colloquia, seminars, workshops, and other academic programmes on a regular basis, with many events conducted in hybrid mode to facilitate wider academic engagement and participation.

The successful organization of Bose-Fest, Open Day, Centre's Foundation Day, and National Science Day, different Outreach Programmes, Alumni day reflected the enthusiastic participation and collective efforts of students and faculty members. This year the centre also introduced "Career Compass" initiative as the industry-academia interaction platform where entrepreneurs & industry representatives had already visited the centre and interacted with the scholars.

Finally, it is a pleasure to acknowledge the enthusiastic cooperation and dedicated support provided by **faculty members, the administrative staffs and the students** in all academic and official activities of the Centre. The achievements of the Centre would not have been possible without their **continuous support, commitment, and hard work.**

COURSES TAUGHT IN 2025-2026

Integrated Ph.D. Programme in Physical Sciences (IPhD-Ph)

1st Semester:

- PHY 401, *Mathematical Methods,* Sunandan Gangopadhyay & Prosenjit Singha Deo;
- PHY 403, *Classical Dynamics,* Jaydeb Chakrabarti;
- PHY 405, *Quantum Mechanics I*, Amitabha Lahiri & Barun Ghosh;
- PHY 407, *Computational Methods in Physics*, Punyabrata Pradhan & Arijit Haldar;
- PHY 491, *Basic Laboratory I*, Avijit Chowdhury & Thirupathaiah Setti.

2nd Semester:

- PHY 402, *Electromagnetic Theory*, Amitabha Lahiri;
- PHY 404, *Statistical Mechanics*, Punyabrata Pradhan & Sunandan Gangopadhyay;
- PHY 406, *Quantum Mechanics II*, Arijit Haldar;
- PHY 408, *Electronics & Instrumentation*, Atindra Nath Pal & Avijit Chowdhury;
- PHY 492, *Basic Laboratory II*, Kalyan Mandal & Thirupathaiah Setti.

3rd Semester:

- PHY 501, *Atomic & Molecular Physics*, Manik Pradhan & Arijit Haldar;
- PHY 503, *Condensed Matter Physics*, Nitesh Kumar & Saquib Shamim;
- PHY 505, *Advanced Quantum Mechanics & Applications*, Manoranjan Kumar & Bhaskar Mukherjee;
- PHY 507, *Nuclear & Particle Physics*, Parijat Dey & Tapas Baug;
- PHY 509, *Project Research II*, Faculty Supervisors.

4th Semester:

- PHY 502, *Project Research III*, Faculty Supervisors;
- PHY 592, *Methods of Experimental Physics*, Nitesh Kumar, Pradip S Pachfule, Ramkrishna Das, Kalyan Mandal, Saquib Shamim, Anjan Barman & Atindra Nath Pal (Coordinator)
- PHY 504, *Astrophysics & Astronomy*, Archan S Majumdar, Soumen Mondal & Chayan Mondal;
- PHY 516, *Magnetism & Superconductivity*, Anjan Barman & Prosenjit Singha Deo;
- PHY 524, *Quantum Information Theory*, Manik Banik;
- PHY 528, *Mesoscopic Physics*, Atindra Nath Pal & Barun Ghosh.

Ph.D. Course Work Programme

- PHY 601, *Research Methodology*, Saquib Shamim & Sanjoy Choudhury;
- PHY 602, *Review of the Topical Research*, Faculty Supervisors;
- PHY/CB 691, *Project Research*, Faculty Supervisors;
- PHY 603, *Condensed Matter Physics*, Nitesh Kumar & Saquib Shamim;
- PHY 604, *Astrophysics*, Soumen Mondal & Ramkrishna Das;
- PHY 615, *Advanced Condensed Matter Physics I*, Anjan Barman & Prosenjit Deo;
- PHY 616, *Observational Techniques in Astronomy*, Ramkrishna Das & Tapas Baug;
- PHY 624, *Quantum Information Theory*, Manik Banik;
- PHY 628, *Mesoscopic Physics*, Atindra Nath Pal & Barun Ghosh
- PHY 632, *General Relativity & Cosmology* , Amitabha Lahiri;

- CB 624, *Physical Chemistry: Experiments & Theory*, Ranjit Biswas;
- CB 626, *Fundamentals of Biophysics*, Rajib Kumar Mitra & Shubhasis Haldar;
- ●● CB 627, *Molecular Physics & Spectroscopy*, Manik Pradhan & Arijit Haldar;
- CB 631, *Advanced Numerical Methods & Simulation*, Suman Chakrabarty;
- CB 641, Surfaces & Interfaces, Pradip S Pachfule.

Note: ●● Conducted partially in combination with IPhD Programme.

Ph.D. THESIS SUBMISSIONS

1. ***Spectroscopic Investigations of Interactions and Dynamical Complexities in Electrolytes and Multicomponent Chemical Systems***, Amrita Mondal, Supervisor: Ranjit Biswas, in the Jadavpur University, in May 2025
2. ***Computation of information theoretic quantities using gauge/gravity correspondence***, Anirban Roy Chowdhury, Supervisor: Sunandan Gangopadhyay, in the University of Calcutta, in June 2025
3. ***Various aspects of quantum measurements and their role in quantum information processing tasks***, Arun Kumar Das, Supervisor: Archan S. Majumdar, in the Jadavpur University, in June 2025
4. ***Examining Unusual Ground States In Transition Metal Compounds***, Krishnendu Patra, Supervisor: Priya Mahadevan, in the University of Calcutta, in June 2025
5. ***Application of Machine Learning Approach in Solving Materials Science Problems***, Aishwaryo Ghosh, Supervisor: Tanusri Saha Dasgupta, in the University of Calcutta, in July 2025
6. ***Effect of inhomogeneities on various astrophysical and cosmological processes in the Universe***, Shashank Shekhar Pandey, Supervisor: Archan S Majumdar, in the Presidency University, in August 2025
7. ***Computational and Theoretical Investigation of Energy Materials and Biological Systems***, Sudipta Mitra, Supervisor: Ranjit Biswas, in the Jadavpur University, in September 2025
8. ***Electronic Structure of Transition Metal (TM) Compounds***, Koushik Pradhan, Supervisor: Tanusri Saha Dasgupta, in the University of Calcutta, in September 2025
9. ***Studies Of Dynamic Properties Of Mass Transport Processes***, Animesh Hazra, Supervisor: Punyabrata Pradhan, in the University of Calcutta, in September 2025
10. ***Study of Optical Beam-Shifts Phenomena Using Different Beam Profiles***, Soumen Mandal, Supervisor: Manik Pradhan, in the University of Calcutta, in October 2025
11. ***Transport In Many-Particle Systems With Time-Dependent Drive***, Deepsikha Das, Supervisors: Sakuntala Chatterjee & Punyabrata Pradhan, in the University of Calcutta, in October 2025
12. ***Electronic Structure of Correlated Electrons***, Manoj Gupta, Supervisor: Tanusri Saha Dasgupta, in the Presidency University, in January 2026
13. ***Photoelectrodes Based on Metal Oxide Semiconductor for Solar-Assisted Electrochemical water splitting***, Soham Saha, Supervisor: Kalyan Mandal, in the University of Calcutta, in January 2026
14. ***Studies Atmospheric Properties of Brown Dwarfs and Low-Mass Stars***, Rajib Kumbhakar, Supervisor: Soumen Mondal, in the University of Calcutta, in January 2026
15. ***Understanding Stellar Activity in M-dwarfs***, Diya Ram, Supervisor: Soumen Mondal, in the University of Calcutta, in February 2026
16. ***Applications of Unruh-DeWitt Detectors in Relativistic Quantum Thermodynamics***, Arnab Mukherjee, Supervisor: Sunandan Gangopadhyay, in the Jadavpur University, in February 2026

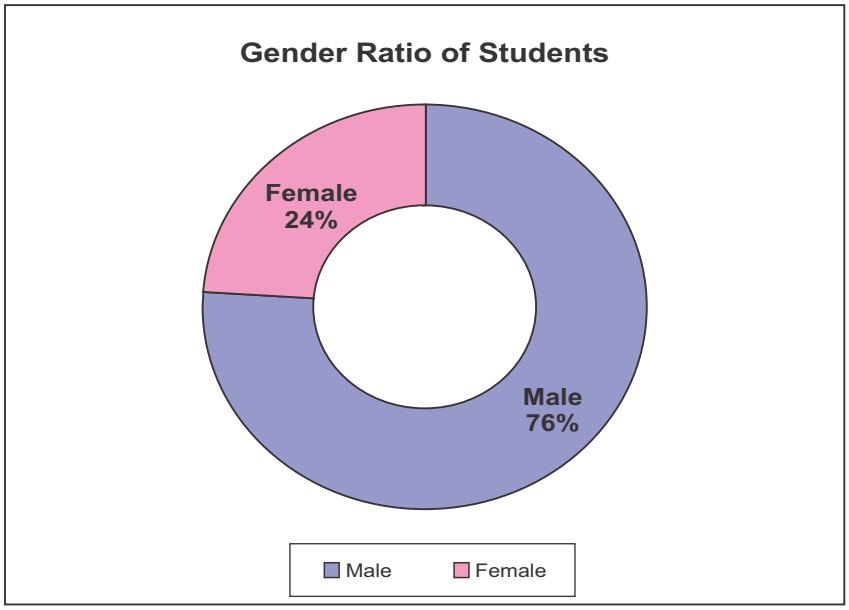
Ph.D. DEGREE AWARDS

1. ***Study Of Low Frequency Noise And Electronic Transport in 2D Van-der Waals Material And Their Functional Devices***, Shubhadip Moulick, Supervisor: Atindra Nath Pal, in the University of Calcutta, in April 2025
2. ***Computational Investigation of the Mechanism of Molecular Recognition and Signaling Processes in Biomolecules: A Thermodynamic Study***, Krishnendu Sinha, Supervisor: Suman Chakrabarty, in the University of Calcutta, in April 2025
3. ***Investigation of Interaction and Dynamics in Complex Liquids: Theory and Computer Simulations***, Dhrubajyoti Maji, Supervisor: Ranjit Biswas, in the Jadavpur University, in May 2025
4. ***Structural, Physical, Electronic Properties Studies on Kagome Lattice Systems***, Achintya Low,

Supervisor: Thirupathaiah Setti, in the University of Calcutta, in June 2025

5. ***Synthesis, Transport, Structural, And Electronic Properties Studies Of Topological Systems***, Sayan Routh, Supervisors: Prosenjit Singha Deo & Thirupathaiah Setti, in the University of Calcutta, in June 2025
6. ***Experimental Dielectric Spectroscopic Investigation of Room Temperature Biodegradable Eutectic Solvents and Related Chemical Systems***, Jayanta Mondal, Supervisor: Ranjit Biswas, in the Jadavpur University, in June 2025
7. ***Investigation Of Electronic Transport In Topological And Correlated Materials***, Rafiqul Alam, Supervisor: Atindra Nath Pal, in the University of Calcutta, in June 2025
8. ***Ultrafast Spin Dynamics in Advanced Magnetic Structures for Applications in Spintronics***, Soma Dutta, Supervisor: Anjan Barman, in the University of Calcutta, in June 2025
9. ***First-Principles Study of Emergent and Technologically Important Materials***, Samir Rom, Supervisor: Tanusri Saha Dasgupta, in the University of Calcutta, in June 2025
10. ***Understanding the Structural and Dynamical Complexities of Neat and Multi-component Media***, Narayan Chandra Maity, Supervisor: Ranjit Biswas, in the Jadavpur University, in July 2025
11. ***Some Studies On The Conformational Stability, Hydration Dynamics And Activity Of Biomolecules In Presence Of Co-Solutes***, Ria Saha, Supervisor: Rajib Kumar Mitra, in the University of Calcutta, in July 2025
12. ***Multi-wavelength Study of Wolf Rayet Stars***, Subhajit Kar, Supervisor: Ramkrishna Das, in the University of Calcutta, in July 2025
13. ***Synthesis, Structural, Electronic, And Magnetic Properties Studies of Two-Dimensional Magnetic Materials***, Shubham Purwar, Supervisor: Thirupathaiah Setti, in the University of Calcutta, in July 2025
14. ***Topological States And Exotic Quantum Phases In Frustrated Low Dimensional Spin Systems***, Monalisa Chatterjee, Supervisor: Manoranjan Kumar, in the University of Calcutta, in July 2025
15. ***Study Of Quantum Resources To Devise Advanced Communication Protocols***, Ram Krishna Patra, Supervisor: Manik Banik, in the Presidency University, in August 2025
16. ***A Study On Various Discrimination Tasks And Their Implications In Quantum Information Processing***, Samrat Sen, Supervisor: Manik Banik, in the Presidency University, in August 2025
17. ***Functions of bio-molecules deviating from canonical structures***, Kanika Kole, Supervisor: Jaydeb Chakrabarti, in the Presidency University, in September 2025
18. ***Some Studies On Exact Solutions Of Models In Noncommutative Spaces***, Manjari Dutta, Supervisor: Sunandan Gangopadhyay, in the University of Calcutta, in October 2025
19. ***Spin Dynamics of Ferromagnetic Thin Films, Heterostructures, and Nanostructures***, Sreya Pal, Supervisor: Anjan Barman, in the University of Calcutta, in October 2025
20. ***Thermal and Quantum Fluctuations in Low Dimensional Frustrated Spin Systems***, Manodip Routh, Supervisor: Manoranjan Kumar, in the University of Calcutta, in November 2025
21. ***Magnetizatiion Dynamics in Quantum Material / Ferromagnet Heterostructures, Suchetana Mukhopadhyay***, Supervisors: Anjan Barman & Chiranjib Mitra (IISER-K), in IISER-K, in November 2025
22. ***Transport and Spectroscopic Studies of Layered Magnetic and Low-Dimensional Superconducting Materials***, Riju Pal, Supervisor: Atindra Nath Pal, in the University of Calcutta, in December 2025
23. ***Study of Various Aspects of Quantum Communications***, Subhankar Bera, Supervisor: Archan S. Majumdar, in the Jadavpur University, in December 2025
24. ***Electronic and Magnetic Properties of Topological Quantum Materials***, Susanta Ghosh, Supervisors: Kalyan Mandal & Thirupathaiah Setti, in the University of Calcutta, in March 2026
25. ***Signatures of quantum gravity in relativistic quantum systems***, Soham Sen, Supervisor: Sunandan Gangopadhyay, in the University of Calcutta, in March 2026
26. ***A Comprehensive Study On Composite Physical Systems And Their Application In Information Protocols***, Sahil Gopalkrishna Naik, Supervisor: Manik Banik, in the Presidency University, in March 2026

GENDER RATIO OF STUDENTS



(As on date 31-03-2026)

POST PhD PLACEMENT

Name	Current Designation	Current Affiliation
Achintya Low	Postdoctoral Research Associate	Ben-Gurion University of the Negev, Israel
Arundhati Adhikari	Postdoctoral Research Fellow	Universita Ca' Foscari Venezia, Italy
Debayan Mondal	Postdoctoral Research Associate	University of Oxford, United Kingdom
Dhrubajyoti Maji	Postdoctoral Fellow	Indian Institute of Technology, Kharagpur, India
Gesesew Reta Habtie	HOD, Dept of Physics	Debre Berhan University, Ethiopia
Jayanta Mondal	National Postdoctoral Fellow	School of physical sciences at Jawaharlal Nehru University
Jyotirmoy Sau	Postdoctoral research fellow	Uppsala University, Sweeden
Kanchan Meena	Postdoctoral research fellow	Technioin University , Israel
Kanika Kole	Postdoctoral Fellow	Indian Institute of Technology Kharagpur, India
Krishnendu Sinha	Postdoctoral Research Associate	Georgia State University, US
Manodip Routh	Postdoctoral Researcher	Tokyo University, Japan
Monalisa Chatterjee	Postdoctoral Fellow	TIFR, Mumbai
Narayan Chandra Maity	Postdoctoral Fellow in Department of Chemistry	IIT Kanpur,India
Nivedita Pan	Postdoctoral Researcher	LMU , München Germany
Rafiqul Alam	Postdoctoral Researcher	Jozef stefan institute, Slovenia
Ram Krishna Patra	Research Associate	HUN-REN Atomki, Hungary
Ria Saha	Postdoctoral Researcher	European Institute Des Membranes, University of Montpellier, France

Samir Rom	Post-doctoral Researcher	IISc. Bangalore
Samrat Sen	Post-doctoral Fellow	Scuola Normale Superiore dr Pisa, Italy
Sayan Routh	Post-doctoral Fellow	IBS Institute for Condensed Matter Science, Korea
Shubhadip Moulick	Post-doctoral Research Fellow	Aalto University, Finland
Shubham Purwar	Post-doctoral Fellow	Technion Israel university of Technology, Israel
Soma Dutta	Post-doctoral Fellow	Uppsala University, Sweden
Subhajit Kar	Post-doctoral Researcher	IUCCA, Pune
Sudip Majumder	Post-doctoral Researcher	University of South Florida,USA
Amrita Mondal	Post-doctoral Fellow	Helmholz Institute of ULM, Germany
Sudipta Mitra	Academic Research Assistant	Physical Institute of the Albert-Ludwigs-Universität Freiburg, Germany
Manoj Gupta	Post-doctoral Researcher	KIAS , South Korea
Sreya Pal	Post-doctoral Researcher,	Politecnico di Milano, Milan, Italy
Riju Pal	DFG Walter Benjamin Post-doctoral Position	Leibniz Institute for Solid State and Materials Research, Dresden, Germany
Manodip Routh	Post-doctoral Fellow	The University of Tokyo, Japan
Suchetana Mukhopadhyay	Post-doctoral Researcher	CIC Nanogume, Donostia, Spain
Subhankar Bera	Post-doctoral Fellow	National Cheng Kung University, Taiwan
Susanta Ghosh	Post-doctoral Researcher	IISER Bhopal, India
Soham Sen	Post-doctoral Researcher	Kyushu University, Fukuoka, Japan
Sahil Gopal Krishna Naik	Post-doctoral Researcher	University of Montreal, Canada
Tanmoy Chakraborty	Post-doctoral Research Fellow	Department of Physics, Technion, Israel

PhD and Integrated PhD Research Scholars of the Centre

(values within brackets indicate source of external funding)
*(names marked with * indicates scholars under Integrated PhD programme)*

Sl. No.	NAME	DESIGNATION	BATCH (JRF)	SUPERVISOR	DATE OF LEAVING
1.	Amrita Mondal	SRF	2019-20	Ranjit Biswas	06.06.2025
2.	Arun Kumar Das	SRF	2019-20	Archan S. Majumdar	30.06.2025
3.	Diya Ram (UGC)	SRF	2019-20	Soumen Mondal	31.12.2025
4.	Krishnendu Patra	SRF	2019-20	Priya Mahadevan	30.06.2025
5.	Manodip Routh	SRF	2019-20	Manoranjan Kumar	03.05.2025
6.	Subhankar Bera	SRF	2019-20	Archan S. Majumdar	05.06.2025
7.	Aishwaryo Ghosh (INSPIRE)	SRF	2020-21	Tanusri Saha Dasgupta	14.09.2025
8.	Animesh Hazra *	SRF	2020-21	Punyabrata Pradhan	14.09.2025
9.	Anirban Roychowdury *	SRF	2020-21	Sunandan Gangopadhyay	14.09.2025
10.	Ariful Hoque (CSIR)	SRF	2020-21	Tapas Baug	
11.	Arnab Chakraborty *	SRF	2020-21	Amitabha Lahiri	
12.	Avik Sasmal *	SRF	2020-21	Jaydeb Chakrabarti and Tanusri Saha Dasgupta	14.09.2025
13.	Chandradip Khamrai (CSIR)	SRF	2020-21	Sakuntala Chatterjee	
14.	Indrajit Ghose	SRF	2020-21	Amitabha Lahiri	
15.	Ishita Jana *	SRF	2020-21	Kalyan Mandal	
16.	Kanika Kole (UGC)	SRF	2020-21	Jaydeb Chakrabarti	14.09.2025
17.	Koushik Pradhan	SRF	2020-21	Tanusri Saha Dasgupta	14.09.2026
18.	Manoj Gupta (CSIR)	SRF	2020-21	Tanusri Saha Dasgupta	05.01.2026
19.	Rajdeep Biswas *	SRF	2020-21	Tanusri Saha Dasgupta	
20.	Rajib Kumbhakar (INSPIRE)	SRF	2020-21	Soumen Mondal	31.01.2026
21.	Ramesh Pramanik (CSIR)	SRF	2020-21	Sakuntala Chatterjee	
22.	Ramkrishna Patra	SRF	2020-21	Manik Banik	20.08.2025
23.	Rik Niranjan Mukherjee (INSPIRE)	SRF	2020-21	Ranjit Biswas & Pradip K Ghorai (IISER-K)	
24.	Ritwick Sarkar (CSIR)	SRF	2020-21	Urna Basu	
25.	Riya Barick	SRF	2020-21	Amitabha Lahiri	
26.	Samrat Sen	SRF	2020-21	Manik Banik	12.08.2025
27.	Sanuja Kumar Khuntia (UGC)	SRF	2020-21	Priya Mahadevan	
28.	Shashank Shekhar Pandey (CSIR)	SRF	2020-21	Archan S. Majumdar	14.09.2025
29.	Shinjini Paul (INSPIRE)	SRF	2020-21	Priya Mahadevan	20.10.2025
30.	Soham Saha *	SRF	2020-21	Kalyan Mandal	08.01.2026
31.	Soumen Mandal *	SRF	2020-21	Manik Pradhan	14.09.2025
32.	Suchetana Mukhopadhyay (INSPIRE)	SRF	2020-21	Anjan Barman & Chiranjit Mitra (IISER-K)	27.10.2025
33.	Sudipta Mitra	SRF	2020-21	Ranjit Biswas	14.09.2025

Sl. No.	NAME	DESIGNATION	BATCH (JRF)	SUPERVISOR	DATE OF LEAVING
34.	Susanta Ghosh (UGC)	SRF	2020-21	Thirupathaiah Setti	30.06.2025
35.	Ajay Sharma *	SRF	2021-22	Sakuntala Chatterjee and Debanjan Bose	
36.	Arnab Mukherjee	SRF	2021-22	Sunandan Gangopadhyay	
37.	Arnab Paul *	SRF	2021-22	Tanusri Saha Dasgupta	17.05.2025
38.	Banik Rai *	SRF	2021-22	Nitesh Kumar	
39.	Bikash Chandra Mishra (CSIR)	SRF	2021-22	Pradip S. Pachfule	
40.	Bivas Mallick (INSPIRE)	SRF	2021-22	Archan S. Majumdar	
41.	Chandan Kumar	SRF	2021-22	Anjan Barman	
42.	Dibyendu Maity *	SRF	2021-22	Amitabha Lahiri	
43.	J Sridhar Mohanty *	SRF	2021-22	Kalyan Mandal	
44.	Jayarshi Bhattacharya *	SRF	2021-22	Sunandan Gangopadhyay and Gautam Gangopadhyay	
45.	Sagar Kumar Maity *	SRF	2021-22	Amitabha Lahiri	
46.	Saheli Mukherjee	SRF	2021-22	Archan S. Majumdar	
47.	Sayan Ghosh (INSPIRE)	SRF	2021-22	Manoranjan Kumar	
48.	Shivam Jani	SRF	2021-22	Priya Mahadevan	
49.	Soham Sen *	SRF	2021-22	Sunandan Gangopadhyay	
50.	Soumya Ghorai (UGC)	SRF	2021-22	Thirupathaiah Setti	
51.	Soumyadipta Chakraborty	SRF	2021-22	Manik Pradhan	
52.	Sourabh Saha (INSPIRE)	SRF	2021-22	Manoranjan Kumar	
53.	Sourav Sarkar (INSPIRE)	SRF	2021-22	Kalyan Mandal	
54.	Aman Das (UGC)	SRF	2022-23	Soumen Mondal	
55.	Ananya Chakraborty *	SRF	2022-23	Manik Banik	
56.	Anusree Sen	SRF	2022-23	Rajib Kumar Mitra and Jaydeb Chakrabarti	
57.	Anutosh Biswas	SRF	2022-23	Manoranjan Kumar and Tanusri Saha Dasgupta	
58.	Anyesh Saraswati	SRF	2022-23	Nitesh Kumar	
59.	Aritra Marick (UGC)	SRF	2022-23	Rajib Kumar Mitra	
60.	Bidhan Kumbhakar (UGC)	SRF	2022-23	Pradip S. Pachfule	
61.	Bikram Baghira (UGC)	SRF	2022-23	Anjan Barman	
62.	Dayal Das (UGC)	SRF	2022-23	Atindra Nath Pal	
63.	Dorothy Museo Mwanzia (TWAS-BOSE)	SRF	2022-23	Soumen Mondal	
64.	Indrayani Patra (UGC)	SRF	2022-23	Manik Pradhan	
65.	Madhurita Das (INSPIRE)	SRF	2022-23	Priya Mahadevan	
66.	Muhammad Usman Shehu (TWAS-BOSE)	SRF	2022-23	Tapas Baug	
67.	Mukul Biswas (UGC)	SRF	2022-23	Avijit Chowdhury	

Sl. No.	NAME	DESIGNATION	BATCH (JRF)	SUPERVISOR	DATE OF LEAVING
68.	Pallabi Roy	SRF	2022-23	Sakuntala Chatterjee and Gautam Gangopadhyay	
69.	Pritam Roy *	SRF	2022-23	Archan S. Majumdar	
70.	Prosanta Sarkar (UGC)	SRF	2022-23	Tanusri Saha Dasgupta & Gautam Dev Mukherjee (IISER ,K)	
71.	Rajesh Jana	SRF	2022-23	Avijit Chowdhury	
72.	Sabuj Mandal	SRF	2022-23	Jaydeb Chakrabarti & Punyabrata Pradhan	
73.	Sahil Gopalkrishna Naik (CSIR)	SRF	2022-23	Manik Banik	28.02.2026
74.	Shah Imtajul Haque (UGC)	SRF	2022-23	Rajib Kumar Mitra	
75.	Sreyan Bhowmick	SRF	2022-23	Suman Chakrabarty	
76.	Subhajit Mondal (UGC)	SRF	2022-23	Saquib Shamim	
77.	Subhankar De (INSPIRE)	SRF	2022-23	Atindra Nath Pal	
78.	Sudip Chakrabarty *	SRF	2022-23	Archan S. Majumdar	
79.	Sutanu Mukhopadhyay (INSPIRE)	SRF	2022-23	Suman Chakrabarty	
80.	Swapnamoy Pramanik (UGC)	SRF	2022-23	Avijit Chowdhury	
81.	Anol Bandyopadhyay *	JRF	2023-24	Punyabrata Pradhan	17.01.2026
82.	Bipasa Hazra *	JRF	2023-24	Saquib Shamim	
83.	Debashruti Maity	JRF	2023-24	Shubhasis Haldar	30.11.2025
84.	Indrajit Banerjee *	JRF	2023-24	Manoranjan Kumar	20.08.2025
85.	Kapil Gope *	JRF	2023-24	Barun Ghosh	
86.	Koushik Das *	JRF	2023-24	Punyabrata Pradhan	
87.	Md Sanowaz Molla *	JRF	2023-24	Manoranjan Kumar	14.04.2026
88.	Ritam Mahanta *	JRF	2023-24	Sunandan Gangopadhyay	
89.	Sauptik Sadhukhan *	JRF	2023-24	Suman Chakrabarty	
90.	Souvik Paul *	SRF	2023-24	Sunandan Gangopadhyay	
91.	Subhanker Dutta *	JRF	2023-24	Tapas Baug	
92.	Sudip Ghorai *	JRF	2023-24	Barun Ghosh	
93.	Anish Chaudhuri *	SRF	2023-24	Arijit Haldar	
94.	Anupam Barik (UGC)	SRF	2023-24	Thirupathaiah Setti	
95.	Anuradha Sett	SRF	2023-24	Manik Pradhan	
96.	Asesh Bera	SRF	2023-24	Rajib Kumar Mitra	
97.	Avanti Chakraborty (CSIR)	SRF	2023-24	Pradip S. Pachfule	
98.	Avirup Chakraborty	SRF	2023-24	Soumen Mondal	
99.	Debojit Sen	SRF	2023-24	Sakuntala Chatterjee	
100.	Debraj Dutta *	SRF	2023-24	Urna Basu	
101.	Dhritisundar Paramanik (UGC)	SRF	2023-24	Atindra Nath Pal	

Sl. No.	NAME	DESIGNATION	BATCH (JRF)	SUPERVISOR	DATE OF LEAVING
102.	Dinesh Chandra Dey	SRF	2023-24	Manik Pradhan	
103.	Kakan Deb	SRF	2023-24	Nitesh Kumar	
104.	Maitreyee Barman (UGC)	SRF	2023-24	Priya Mahadevan	
105.	Modhumita Sariket	SRF	2023-24	Nitesh Kumar	
106.	Najrul Islam (UGC)	SRF	2023-24	Saquib Shamim	
107.	Sayan Mathur (UGC)	SRF	2023-24	Anjan Barman	
108.	Sayanti Mondal	SRF	2023-24	Anjan Barman	
109.	Sayari Bhattacharya *	SRF	2023-24	Suman Chakrabarty	
110.	Subhadeep Mukherjee (CSIR)	SRF	2023-24	Archan S. Majumdar	
111.	Supriti Dutta	SRF	2023-24	Pradip S. Pachfule	
112.	Aniket Samanta	JRF	2024-25	Punyabrata Pradhan	
113.	Anita Ratha	JRF	2024-25	Priya Mahadevan	
114.	Antara Dey	JRF	2024-25	Manoranjan Kumar	
115.	Anurag Paul	JRF	2024-25	Priya Mahadevan	
116.	Arpita Jana *	JRF	2024-25	Sunandan Gangopadhyay	
117.	Arup Biswas (UGC)	JRF	2024-25	Manik Pradhan	
118.	Ayan Jana	JRF	2024-25	Manoranjan Kumar	
119.	Dipyendu Dhar *	JRF	2024-25	Parijat Dey	
120.	Gopinath Guin (CSIR)	JRF	2024-25	Sunandan Gangopadhyay	
121.	Jayashree Karmakar (UGC)	JRF	2024-25	Manik Banik	
122.	Mohana Roy (UGC)	JRF	2024-25	Atindra Nath Pal	
123.	Naglaa Atif Alhadi Rahma (TWAS-BOSE)	JRF	2024-25	Samir Kumar Pal & Ranjit Biswas	
124.	Najrul Ansary *	JRF	2024-25	Anjan Barman & Atindra Nath Pal	
125.	Nilesh Bauri	JRF	2024-25	Saquib Shamim	
126.	Partha Das (UGC)	JRF	2024-25	Rajib Kumar Mitra	
127.	Premananda Chatterjee	JRF	2024-25	Atindra Nath Pal	
128.	Rianita Mondal	JRF	2024-25	Shubhasis Haldar	
129.	Rudra Prosad Sarkar *	JRF	2024-25	Tapas Baug	30.07.2026
130.	Sachin Paul (CSIR)	JRF	2024-25	Avijit Chowdhury	
131.	Sagnik Bhattacharya	JRF	2024-25	Rajib Kumar Mitra	31.05.2025
132.	Sahanawaj Akhtar	JRF	2024-25	Arijit Haldar	
133.	Sakshi Chaudhary *	JRF	2024-25	Ramkrishna Das	
134.	Shaheerah Shahid *	JRF	2024-25	Suman Chakrabarty	
135.	Soumava Mondal (CSIR)	JRF	2024-25	Anjan Barman & Barun Ghosh	
136.	Sourav Das	JRF	2024-25	Tanusri Saha Dasgupta and Arijit Haldar	
137.	Sourav Mandal *	JRF	2024-25	Anjan Barman & Saquib Shamim	
138.	Subhradeep Chakravarty (CSIR)	JRF	2024-25	Shubhasis Haldar	
139.	Susmita Das (UGC)	JRF	2024-25	Anjan Barman & Rajib Kumar Mitra	

Sl. No.	NAME	DESIGNATION	BATCH (JRF)	SUPERVISOR	DATE OF LEAVING
140.	Sutirtha Banerjee	JRF	2024-25	Thirupathaiah Setti	05.06.2025
141.	Swastik Sardar	JRF	2024-25	Ramkrishna Das	
142.	Trisha Mishra *	JRF	2024-25	Ramkrishna Das and Amitabha Lahiri	
143.	Tunir Kundu	JRF	2024-25	Tapas Baug	
144.	Suranjana Chakraborty (CSIR)	SRF	2024-25	Anjan Barman and Anup Ghosh (Bose Institute)	
145.	Arijit Barman	JRF	2025-26	Avijit Chowdhury	17.10.2025
146.	Arindam Jana	JRF	2025-26	Thirupataiah Setti	
147.	Ayandip Roy (CSIR)	JRF	2025-26	Urna Basu	
148.	Biswadeep Chatterjee	JRF	2025-26	Manik Banik	
149.	Debasish Ghosh	JRF	2025-26	Atindra Nath Pal	
150.	Gourab Hazra	JRF	2025-26	Nitesh Kumar	
151.	Harshal Rohidas Patil	JRF	2025-26	Pradip S. Pachfule	
152.	Promita Ghosh (CSIR)	JRF	2025-26	Ramkrishna Das	
153.	Rafiuddin Gazi	JRF	2025-26	Manik Banik	
154.	Saptarshi Dutta	JRF	2025-26	Chayan Mondal	
155.	Sayan Mondal	JRF	2025-26	Arijit Haldar	
156.	Shrabasti Mukherjee(CSIR)	JRF	2025-26	Rajib Kumar Mitra	
157.	Somasree Dey	JRF	2025-26	Shubhasis Haldar	
158.	Sudipta Adhya (CSIR)	JRF	2025-26	Shubhasis Haldar	
159.	Tuhin Das(UGC)	JRF	2025-26	Pradip S. Pachfule	

Research Scholars of under Extramural Projects

NAME	DESIGNATION	DATE OF ADMISSION	SUPERVISOR	DATE OF LEAVING
Saikat Mitra	Project Assistant (Adhoc)	17.10.2025	Barnali Ghosh (Saha)	Continuing
Payal Bhattacharjee	Project JRF (Ad-hoc)	20.01.2025	Anjan Barman	19.07.2025
Thansingh Jankawat	Project Assistant (Adhoc)	10.09.2025	Barun Ghosh	09.03.2026
Shinjini Paul	Project SRF	27.10.2025	Priya Mahadevan	29.03.2026
Soumya Dasgupta	Project JRF	27.10.2025	Atindra Nath Pal	Continuing
Nilabha Chatterjee	Project Assistant (Ad-hoc)	25.02.2026	Sujit Deshmukh	Continuing
Bikram Das	Project JRF	23.03.2026	Ali Hossain Khan	Continuing
Sourik Dutta	Project JRF	12.06.2023	Ali Hossain Khan	Tenure Completed

Integrated PhD Scholars of the Centre

NAME	DESIGNATION	BATCH	DATE OF LEAVING
Dhananjoy Ghosh	IPhD Student	2023-24	31.07.2025
Shibcharan Mahato	IPhD Student	2023-24	29.07.2025
Subhransu Dey	IPhD Student	2023-24	16.07.2025
Thansingh Jankawat	IPhD Student	2023-24	31.07.2025
Amrit Sagar Kar	IPhD Student	2024-25	
Anurag Agarwal	IPhD Student	2024-25	
Debdita Ghosh	IPhD Student	2024-25	
Kushal Mondal	IPhD Student	2024-25	
Partha Sarathi De	IPhD Student	2024-25	
Purnendu Khamrui	IPhD Student	2024-25	
Rishav Chakraborty	IPhD Student	2024-25	
Shib Shankar Utthasini	IPhD Student	2024-25	
Sreedevi Ajikumar	IPhD Student	2024-25	
Tamanna Khanna	IPhD Student	2024-25	
Tuhin Chatterjee	IPhD Student	2024-25	
Akash Basak	IPhD Student	2025-26	
Ankur Das	IPhD Student	2025-26	
Ankur Sardar	IPhD Student	2025-26	
Aratrick Maity	IPhD Student	2025-26	
Bidyut Ghosh	IPhD Student	2025-26	
Deepranjan Das	IPhD Student	2025-26	
Gayathri V	IPhD Student	2025-26	
Gopal Sarkar	IPhD Student	2025-26	
K Avishek Patra	IPhD Student	2025-26	
Mahesh Singh Yadav	IPhD Student	2025-26	
Shibangshu Sen	IPhD Student	2025-26	
Sk Arif Ali	IPhD Student	2025-26	
Subhajit Paul	IPhD Student	2025-26	
Sunayak Roy	IPhD Student	2025-26	

Part Time PhD Scholars of the Centre

1) Soumita Chakraborty, Supervisor- Prof. Soumen Mondal
2) Bidisha Sarkhel, Supervisor- Prof. Rajib Kumar Mitra

Ranjit Biswas

Ranjit Biswas
Dean, Academic Programme

Manoranjan Kumar
Coordinator, IPhD Programme

EXTENDED VISITORS AND LINKAGE PROGRAMME

Report on Visitor, Associates and Students' Programme (VASP)

During the year 2025–26, the VASP_VLP Associateship program welcomed nine associates, including post-doctoral researchers and one student associate. They came from well-known institutions such as Academia Sinica (Taiwan), Howard University (USA), Arizona State University, IIT Delhi, NISER Bhubaneswar, IIT Kanpur, IPR Ahmedabad, IISER Tirupati, and Jagiellonian University (Poland).

Each visitor worked with faculty members from departments like PCS, CMMP, and APHEP. The visits lasted from two weeks to three months, allowing the associates to contribute to ongoing projects and gain valuable research experience. These collaborations strengthened international ties, encouraged knowledge sharing, and supported the professional growth of young scientists.

Overall, the program was successful in creating a vibrant academic exchange and highlighted the institute's commitment to supporting young researchers and building global partnerships.

Sl No	Name of the Visitor (with Designation)	Affiliation	Duration of Visit	Host Faculty / Department
1	**Dr. Anirban Mukherjee** *(Post-Doctoral Associate)*	Former Research staff at the Institute of Physics, Academia Sinica, Taipei, Taiwan (R.O.C.)	29.08.2025 to 28.09.2025	*Prof. Punyabrata Pradhan (PCS)*
2	**Dr. Sougata Mardanya** *(Post-Doctoral Associate)*	Former Postdoc at Howard University, DC, USA.	08.09.2025 to 16.09.2025	*Dr. Barun Ghosh (CMMP)*
3	**Dr. Jyotirish Das** *(Post-Doctoral Associate)*	Formar PhD student from Arizona State University	09.09.2025 to 08.12.2025	*Prof. Manoranjan Kumar (CMMP)*
4	**Mr. Sibashish Chakraborty** *(Post-Doctoral Associate)*	Former PhD candidate from IIT Delhi	09.10.2025 to 07.01.2026	*Prof. Anjan Barman (CMMP)*
5	***Mr. Subhajyoti Pal*** *(Post-Doctoral Associate)*	Former PhD Student from NISER, Bhubaneswar	03.11.2025 to 01.02.2026	*Prof. Prosenjit Singha Deo (PCS)*
6	**Dr. Apurba Dutta** *(Post-Doctoral Associate)*	Former Project Associate at IIT, kanpur	27.01.2026 to 27.04.2026	*Dr. Atindra Nath Pal (CMMP)*
7	**Dr. Jayanta Dutta** *(Post-Doctoral Associate)*	Former Post-Doctoral Fellow, IPR, Ahmedabad	28.01.2026 to 28.04.2026	*Prof. Ramkrishna Das (APHEP)*

Sl No	Name of the Visitor (with Designation)	Affiliation	Duration of Visit	Host Faculty / Department
8	**Dr. Sudeshna Patra** *(Post-Doctoral Associate)*	Former PhD candidate from IISER, Tirupati	27.01.2026 to 11.02.2026	*Dr. Tapas Baug (APHEP)*
9	**Mr. Satyaki Chowdhury** *(Student Associate)*	PhD student, Jagiellonian University,Poland	27.01.2026 to 27.04.2026	*Prof. Sunandan Gangopadhyay (APHEP)*

Report on Summer Research Programme 2025-26

Sl. No.	Name of the Guide	Name of the Student	Affiliation
1	Avijit Chowdhury	Animesh Pradhan	Jadavpur University
2	Pradip S. Pachfule	Taufique Ali	Aliah University
3	Sunandan Gangopadhyay	Junik Sengupta	Sister Nivedita University
4	Manik Pradhan	Bibhutibhusana Panda	NIST University, Berhampur, Odisha
5	Manik Pradhan	Upasana Das	Indian Institute of Technology (IIT) Dhanbad
6	Suman Chakrabarty	Shreya Mondal	Bidhannagar College
7	Rajib Kumar Mitra	Janis Mathew	National Institute of Technology, Warangal
8	Anjan Barman	Aparna Bhunia	IIT(ISM) DHANBAD
9	Thirupathaiah Setti	Saheli Chakrabortty	Indian Institute of Technology Kharagpur
10	Manoranjan Kumar	Shreya Barman	National Institute of Technology Rourkela
11	Manoranjan Kumar	Anirbit Mulo	IIT(ISM), DHANBAD
12	Arijit Haldar	Aviral Verma	National Institute of Science Education and Research (NISER)
13	Nitesh Kumar	Rudra Saha	Indian Association for the Cultivation of Science
14	Ramkrishna Das	Ekta	Indian Institute of Technology Jodhpur
15	Tapas Baug	Joydeep Das	IISER Thiruvananthapuram
16	Punyabrata Pradhan	Ritabrata Sarkar	Indian Institute of Technology Patna
17	Barun Ghosh	Kaustav Mukhopadhyay	Indian Institute of Technology Kanpur
18	Soumen Mondal	Ayantika Mahanty	National Institute of Technology Rourkela
19	Thirupathaiah Setti	Thirumurugan K	IIT Bombay
20	Ranjit Biswas	Febinsha	National Institute of Technology Karnataka Surathkal
21	Ranjit Biswas	Rohit Valvi	Savitribai Phule Pune University
22	Priya Mahadevan	Vijaykiran N. Narwade	Swami Ramanand Teerth Marathwada University
23	Ali Hossain Khan	Shubhadeep Mandal	Ramakrishna Mission Vidyamandira Belur

Sl. No.	Name of the Guide	Name of the Student	Affiliation
24	Ali Hossain Khan	Subhajit Barman	IIT Kanpur
25	Suman Chakrabarty	Avinandan Maity	Adamas University
26	Anjan Barman	Sreyasi Samanta	National Institute of Technology Rourkela
27	Atindra Nath Pal	Anumita Saha	IISER Berhampur
28	Jaydeb Chakrabarti	Tithi Sen	Indian Institute of Technology Jodhpur
29	Tanusri Saha Dasgupta	Shivam Randive	Sardar Vallabhai Nationalinstitute of Technology
30	Saquib Shamim	Tajinder Kaur	D.A.V College, Chandigarh

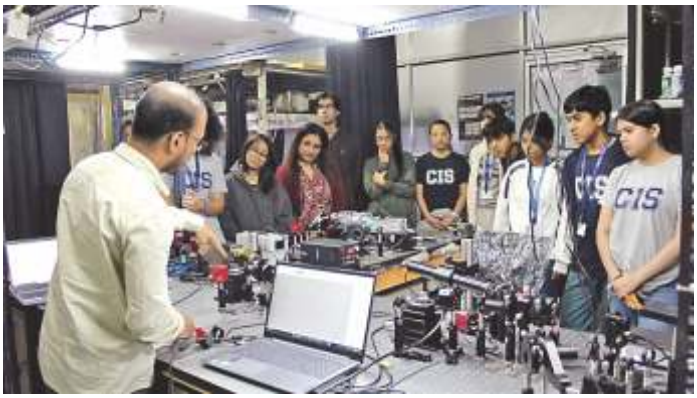
Report on Summer Research Student(s) under NEP

Sl. No.	Name of the Guide	Name of the Student	Affiliation
1	Shubhasis Haldar	Tiyasha Chakraborty	Presidency University

Report on Educational Visits

9th December, 2025

On 9th December 2025, our centre welcomed 25 students and 5 educators from Calcutta International School for an Educational Outreach Programme. The visit featured a documentary on S. N. Bose, an address by Prof. Ranjit Biswas, interactive laboratory sessions with Prof. Manik Pradhan and Prof. Biswas, a guided tour of the S. N. Bose Archive, and a demonstration of the PARAM Rudra Supercomputing Facility. The programme was marked by the participants' keen interest and enthusiasm, making it a valuable and inspiring engagement.









27th November, 2025

On the occasion of the Curtain Raiser for IISF 2025, the centre organized a special programme to promote scientific curiosity and innovation. The event commenced with an address by Director Prof. Tanusri Saha Dasgupta, followed by talks from scientists, interactive discussions, and guided visits to the laboratories and the S.N. Bose Archives. Nearly 70 students and teachers from Kendriya Vidyalaya No. 2, Salt Lake, Kolkata participated, gaining meaningful exposure to the Centre's research environment and engaging directly with scientists.











16th September, 2025

The Centre had the privilege of hosting 51 Class XII girl students and 9 teachers from Chhattisgarh under the *Vigyan Anusandhan Yatra* initiative of the Chhattisgarh Council of Science and Technology, Raipur. During their visit, the participants explored the S. N. Bose Archive and gained hands-on exposure to advanced research facilities, including the Optical Laboratory, Transmission Electron Microscope (TEM), Pulsed Laser Deposition (PLD), X-ray Diffractometer (XRD), and the Physical Property Measurement System (PPMS). The programme provided an enriching experience, fostering scientific curiosity and encouraging the pursuit of STEM among young women, thereby contributing to the vision of nurturing future scientists and innovators.









Report on IMPACT 2026 – The Alumni Day

29th January, 2026

The Centre hosted *IMPACT 2026 – The Alumni Day* on 29th January 2026 to strengthen connections between past and present members of SNBNCBS and to explore new opportunities. Alumni from India and abroad participated with great enthusiasm. The programme began with a welcome address by Director Prof. Tanusri Saha Dasgupta, herself an alumna of the Centre. Distinguished alumni from leading academic institutions and global industries shared their research journeys and provided guidance to current scholars through panel discussions on "Post PhD to Professor: Exploring Academia" and "Industry Career Pathways after a PhD." Research scholars, postdoctoral fellows, and faculty members actively engaged in the discussions, making the event a valuable platform for knowledge exchange and networking.
















Report on National Science Day

27th February, 2026

The S. N. Bose National Centre for Basic Sciences, Kolkata, observed National Science Day, 2026 on 27th February, 2026 with the theme "Women in Science: Catalysing Viksit Bharat." The programme highlighted the vital role of women scientists in shaping India's scientific future.The event featured inspiring talks by Dr. Dibyashree Chakraborti, Dr. Shrestha Chowdhury, and Dr. Naomi Karmakar, who shared their journeys and perspectives, enriching the occasion with valuable insights. Prof. Tanusri Saha-Dasgupta, Director of the Centre, delivered the welcome address, setting the tone for meaningful discussions.The programme concluded with remarks by Prof. Priya Mahadevan, who emphasized the indispensable contribution of women in advancing Indian science.This year's celebration served as a platform for dialogue, reflection, and recognition of women's leadership in science, aligning with the vision of Viksit Bharat.





Report on Open Day

1st January, 2026

The S. N. Bose National Centre for Basic Sciences, Kolkata, observed the 132nd Birth Anniversary of Prof. Satyendra Nath Bose on 1st January,2026. The solemn occasion was marked by the garlanding of his bust, paying tribute to his monumental contributions to physics, including the Bose–Einstein statistics and the concept of the boson. The ceremony served as a reminder of his enduring legacy and the spirit of inquiry he championed.





2nd January, 2026

On 2nd January, 2026, the Centre celebrated its annual Open Day, coinciding with the birth anniversary of Prof. Bose. The programme was inaugurated by Prof. Tanusri Saha-Dasgupta, Director of the Centre, and drew enthusiastic participation from over 70 visitors, including students, researchers, and science enthusiasts.



Highlights of the Open Day included:

- A lecture on Astrophysics and Astronomy by Dr. Debiprosad Duari (Former Director of Research and Academics , M.P. Birla Planetarium, Kolkata)
- Hands-on exploration in research laboratories
- A guided tour of the S. N. Bose Archive
- Interactive sessions with scientists and researchers
- An evening programme of stargazing and planet watching.

The event created an atmosphere of curiosity and discovery, inspiring young minds to engage with science and explore its possibilities. Through these activities, the Centre reaffirmed its commitment to fostering innovation, nurturing talent, and carrying forward the legacy of Prof. Satyendra Nath Bose.



Report on Extended Visitor and Linkage Program (SCOLP)

(Period: 1st April 2025 to 31st March 2026)

Seminar Type	Date	Speaker & Affiliation	Title
Bose Colloquium	19.11.2025	**Prof. Carla Molteni** PhD CPhys FInstP, King's College London, Physics Department	Unravelling the Working Mechanisms of Ligand-Gated Ion Channel with Atomistic Simulations
	16.12.2025	**Prof. Diptiman Sen** Honorary Professor, Centre for High Energy Physics, Indian Institute of Science, Bengaluru	Kinetically constrained models showing Hilbert space fragmentation
	25.02.2026	**Prof. Kaustubh R. Priolkar** Director, UGC-DAE CSR, Indore and also a Senior Professor at the School of Physical and Applied Sciences, Goa University	EXAFS: a local structural tool for understanding materials
	06.03.2026	**Dr. Ashutosh Ghosh** Vice-Chancellor of the University of Calcutta	Isolation of ra and Po from Pitch blend : A facinating analytical chemistry research by a physicist
Institute Colloquium	21.07.2025	**Prof. Sanjay Kumar** Director & Senior Professor, Institute of Science, Banaras Hindu University	Crossing Barriers: Stochastic Dynamics of Polymer Translocation
	20.11.2025	**Dr. Sergey Streltsov** Corresponding Member of Russian Academy of Sciences (RAS), Chair of Theory of Low-dimensional Spin Systems & Institute of Metal Physics (IMP) of the Ural Branch of RAS	More is Different: The Emergent Physics of Correlated Clusters
	26.12.2025	**Dr. Supriyo Bandyopadhyay** Department of Electrical and Computer Engineering, Virginia Commonwealth University, Richmond, USA	Topological Analog Electronics: Quantum micro-antenna and electromagnetic beam steering based on spin-momentum locking in the topological insulator $Bi_2 Se_3$
Special Lecture	01.12.2025	**Prof. Ganapati D. Yadav** National Science Chair, Emeritus Professor of Eminence, and former Vice Chancellor of ICT Mumbai, Honorary Professor, JNCASR Bengaluru and Chairman, Governing Body, SNBNCBS	Net Negative Carbon Goal & Sustainability: Role of Green Hydrogen in Decarbonization, Biomass Valorization & Waste Plastic Recycling

Sl. No.	Seminar Type	Department	Date	Speaker & Affiliation	Title
1.	**Departmental Seminar**	AHEP	01.05.2025	**Dr. Andrew Miller** Postdoctoral Researcher at NIKHEF, Amsterdam and Utrecht University & a member of the International LIGO Scientific Collaboration	Multi-messenger astronomy with continuous gravitational waves
2.	**Departmental Seminar**	PCS	21.05.2025	**Dr. Samriddhi Sankar Ray** Associate Professor, International Center for Theoretical Sciences (ICTS-TIFR), Tata Institute of Fundamental Research, Bangalore, India	A high Reynolds number perspective on what makes dense, bacterial suspensions truly turbulent
3.	**Departmental Seminar**	CBS	25.06.2025	**Dr. Prakash Chandra Mondal** Associate Professor, Department of Chemistry, Indian Institute of Technology, Kanpur	Charge Transport in Large-Scale Molecular Junctions
4.	**Departmental Seminar**	CMMP	31.07.2025	**Dr. Isao H. Inoue** DSc., Senior Researcher at National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan	Unveiling the Unexpected in SrTiO3: Polar Metal States as a Superconductivity Enhancer
5.	**Departmental Seminar**	CMMP	06.08.2025	**Dr. Ashutosh Mohanty** Assistant Professor (Chemistry), Department of Education, Indian Institute of Technology (IIT), Kharagpur	Structure-Property Correlation and Cation Dynamics in APbX 3 Perovskite
6.	**Departmental Seminar**	PCS	30.10.2025	**Dr. Debleena Thacker** Associate Professor in Probability in the Department of Mathematical Sciences, Durham University, UK.	Border aggregation models and its connections to other models in statistical physics
7.	**Departmental Seminar**	CMMP	03.12.2025	**Prof. Siddhartha Lal** Professor, IISER Kolkata	Mott Criticality as the Confinement Transition of a Pseudogap-Mott Metal
8.	**Departmental Seminar**	PCS	04.12.2025	**Dr. Deepak Gupta** A Humboldt Research Fellow in TU Berlin and a former faculty member at IIT Indore	Inference of time delay in stochastic systems
9.	**Departmental Seminar**	CBS	06.01.2026	**Dr. Soumya Mukherjee** Associate Professor of Materials Chemistry in the Dept. of Chemical Sciences at the University of Limerick (UL)	Structural Adaptiveness-enabled High Selectivity in Transiently Porous Crystals
10.	**Departmental Seminar**	CMMP	07.01.2026	**Dr. Bhagwati Prasad** Assistant Professor, Materials Engineering Department, Indian Institute of Science, Bengaluru	Beyond-CMOS Computing: Novel, Energy-Efficient Spintronic Logic and Memory Platforms
11.	**Departmental Seminar**	AHEP	08.01.2026	**Dr. Ashok Kumar** Associate Professor, Indian Institute of Space Science & Technology, Thiruvananthapuram	Bright Squeezed Light: From EPR Entanglement to Quantum Technologies
12.	**Departmental Seminar**	AHEP	12.02.2026	**Dr. Amit Rai** Associate Professor, School of Physical Sciences, Jawaharlal Nehru University	Quantum Effects in Photonic Waveguide Systems

Sl. No.	Seminar Type	Department	Date	Speaker & Affiliation	Title
13.	**Departmental Seminar**	CMMP	10.03.2026	**Dr. Shouvik Chatterjee** Reader, Condensed Matter Physics & Materials Science, Tata Institute of Fundamental Research, Mumbai	Thin-Film Alchemy: Imprinting novel functionalities in quantum materials by strain engineering
14.	**Early Career Talk**	CMMP	01.04.2025	**Dr. Bidisha Roy** Faculty of Physics, School of Sciences, Woxsen University	Some interesting optical manifestations in quantum confined excitonic systems.
15.	**Early Career Talk**	AHEP	08.04.2025	**Dr. Rahul Bandyopadhyay** Postdoctoral Researcher, Universidad de Chile	Polycyclic aromatic hydrocarbon abundances in protoplanetary disks - a study with the JWST spectrum of the T Tauri disk T Chamaeleontis (T Cha)
16.	**Early Career Talk**	PCS	17.04.2025	**Dr. Ajoy Maji** Postdoctoral Fellow at Weizmann Institute of Science, Rehovot, Israel	Shape Transition in Network Models of Active Elastic Shells
17.	**Early Career Talk**	CMMP	24.04.2025	**Dr. Ritwik Mondal** Assistant Professor. Department of Physics, Indian Institute of Technology (ISM) Dhanbad	Inertial Magnons: A New Frontier in Terahertz Spin Dynamics
18.	**Early Career Talk**	CMMP	25.04.2025	**Dr. Alexander Mook** Research Group Leader, Johannes Gutenberg University Mainz	A tale of demons and decay in alter magnets
19.	**Early Career Talk**	PCS	05.05.2025	**Mr. Vishwajeet Kumar** PhD student, Institute of Mathematical Sciences, Chennai	Exploring Metastabilities : Decoding unknown energy landscapes by leveraging Generalized Arrhenius Law.
20.	**Early Career Talk**	AHEP	20.06.2025	**Dr. Jyotirmay Paul** Post-Doctoral Fellow, University of Exeter, UK	Pushing the Frontiers of High Angular Resolution Astronomy: Insights from iRobo-AO, SALTO, SCExAO VAMPIRE, and the BIFROST/ Asgard Suite
21.	**Early Career Talk**	CBS	26.06.2025	**Dr. Arijit Kumar De** Associate Professor, Department of Chemical Sciences, IISER Mohali	New Insights into Ultrafast Excited-State Dynamics of Fluorescent Proteins
22.	**Early Career Talk**	CBS	03.07.2025	**Dr. Rohan Erande** Associate Professor, IIT Jodhpur	Organic Synthesis: A Nexus Between Natural Products and Drug Delivery
23.	**Early Career Talk**	PCS	09.07.2025	**Dr. Anish Acharya** Ph. D, Department of Theoretical Physics, TIFR, Mumbai	Manipulating Phases of many-body interacting systems with stochastic subsystem resetting
24.	**Early Career Talk**	CMMP	24.07.2025	**Dr. Srimanta Pakhira** Associate Professor of Physics, IIT Indore	Design Principle for 2D Transition Metal Dichalcogenides Towards H 2 Evolution and O 2 Reduction Reaction

Sl. No.	Seminar Type	Department	Date	Speaker & Affiliation	Title
25.	**Early Career Talk**	AHEP	28.07.2025	**Dr. Arpan Ghosh** Post-Doctoral Fellow, Instituto de Radioastronomíay Astrofísica, UNAM, México	The Accretion to Ejection Relation for Young Stellar Objects in the Coronet Cluster
26.	**Early Career Talk**	AHEP	31.07.2025	**Dr. Rupak Roy** Assistant Professor, Manipal Centre for Natural Sciences (Centre of Excellence), Manipal Academy of Higher Education (MAHE), Manipal, Karnataka	Extremely luminous cosmic catastrophes and their progenitors.
27.	**Early Career Talk**	AHEP	01.08.2025	**Dr. Sumana Nandi** Assistant Professor, Manipal Centre for Natural Sciences (Centre of Excellence), Manipal Academy of Higher Education (MAHE), Manipal, Karnataka	Investigation of the central system of the Black Hole Binary Candidates
28.	**Early Career Talk**	AHEP	08.08.2025	**Dr. Sagnik Chakraborty** Postdoctoral Fellow, Dipartimento di Ingegneria, University of Palermo	Intrinsic Hamiltonian of Mean Force and Strong-Coupling Quantum Thermodynamics
29.	**Early Career Talk**	CMMP	11.08.2025	**Dr. Madhumita Sarkar** Postdoc at University College London	Floquet-Enhanced Binding and Exotic Pairing States in Doped Mott Insulators, and Quantum State Transfer via Spin Chains.
30.	**Early Career Talk**	AHEP	19.08.2025	**Dr. Sajal Mukherjee** Assistant Professor, BITS Pilani	Modeling environmental effects with future Gravitational wave (GW) detectors
31.	**Early Career Talk**	CMMP	20.08.2025	**Mr. Mona Garg** PhD Student, IISER Mohali	Mesoscopic Transport Characteristics of Natural and Engineered Superlattices
32.	**Early Career Talk**	CMMP	27.08.2025	**Dr. Koushik Mukherjee** Postdoctoral Research Associate at Lund University, Sweden	Creation and detection of Higgs-like quasi-particles in a supersolid state
33.	**Early Career Talk**	CMMP	11.09.2025	**Dr. Akshay Singh** Assistant Professor, Department of Physics, IISc Bangalore	2D Materials for Future Technologies and Novel Physics
34.	**Early Career Talk**	PCS	18.09.2025	**Dr. Sourabh Lahiri** Assistant Professor, Department of Physics, BIT - Mesra, Ranchi	Two and three-state quantum heat engines with stochastic resetting
35.	**Early Career Talk**	CMMP	07.10.2025	**Dr. Kingshuk Mukhuti** Post-doctoral researcher at High Field Magnet Laboratory, Radboud University, Nijmegen, Netherlands.	Probing and controlling the properties of halide perovskite semiconductors with high magnetic fields
36.	**Early Career Talk**	AHEP	09.10.2025	**Mr. Satyaki Chowdhury** PhD student at the Institute of Theoretical Physics, Jagiellonian University, Poland	Aspects of geometric quantum complexity.

Sl. No.	Seminar Type	Department	Date	Speaker & Affiliation	Title
37.	**Early Career Talk**	CMMP	09.10.2025	**Mr. Aniket Majumdar** Senior Research Fellow, Quantum Materials and Devices Group, IISc., Bangalore	Quantum-critical flow of charge and heat in ultra-clean graphene
38.	**Early Career Talk**	CMMP	10.10.2025	**Dr. Pratap Vishnoi** Assistant Professor, New Chemistry Unit, International Centre for Materials Science & School of Advance Materials, JNCASR	Transition-Metal Halide Double Perovskites: Design, Structural, Dimensionality and Magnetism
39.	**Early Career Talk**	PCS	31.10.2025	**Dr. Soumik Bandhopadhyay** Post Doctoral Researcher (Quantum Technologies Theory group), Pitaevskii BEC Center, INO-CNR and Department of Physics, University of Trento	Cold atom quantum simulation and thermalisation aspects of synthetic quantum matter: from condensed matter to quantum gravity
40.	**Early Career Talk**	AHEP	03.11.2025	**Dr. Joydeep Roy** Former Post-doctoral Fellow at Indian Association for the Cultivation of Science (IACS), Kolkata	Effective Field Theory as a probe for Charged Lepton : Flavor Violation
41.	**Early Career Talk**	CMMP	26.11.2025	**Dr. Nirmal Roy** Postdoctoral Fellow, School of Physics & Astronomy, Faculty of Exact Sciences, Tel Aviv University, Israel	Switching van der Waals Polytypes
42.	**Early Career Talk**	AHEP	28.11.2025	**Dr. Paramita Dasgupta** CCAPP Fellow, The Ohio State University	Exploring the High Energy Universe through Radio Observations
43.	**Early Career Talk**	CBS	28.11.2025	**Dr. Juriti Rajbangshi** Postdoctoral Researcher, Van Lehn Group, Department of Chemical and Biological Engineering, University of Wisconsin-Madison, USA	Molecular insights and predictive models for solvent selection in lignin valorization
44.	**Early Career Talk**	CMMP	02.12.2025	**Dr. Indranil Roy** Postdoctoral Associate (Eva Andrei Lab), SAS - Physics & Astronomy Rutgers, The State University of New Jersey	Visualizing correlated ground states using quantum oscillation in twisted graphene
45.	**Early Career Talk**	PCS	09.12.2025	**Dr. Saikat Chakraborty** Postdoc, Laboratoire Interdisciplinaire de Physique, Université Grenoble Alpes	The Polymer Physics of Disordered Proteins: From single chain fluctuations to protein aggregation
46.	**Early Career Talk**	CMMP	10.12.2025	**Dr. Sreeja Loho Choudhury** Postdoctoral Fellow, Materials Theory Team, Department of Chemistry, NC State University	From Quantum Coherence to Classicality: Variational Wave packet, Approaches to Open Quantum Dynamics
47.	**Early Career Talk**	AHEP	12.12.2025	**Dr. Shouvik Roy Choudhury** Distinguished Postdoctoral Fellow, Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), Taiwan	Cosmology in an extended parameter space: new constraints on dark energy and neutrino masses with DESI BAO

Sl. No.	Seminar Type	Department	Date	Speaker & Affiliation	Title
48.	**Early Career Talk**	AHEP	15.12.2025	**Dr. Subham Dutta Chowdhury** Postdoctoral Researcher, International Centre for Theoretical Physics (ICTP), Italy	Symmetry and causality constraints on Fermi liquids
49.	**Early Career Talk**	AHEP	18.12.2025	**Dr. Naval Kishor Bhadari** Boya postdoctoral fellow, Kavli Institute for Astronomy and Astrophysics, Beijing	A Tale of Galactic Snake: Unveiling Star Formation Processes
50.	**Early Career Talk**	CMMP	18.12.2025	**Dr. Sagar Paul** Postdoctoral Fellow at Karlsruhe Institute of Technology	Single Molecule Magnets for Quantum Computation: Insights from Micro-SQUID-EPR
51.	**Early Career Talk**	CMMP	22.12.2025	**Dr. Susmita Changdar** Postdoctoral Fellow, IFW Dresden, Germany	Nodal superconductivity on the Topological Fermi arcs of PtBi2
52.	**Early Career Talk**	AHEP	05.01.2026	**Dr. Suman Kundu** Postdoctoral Researcher, International School for Advanced Studies (SISSA), Italy	A String Theory for 2D QCD
53.	**Early Career Talk**	AHEP	06.01.2026	**Dr. Swastik Chowbey** Postdoctoral Fellow, Università di degli studi di Milano, Italy	The search for other worlds through giant telescopes by high contrast imaging
54.	**Early Career Talk**	PCS	06.01.2026	**Dr. Ahana Ghoshal** Postdoctoral researcher; Department Physik; Universitaet Siegen, Germany	Qubits in second quantisation in fermionic simulators
55.	**Early Career Talk**	AHEP	09.01.2026	**Dr. Trisha Bhowmik** Postdoctoral Fellow, Universidad Diego Portales, Santiago, Chile	Understanding planet and satellite formation with ALMA and VLT
56.	**Early Career Talk**	AHEP	12.01.2026	**Dr. Sayan Saha** Postdoctoral Research Associate, Northeastern University, Boston, USA	Mapping Dark Matter from the Stratosphere: A First-of-Its-Kind Weak-Lensing Mission (Super BIT)
57.	**Early Career Talk**	CMMP	14.01.2026	**Dr. Ankita Bhattacharya** Postdoctoral researcher in the Department of Physics and Astronomy, Uppsala University, Sweden	Geometric Control of Electrons: Nonlinear transport and Flat-band Superconductors
58.	**Early Career Talk**	AHEP	15.01.2026	**Dr. Bihalan Bhattacharya** PDRA, Institute of Physics, Nicolaus Copernicus University	Qubit Schwarz maps with diagonal unitary and orthogonal symmetries.
59.	**Early Career Talk**	CMMP	15.01.2026	**Dr. Supriya Mandal** Postdoc at Institut Néel Superconducting Quantum Circuits (SQC), France	Scaling superconducting qubits: remote entanglement and hardware-efficient modularity
60.	**Early Career Talk**	AHEP	19.01.2026	**Dr. Arpit Das** Postdoctoral Fellow, School of Mathematics, University of Edinburgh	Entanglement Entropy, twist fields and anomalies of non-invertible symmetries

Sl. No.	Seminar Type	Department	Date	Speaker & Affiliation	Title
61.	**Early Career Talk**	AHEP	20.01.2026	**Dr. Aritra Chakrabarty** NPP Fellow, NASA AMES, Mountain View, USA	From Exoplanet Detection to Demographics: Inferring the Physical Origins of the Close-in Exoplanet Population
62.	**Early Career Talk**	AHEP	27.01.2026	**Dr. Gourav Banerjee** Post Doc Fellow, Vainu Bappu Observatory, Indian Institute of Astrophysics, Bangalore	Stellar gaseous disc study: an Indian odyssey using 1-m telescope at Kavalur
63.	**Early Career Talk**	CMMP	28.01.2026	**Mr. Subhajyoti Pal** Ph. D Student, NISER, Bhubaneswar	Probing Multi-Spin Excitations of Low-Dimensional Spin Systems Beyond Linear Response
64.	**Early Career Talk**	AHEP	05.02.2026	**Dr. Sudeshna Patra** IISER Tirupati (Postdoc Associate, SNBNCBS)	The Outer Milky Way: Our Nearest Laboratory for Low-Metallicity Star Formation
65.	**Early Career Talk**	CMMP	05.02.2026	**Mr. Sashikanta Mohapatra** SRF in the group of Prof. Ajit C. Balram at IMSC, Chennai	Unraveling quantum many-body scars of the spin-1 XY model with Fock-space cages and commutant algebras
66.	**Early Career Talk**	CMMP	13.02.2026	**Dr. Amit Kumar Jash** Post Doc at Weizmann Institute of Science	Dark Exciton Condensate and Nuclear Polarization in Coupled Quantum Wells
67.	**Early Career Talk**	PCS	26.02.2026	**Dr. Arghya Das** Post-doctoral Fellow at IMSC, Chennai	Active processes driven by nonequilibrium reservoirs: transport and universality
68.	**Early Career Talk**	CMMP	02.03.2026	**Dr. Bivas Dutta** Assistant Professor, Department of Physics, IIT Indore	Thermal Probe of Majorana Modes with the Isolation of Quantum Hall Channels
69.	**Early Career Talk**	AHEP	05.03.2026	**Dr. Piyali Saha** Postdoctoral Fellow, Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), Taiwan	ALMA Perseus Polarization Survey (ALPPS)
70.	**Early Career Talk**	AHEP	26.03.2026	**Dr. Tanmoy Biswas** PDRA, Los Alamos National Laboratory, USA	Catalytic Advantage in Otto-like Two-Stroke Quantum Engines

Memorial Lectures

Seminar Type	Date	Speaker & Affiliation	Title
7th G. N. Ramachandran Memorial Lecture	10.04.2026	**Prof. Shekhar C. Mande** (Distinguished Professor, Bioinformatics Centre, Former Director General, CSIR & Secretary, DSIR.)	History of Structural Sciences in India
18th C.K. Majumdar Memorial Lecture	16.04.2026	**Prof. Hidenori Takagi** (Director, Max Planck Institute for Solid State Research, and AvH Professor, University of Stuttgart)	When electron correlations meet with Einstein in heavy transition metal compounds
















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Report on 39th Foundation Day of SNBNCBS

13th June, 2025

The S.N. Bose National Centre for Basic Sciences (SNBNCBS), Kolkata, celebrated its 39th Foundation Day on 13th June, 2025. The programme began with a floral tribute to Satyendra Nath Bose, followed by welcome speeches from Prof. B.N. Jagatap (Chairman, Governing Body) and Prof. Tanusri Saha Dasgupta (Director, SNBNCBS).

The highlight of the day was a keynote lecture by Prof. Umesh V. Waghmare (JNCASR, Bengaluru), along with presentations by research scholars that reflected the Centre's strong academic environment. Awards were given to faculty, scholars, and staff in recognition of their contributions and achievements.

The celebration ended with a Sarod recital by Shri Indrayuddh Majumder, adding a cultural touch to the occasion.





The 39th Foundation Day was a moment of pride for SNBNCBS, showcasing its journey of nearly four decades in advancing science, nurturing talent, and building a vibrant academic community.

Celebration of World Quantum Day

The day 25th April is celebrated as the World Quantum Day to promote public awareness and understanding of quantum science and technology around the world. The event kicked off with an inspiring address by Prof. Tanusri Saha Dasgupta, Director of SNBNCBS, who ignited the young minds with her passion for quantum science. Faculty experts from the Centre as well as from other institutions delivered lectures on quantum science and technologies:

- Dr. Manik Banik (SNBNCBS)
- Dr. Saquib Shamim (SNBNCBS)
- Prof. Prasenjit Sen (HRI Prayagraj)
- Prof. Anand Jha (IIT Kanpur)

High school students from PM SHRI Kendriya Vidyalaya No. 2, Salt Lake to SNBNCBS, Kolkata participated in the event for an electrifying day of quantum exploration!



Highlights of the Day:

- Mind-Expanding Talks: Interactive sessions with leading scientists from SNBNCBS Kolkata, HRI Prayagraj, and IIT Kanpur on quantum computing & physics.
- Behind-the-Scenes Lab Tours: A firsthand look at state-of-the-art research facilities!
- Journey Through History: An exclusive visit to the Bose Archive, honoring the legacy of quantum pioneers.
- Q&A with Experts: Curious minds met brilliant researchers – ideas sparked everywhere!

The energy, curiosity, and innovative spirit of these future quantum leaders left us inspired! A huge shoutout to all the students, educators, and scientists who made this day unforgettable. The future of quantum breakthroughs is bright!

C. K. Majumdar Memorial Summer Workshop in Physics

The C. K. Majumdar Memorial Summer Workshop in Physics held during 15-24 July, 2025 in association with Indian Association of Physics Teachers (IAPT; RC-15). Final year B.Sc. (Physics) and 1st year M.Sc. (Physics) students (total of 30 nos.) from different universities/colleges from the state of WB as well as from other states participated in the programme.

Outreach Programme

- High school students from PM SHRI Kendriya Vidyalaya No. 2, Salt Lake to SNBNCBS, Kolkata visited the Centre on 25.04.2025 to explore the cutting-edge research trends at the Centre. As part of their visit, they were exposed to the interactive sessions with leading scientists from SNBNCBS Kolkata, HRI Prayagraj, and IIT Kanpur on quantum computing & physics. Later, they got a firsthand look at state-of-the-art research facilities! The visit ended with an exclusive visit to the Bose Archive, honoring the legacy of quantum pioneer.

- Young curious minds (XI & XII Science) and teachers from Naktala High School, Kolkata visited the Centre on 23.07.2025 for enrichment of their knowledge in science education. This visit was aimed to give the opportunity to observe practical applications of their studies, interact with professionals in the field, and develop a deeper understanding of complex concepts. These experiences not only reinforce classroom learning but also inspire students to pursue scientific inquiry and innovation.
  - Talk by Prof. Ranjit Biswas, Dean(AP): "S N Bose - Beyond Science"
  - Talk by Dr. Ramkrishna Das: "Observational Astronomy - Centre's approach"
  - Talk by Dr. Avijit Chowdhury: "Energy Harvesting using Triboeltric Nano Generator"
  - Visit to S. N. Bose Archive
  - Laboratory demonstrations:
    - Different types of single crystals (2D, bulk)
    - Different growth process of single crystals (CVT, Flux, Bridgman)
    - Glove box
    - Diamond wire saw
    - Different high temperature furnaces
    - Pressure cell set up for electrical transport
    - X-ray Diffractometer (XRD)
    - Field Emission Scanning Electron Microscopy (FESEM)
    - High Resolution Transmission Electron Microscope (HRTEM)
    - Dynamic Light Scattering (DLS)
    - Raman Effect

The energy, curiosity, and innovative spirit of these future quantum leaders left us inspired! A huge shoutout to all the students, educators, and scientists who made this day unforgettable. The future of quantum breakthroughs is bright!

- The Outreach Programme for students belonging to SC/ST and other underprivileged communities was organised by the Department of Chemistry, Suri Vidyasagar College and sponsored by Satyendra Nath Bose National Centre for Basic Sciences on 08.05.2025. The programme was aimed to go beyond textbooks, using hands-on or immersive experiences to spark genuine excitement for science.

Programme Highlights:

- Talk by Prof. Ranjit Biswas: *"Chemistry: Excitements and Applications"*
- Talk by Dr. Ali Hossain Khan: *"Synthesis and application of optical nanomaterials"*
- Talk by Dr. Ramkrishna Das: "Astrophysics"
- Scientific demonstration by Dr. Arijit Halder
- Sky Watching by Dr. Ramkrishna Das

Workshop on Enriching Research Life

The Centre arranged a workshop on 'Enriching Research Life' at the Silver Jubilee Hall on 12th February 2026. Expert personnel from YourDOST guided research scholars and staff members with important conversation on mental well-being and balance in academia.

Foundation Course on Entrepreneurship & Legal Compliance

In collaboration with University of Engineering and Management (UEM), Kolkata the Centre launched course on "**Entrepreneurship and Legal Compliance: Foundation Course (Part – I)**". The thought behind this course is to create a space within the institution where students can develop their business ideas with support from mentors, access to resources, and networking opportunities. By encouraging collaboration between students from different disciplines, creativity will be fostered, and innovation in problem-solving will be developed. Resource persons from UEM, Kolkata take classes once in a week.

Career Compass – interaction series

The Centre initiated interaction series on career guidance for the current scholars. Specialists from industry and academia are invited to share their experiences and guidance on choosing correct career path.

Speakers visited during the reported period:

- **Dr. Biswajit Pabi**

  SNBNCBS Alumni & Postdoctoral Research Associate, Kiel University (CAU), Humboldt Research Fellow

- **Dr. Sachin Barthwal**

  Head Quantum Technology, Quantum AI Global, Qulabs Pvt. Ltd. Hyderabad

- **Dr. Kunj S. Tandon**

  Chief Executive Officer, I-HUB Quantum Technology Foundation (QTF), IISER Pune

Outreach Programmes

- The Centre hosted 51 brilliant young minds from Chhattisgarh as part of the "Vigyan Anusandhan Yatra" (Scientific Research Journey). These Class XII girl students, along with their 9 dedicated teachers, visited our campus on 16th September, 2025 for an immersive exposure trip organized by the Chhattisgarh Council of Science and Technology, Raipur. The group explored our state-of-the-art laboratories and delved into the rich history of science at the S N Bose Archive. It was inspiring to see their curiosity and enthusiasm as they interacted with our researchers and learned about cutting-edge scientific advancements.
- The Centre hosted 25 bright students and 5 educators from Calcutta International School on 9th December 2025 for an immersive Educational Outreach Programme. The young minds embarked on a scientific journey through:
  - A special documentary screening on the legendary S N Bose
  - An inspiring introductory talk by Prof. Ranjit Biswas, Dean (AP)
  - Interactive lab visits exploring Laser Spectroscopy with Prof. Manik Pradhan & Physical Chemistry with Prof. Ranjit Biswas
  - An insightful tour of the S N Bose Archive
  - A glimpse into the computational power of the PARAM Rudra Supercomputing Facility
- **India International Science Festival 2025**
  - **Curtain Raiser Ceremony at SNBNCBS**: In the lead-up to the India International Science Festival (IISF) 2025, the Centre hosted an engaging Curtain Raiser Event designed to foster scientific temperament and motivate future innovators. The program opened with an insightful address by Director Prof. Tanusri Saha Dasgupta, followed by special talks from scientists, interactive discussions, and guided visits to the Science Laboratory and the S.N. Bose Archives. Nearly 70 enthusiastic students/teachers from Kendriya Vidyalaya No. 2 Salt Lake, Kolkata took part, immersing themselves in the Centre's research environment and connecting directly with scientists.
  - **Main Event**: The Centre proudly participated in the greatest extravaganza of science in India: IISF 2025 at Panchkula, Haryana. The pavilion of the Centre was visited by a huge number of young budding and enthusiastic individuals. The scientists of the Centre demonstrated to them the present state-of-the-art scientific progress in both fundamental as well as application-based research made by the Centre. The overwhelming quest for scientific knowledge and temperament of the visitors, specifically of the school students, marks the grand success of the festival.
- **Open Day 2026 – 2nd January 2026**

  The Open Day celebration began on a profoundly inspiring note with the inaugural address by our Director, Prof. Tanusri Saha Dasgupta. The S. N. Bose National Centre was buzzing with curiosity and wonder as we welcomed visitors to explore the legacy of a pioneer whose work lights up the very foundation of modern physics. Here's a glimpse of the magic we shared:
  - An enthralling journey through the cosmos with Dr. Debiprosad Duari's lecture on Astrophysics & Astronomy
  - Hands-on exploration in our state-of-the-art research laboratories
  - A walk through history at the exclusive S N Bose Archive
  - Enlightening conversations with our scientists and researchers
  - An unforgettable evening of stargazing and planet watching
- **National Science Day 2026**

  The Centre successfully organized the National Science Day 2026 celebration on 27th February 2026 at the Silver Jubilee Hall. The event

commemorated the discovery of the Raman Effect by C. V. Raman and emphasized the pivotal role of women scientists in shaping a developed India under the theme *"Women in Science: Catalysing Viksit Bharat."* The programme brought together academicians, researchers, scholars, and students to celebrate scientific achievements and promote gender inclusivity in STEM disciplines. The event featured distinguished speakers who highlighted research excellence, policy perspectives, innovation pathways, and institutional responsibilities toward empowering women in science.

Other Activities

Sensitization Workshop on the POSH Act

The Centre organized one day sensitization workshop on 23rd December, 2025 to commemorate the anniversary of notification of the landmark legislation. The workshop was a part of commemoration of Sexual Harassment at Workplace Prevention Week. Approx. 90 nos. of students, faculty and staff members from the Centre participated in the programme. The Centre is grateful to the incredible speakers, Dr. Sarbari Guha (Department of Physics, St. Xavier's College (Autonomous) & ICC Member, SNBNCBS) and Prof. Piyali Sur (Department of Sociology, Jadavpur University & ICC Member, JU), for sharing their expertise on awareness, prevention, and our shared responsibility. The engaging discussions were a powerful reminder that creating a culture of safety and respect is a journey we are on together. We reaffirm our commitment to fostering environments where every individual feels safe, respected, and empowered to thrive. The lecture session was followed by question & answer session and discussion from the audience.

IMPACT 2026 – The Alumni Meet

The Centre hosted "IMPACT 2026 – The Alumni Day" on 29th January 2026 to renew and rejuvenate bonding between the past and present members of SNBNCBS, to create new contacts, to learn about new opportunities. Alumni members from the India and abroad attended the programme with great enthusiasm. The programme began with welcome address by Prof. Tanusri Saha Dasgupta, Director and alumni of SNBNCBS. The alumni members from renowned academic institutions as well as global industries shared their research journeys and gave insightful guidance to the current research scholars through dedicated panel discussions namely "Post PhD to Professor: Exploring Academia" (moderated by Dr. Barun Ghosh, Asst. Professor) and "Industry Career Pathways after a PhD" (moderated by Dr. Pradip S. Pachfule, Asso. Professor). Research scholars, postdoctoral fellows and faculty members actively participated in the programme.

Bose Fest 2026

Bose Fest 2026 – The Annual Celebration of Science was celebrated during 23-25 March, 2026. The 3-day celebration started with the inaugural message by Prof. Tanusri Saha Dasgupta, Director followed by message from Prof. Ranjit Biswas, Dean (Academic Programme). The fest hosted 28 scientific talks and 48 poster presentations by the research scholars and postdoctoral fellows of the Centre. The oral and poster presentations showcased cutting-edge work by early-career researchers, all coming together to celebrate research, innovation, and discovery.

A BRIEF REPORT OF CONFERENCES, WORKSHOPS AND EXTENSION PROGRAMMES (CWEP) HELD DURING 01.04.2025 TO 31.03.2026

As per available records, during the period under reference, the following conferences / workshops/discussion meetings held at Centre under CWEP of EVLP. A brief report of the programmes are as below:

1) Conference Proposal titled "Physics of Non-Equilibrium Systems" held at Centre during 22.05.2025 to 23.05.2025. The Convener of the conference was Dr. Arijit Haldar, Assistant Professor and Co-Conveners were Dr. Sanku Pal and Dr. Bhaskar Mukherjee, DST INSPIRE faculties. The purpose of this conference was to unite researchers working on non-equilibrium systems, facilitating discussions on current research topics and potential collaborations. The conference focussed both on classical and quantum non-equilibrium systems covering the topics like, quantum scars, Hilbert space fragmentation, time crystals, non-equilibrium dynamics (ramp, quench etc) and transport phenomena, Floquet systems, stochastic processes, quantum chaos, role of quantum information in non-equilibrium physics, non-Hermitial systems, open quantum systems, hydrodynamics and non-equilibrium universality.

   An amount of Rs. 2,50,000/- has been sanctioned from the Centre as assistance for organizing this conference.

2) C.K. Majumdar Memorial Summer Workshop in Physics 2025 held at Centre during 15.07.2025 to 24.07.2025.The Conveners of this summer workshop jointly organized with Centre were Dr. LipikaSantra, Associate Professor, Bangabasi College, Kolkata and Dr. Swati Das, Assistant Professor, Ananda Mohan College, Kolkata. The Co-Conveners were Dr. UrnaBasu, Associate Professor, SNBNCBS and Dr. ShubhasisHaldar, Associate Professor, SNBNCBS.

   The purpose of this workshop was to give exposure to a group of outgoing final year (3rd year) B.Sc. (due to get their B.Sc degree in 2025) and the M.Sc. Physics students (who completed their B.Sc. in 2024) on different emerging fields of theoretical and experimental physics. The Indian Association of Physics Teachers (IAPT) Regional Council 15 (RC-15) organized this programme in collaboration with the Centre.

   An amount of Rs. 2,20,000/- has been sanctioned from the Centre as assistance for organizing this summer workshop.

3) Three- days national conference titled "Driving Discovery Through Synergy-2025" held at JNCASR, Bengaluru during 15th to 17th September, 2025. The Convener of the conference from Centre was Dr. ThirupathaiahSetti, Associate Professor.

   An amount of Rs. 1,00,000/- has been sanctioned from the Centre as financial assistance for organizing this conference.

4) One-day discussion meeting titled "Stat.Mech Meet Kolkata 2025 (SMMK-2025)" held at Centre on 19th September, 2025. The Conveners of this discussion meeting was Prof. Punyabrata Pradhan, Professor and Co-Convener was Prof. Jaydeb Chakrabarti, former Senior Professor.

   An amount of Rs. 12,250/- has been sanctioned from the Centre as assistance for organizing this discussion meeting.

5) One-day conference titled "Sustainable Futures: Science, Technology and the Environment" was held at Centre on 20th November, 2025. The Convener of the conference was Dr. Pradip S. Pachfule, Associate Professor.

   There was no financial assistance required from Centre.

6) 8th National Conference on Electronic Structure (NCES-2025) held at IISER, Bhopal during 19th to 22nd November, 2025. The Convener of the Conference from the Centre was Dr. ThirupathaiahSetti, Associate Professor.

   An amount of Rs. 2,00,000/- has been sanctioned from the Centre as assistance for organizing this conference.

7) International Conference on "Spins in Molecular Systems 2025 (SiMS 2025)" during 29th November,

2025 to 1st December, 2025. The venue was IIT Kharagpur Research Park, Kolkata. The Conveners of the conference from Centre were Prof. Manoranjan Kumar, Professor and Dr. Atindra Nath Pal, Associate Professor.

8) Three days international conference titled "Biophysics Today 2025" held at Centre during 2nd to 4th December, 2025. The convener of the conference was Dr. ShubhasisHaldar, Associate Professor.

An amount of Rs. 7,30,000/- has been sanctioned from the Centre as financial assistance for organizing this conference.

9) Conference titled "Quantum Materials and Emerging Concepts (QMEC-2025)" held at IISER, Bhopal during 22nd to 24th December, 2025. The Conveners from Centre were Prof. Manoranjan Kumar, Professor and Dr. ThirupathiahSetti, Associate Professor.

An amount of Rs. 1,00,000/- has been sanctioned from the Centre as assistance for organizing this conference.

10) Conference titled "StatPhys-Kolkata XIII" held at Centre during 12th to 16th January, 2026 at Centre in collaboration with IISER, Kolkata. The Convener of the conference was Prof. Pradeep K. Mohanty, Department of Physical Sciences, IISER, Kolkata and the Co-Conveners from Centre were Prof. Sakuntala Chatterjee, Professor and Dr. UrnaBasu, Associate Professor.

An amount of Rs. 5,00,000/- has been sanctioned and disbursed from the Centre as assistance for organizing this conference.

11) One-day discussion meeting on "Quantum Materials and Devices" held at Centre on 20th January, 2026. The convener of this discussion meeting was Dr. ThirupathaiahSetti, Associate Professor.

There was no financial assistance required from Centre.

12) A two days discussion meeting titled "Disorder and Size Effect in Quantum Materials" was organized at Centre during 4th and 5th February, 2026 in connection to the 80th birth anniversary of Late Prof. Abhjit Mookherjee, who was a pioneer in the theory of disordered alloys and a long term faculty of SNBNCBS. The Convener of the meeting was Prof. Biplab Sanyal, Associate Professor, Department of Physics and Astronomy, Uppsala University and Co-conveners from Centre were Dr. Nitesh Kumar, Associate Professor and Dr. Thirupathaiah Setti, Associate Professor.

An amount of Rs. 49,610/- has been sanctioned from the Centre as financial assistance for organizing this discussion meeting.

13) A two-days discussion meeting on "2dMAT-2026" held during 16th and 17th March, 2026 at Centre. The Convener of this discussion meeting was Prof. Priya Mahadevan, Senior Professor and Co-Convener was Dr. Saquib Shamim, Assistant Professor.

An amount of Rs.40,000/- has been sanctioned from the Centre as financial assistance for organizing this discussion meeting.

ADVANCED POST DOCTORAL RESEARCH PROGRAM (APRP): 2025-2026 [01.04.2025 - 31.03.2026]

Sl. No.	Name	Designation	Department	Mentor / Host	Dt. of Joining	Dt. of Leaving
1.	Mr. Achintya Low	PDRA (SNB)	CMMP	Dr. T. Setti	02.12.2024	01.06.2025
2.	Mr. Aishwaryo Ghosh	PDRA (SNB)	CMMP	Prof. Tanusri Saha Dasgupta	04.12.2025	Contd...
3.	Mr. Amrita Mondal	PDRA (SNB)	CBS	Prof. Ranjit Biswas	18.07.2025	Contd...
4.	Dr. Amar Nath Pal	PDRA –I	CBS	Dr. Shubhasis Haldar	14.06.2024	Contd...
5.	Dr. Amit Kundu	PDRA –I	AHEP	Prof. Archan S Majumdar	09.09.2024	Contd...
6.	Dr. Anannya Bhattacharya	PDRA –I	CBS	Prof. Rajib K Mitra	20.01.2025	Contd...
7.	Mr. Animesh Hazra	PDRA (SNB)	PCS	Prof. Punyabrata Pradhan	29.10.2025	Contd...
8.	Mr. Anirban Paul	PDRA (SNB)	PCS	Prof. Jaydeb Chakrabarti	19.05.2025	18.12.2025
9.	Mr. Anirban Roy Chowdhury	PDRA (SNB)	AHEP	Prof. Sunandan Gangopadhyay	29.10.2025	Contd...
10.	Mr. Arun K Das	PDRA (SNB)	AHEP	Dr. Parijat Dey	18.07.2025	Contd...
11.	Dr. Arijit Manna	PDRA-I	AHEP	Dr. Tapas Baug	26.09.2025	Contd...
12.	Dr. Ashis Saha	PDRA – I	AHEP	Prof. Sunandan Gangopadhyay	10.10.2023	09.10.2025
13.	Dr. Atul Rathore	PDRA-I	PCS	Dr. Arijit Haldar	04.10.2024	Contd...
14.	Dr. Bikash Gajar	PDRA -I	CMMP	Dr. Atindra Nath Pal	09.08.2023	20.05.2025
15.	Dr. Devaparna Bhattacharya	PDRA-I	CMMP	Prof. Tanusri Saha Dasgupta	02.07.2025	04.02.2026
16.	Ms. Deepsikha Das	PDRA (SNB)	PCS	Prof. Sakuntala Chatterjee	23.02.2026	Contd...
17.	Dr. Dibyashree Chakraborti	PDRA -I	CMMP	Dr. Saquib Shamim	26.10.2023	25.10.2025
18.	Dr. Dibyajyoti Saikia	PDRA – I	CMMP	Prof. Manoranjan Kumar	13.02.2025	Contd...
19.	Dr. Dipanwita Mitra	PDRA – I	CMMP	Dr. Avijit Chowdhury	09.10.2025	Contd...
20.	Mr. Dhrubajyoti Maji	PDRA (SNB)	PCS	Dr. Arijit Haldar	10.06.2024	21.05.2025
21.	Dr. Djeugoue Nzeuga Hermann	TWAS BOSE PDF	CMMP	Dr. Sanjoy Chaudhury	02.07.2025	Contd...
22.	Dr. Koyendrila Debnath	PDRA-II	CMMP	Dr. Barun Ghosh	01.07.2025	Contd...
23.	Mr. Jayanta Mondal	PDRA (SNB)	CBS	Dr. Pradip Pachfule	18.06.2024	17.06.2025
24.	Mr. Krishnendu Sinha	PDRA (SNB)	CBS	Prof. Suman Chakrabarty	02.09.2024	23.04.2025
25.	Mr. Krishnendu Patra	PDRA (SNB)	CMMP	Prof. Priya Mahadevan	18.07.2025	Contd...
26.	Mr. Koushik Pradhan	PDRA (SNB)	CMMP	Dr. Barun Ghosh	29.10.2025	Contd...
27.	Ms. Manjari Dutta	PDRA (SNB)	AHEP	Prof. Sunandan Gangoapdhyay	07.10.2024	06.10.2025

Sl. No.	Name	Designation	Department	Mentor / Host	Dt. of Joining	Dt. of Leaving
28.	Mr. Manodip Routh	PDRA (SNB)	CMMP	Dr. Nitesh Kumar	20.06.2025	12.11.2025
29.	Mr. Manoj Gupta	PDRA (SNB)	CMMP	Prof. Tanusri Saha Dasgupta	23.02.2026	Contd...
30.	Ms. Monalisa Chatterjee	PDRA (SNB)	CMMP	Prof. Manoranjan Kumar	10.07.2024	09.07.2025
31.	Mr. Narayan Ch. Maity	PDRA (SNB)	CBS	Prof. Ranjit Biswas	20.09.2024	01.08.202
32.	Dr. Naomi Karmakar	PDRA-I	PCS	Prof. P. S. Deo	04.06.2025	Contd...
33.	Dr. Olivia Mallick	PDRA – I	PCS	Prof. Punyabrata Pradhan	21.01.2025	Contd...
34.	Dr. Pekham Chakrabortty	PDRA – I	CBS	Dr. Pradip Pachfule	24.02.2025	23.02.2026
35.	Dr. Pratik Ghosal	PDRA – I	PCS	Dr. Manik Banik	05.02.2024	04.02.2026
36.	Dr. Ramu K Yadav	PDRA – I	PCS	Prof. Sakuntala Chatterjee	03.07.2023	02.07.2025
37.	Dr. Ranjini Bhattacharya	PDRA – I	CMMP	Prof. Priya Mahadevan	27.05.2024	16.12.2025
38.	Ms. Ria Saha	PDRA (SNB)	CBS	Prof. Rajib K Mitra	02.09.2024	18.06.2025
39.	Dr. Rubina Ghosh	PDRA -I	CMMP	Prof. Anjan Barman	27.05.2024	17.12.2025
40.	Dr. Saheb Dutta	PDRA – II	CBS	Prof. Suman Chakrabarty	01.06.2023	31.05.2025
41.	Mr. Samir Rom	PDRA (SNB)	CMMP	Prof. Tanusri Saha Dasgupta	12.02.2025	02.06.2025
42.	Dr. Semanti Dutta	PDRA – I	AHEP	Dr. Parijat Dey	07.10.2024	Contd...
43.	Mr. Shashank Shekhar Pandey	PDRA (SNB)	AHEP	Prof. Ramkrishna Das	29.10.2025	Contd...
44.	Mr. Shubham Purwar	PDRA (SNB)	CMMP	Dr. Barun Ghosh	12.02.2025	25.07.2025
45.	Dr. Shrestha Chowdhury	PDRA –I	CBS	Prof. Ranjit Biswas	26.09.2025	Contd...
46.	Mr. Soumen Mandal	PDRA (SNB)	CBS	Prof. Manik Pradhan	01.12.2025	Contd...
47.	Dr. Souvik Manna	PDRA –I	AHEP	Dr. Tapas Baug	01.06.2023	31.05.2025
48.	Dr. Sourav Kanthal	PDRA – I	CMMP	Dr. Nitesh Kumar	20.01.2025	28.11.2025
49.	Dr. Sourav Nandi	PDRA – II	CBS	Prof. Rajib K Mitra	09.10.2025	Contd...
50.	Mr. Subhankar Bera	PDRA (SNB)	AHEP	Prof. Archan S Majumdar	18.07.2025	03.12.2025
51.	Dr. Subhadip Chakrabortty	PDRA-I	CMMP	Dr. T. Setti	02.06.2025	Contd...
52.	Mr. Subhajit Kar	PDRA (SNB)	AHEP	Prof. Ramkrishna Das	21.02.2025	08.08.2025
53.	Dr. Suchismita Banerjee	PDRA – I	PCS	Dr. Urna Basu	24.06.2024	Contd...
54.	Mr. Sudipta Mitra	PDRA (SNB)	CBS	Prof. Suman Chakrabarty	29.10.2025	Contd...
55.	Dr. Suman K Mandal	PDRA –I	AHEP	Prof. Soumen Mondal	01.06.2023	31.05.2025
56.	Dr. Suma Das	PDRA –I	CMMP	Dr. Avijit Chowdhury	17.03.2025	Contd...
57.	Mr. Susanta Ghosh	PDRA (SNB)	CMMP	Dr. T. Setti	10.07.2025	02.12.2025

NPDF / RESEARCH ASSOCIATE (EXTERNAL FUND) / DST (INSPIRE) / RAMANUJAN FELLOW etc: 01.04.2025-31.03.2026

Sl. No.	Name	Designation	Dept.	Mentor / Host	Title of The Project	Dt. of Joining	Dt. of Leaving
1.	Prof. Kalyan Mandal	Emeritus Professor	CMMP	—	—	01.10.2025	Contd..
2.	Dr. Barnali Ghosh (Saha)	WIDUSHI - A Scientist under WISE KIRAN	CMMP	—	Synthesis, Physics and Technological applications of 2D Perovskite Haldies	01.08.2025	Contd..
3.	Prof. Prabhat Mandal	Raja Ramanna Chair	CMMP	—	Basic Research & Development Emergent quantum phenomena in topological and van der Waals systems	02.02.2026	Contd..
4.	Prof. Jaydeb Chakrabarti	CSIR Emeritus Scientist	CBS	—	Coarse grained description of misfolded proteins in an aqueous dispersion	02.02.2026	Contd..
5.	Prof. Amitabha Lahiri	Visiting (Hon.) Fellow	AHEP	—	—	01.03.2025	Contd..
6.	Prof. Gautam Gangopadhyay	Visiting (Hon.) Fellow	CBS	—	—	01.03.2024	Contd..
7.	Dr. Ananda Gopal Maity	Senior Project Scientist (DST-NQM)	PCS	Dr. Manik Banik	Design and development of quantum entanglement – enhanced imaging systems	21.02.2025	31.08.2025
8.	Mr. Anil K Singh	RA-I	CMMP	Prof. Priya Mahadevan	Twistronics with transition metal dichalogenides	29.01.2026	29.03.2026
9.	Dr. Ali Hossain Khan	Ramanujan Fellow	CBS	Prof. Rajib K Mitra	Doped 2D Nanocrystals for Photonic Applications	01.11.2021	31.03.2026
10.	Mr. Arka Prava Sarkar	RA-I (Adhoc)	CMMP	Prof. Priya Mahadevan	Optimising hybrid perovskite Solar Cells	05.01.2026	Contd..
11.	Dr. Arun K Maurya	Research Associate – I (Ad-hoc)	CMMP	Prof. Tanusri Saha-Dasgupta	JC Bose Award Fellowship	02.01.2025	31.05.2025
12.	Dr. Bhaskar Mukherjee	DST INSPIRE FACULTY	CMMP	Prof. Manoranjan Kumar	Exploration of non-ergodic quantum many body systems without disorder	17.09.2024	31.03.2026
13.	Dr. Dibyashree Chakraborti	CSIR RA	CMMP	Dr. Saquib Shamim	Study spin charge inter-conversion and its control mechanism in van-der Waals heterostructurestacks and striving towards development of topological spintronics	27.10.2025	Contd..
14.	Dr. Indrani Bhattacharyya	Project Associate – I (Ad-hoc)	CBS	Prof. Rajib K Mitra	Biomolecular Condensates: Exploring the associated hydration and energetics using THz spectroscopy	10.01.2025	Contd..
15.	Dr. Jiban Kangsabanik	DST INSPIRE FACULTY	CMMP	Prof. Tanusri Saha Dasgupta	Optimization of point defects and associated	17.09.2024	22.04.2025

Sl. No.	Name	Designation	Dept.	Mentor / Host	Title of The Project	Dt. of Joining	Dt. of Leaving
16.	Dr. Nicky Didwania	NPDF	CBS	Dr. Shubhasis Haldar	Chaperone-Mediated Folding of Mechanosensitive Proteins in Macrophages: Insights Using Single-Molecule Technique	11.11.2025	Contd..
17.	Dr. Pampa Jhariat	NPDF	CBS	Dr. Pradip Pachfule	Anionic Covalent Organic Frameworks for Photocatalytic Uranium Extraction from Seawater	01.12.2025	16.04.2026
18.	Mr. Prasun Boyal	RA - I	CMMP	Prof. Priya Mahadevan	Twistronics with transition metal dichalogenides	16.05.2025	21.11.2025
19.	Dr. Rubina Ghosh	NPDF	CMMP	Prof. Anjan Barman	Anionic Covalent Organic Frameworks for Photocatalytic Uranium Extraction from Seawater	18.12.2025	Contd..
20.	Dr. Sakila Khatun	CSIR RA	CMMP	Dr. Nitesh Kumar	Nonprecious Topological Quantum Materials for Electrocatalytic Water Splitting	22.09.2025	Contd..
21.	Dr. Sanku Paul	DST INSPIRE FACULTY	PCS	Dr. Arijit Haldar	Hidden quantum criticality and its application in data hiding	22.05.2023	Contd..
22.	Ms. Soma Dutta	Chanakya PDF (Ad-hoc)	CMMP	Prof. Anjan Barman	Two-dimensional Ferromagnetic and Organic Molecule Spinterfaces as Molecular Spin Qubits for Quantum Technologies and Energy Harvesting Applications	21.10.2024	20.04.2025
23.	Dr. Sourav Kanthal	NPDF	CMMP	Dr. Nitesh Kumar	Structure-property correlation in RAlGa quantum materials to realize topological spin textures	01.12.2025	Contd..
24.	Dr. Subhas Chandra Bera	DBT - RA I	CBS	Dr. Shubhasis Haldar	Development of a high-throughput single-molecule magnetic tweezers setup for automated antiviral drug screening	01.05.2025	Contd..
25.	Dr. Subhendu Bikash Ghosh	Project Post-doctoral Fellow (DST-NQM)	PCS	Dr. Manik Banik	Design and development of quantum entanglement – enhanced imaging systems	07.02.2025	Contd..
26.	Dr. Sujit Deshmukh	Ramanujan Fellow	CMMP	Prof. Anjan Barman	Laser-Assisted Synthesis of Single-Atom Catalysts for Zinc-Air Battery	06.01.2026	Contd..

Sl. No.	Name	Designation	Dept.	Mentor / Host	Title of The Project	Dt. of Joining	Dt. of Leaving
27.	Dr. Sumit Mukherjee	NPDF	AHEP	Prof. Archan S Majumdar	Characterizing Nonlocal and Contextual Correlations in Multipartite Quantum State Discrimination : Foundations and Applications to Quantum Communication Protocols	01.12.2025	Contd..
28.	Dr. Vibeizonuo Rupreo	CSIR RA	CBS	Prof. Rajib K Mitra	Probing Protein Aggregation Inhibition Using Terahertz Spectroscopy and Multi-Modal Experimental Approaches	06.08.2025	19.12.2025

Nibedita Konar | Debashish Bhattacharjee | Sanchari Dasgupta | Rupam Porel



THEORETICAL PHYSICS SEMINAR CIRCUIT

Topical Research School (TRS) [under the Theoretical Physics Seminar circuit (TPSC)] on Recent Advances in Physical and Chemical Sciences 11-13 March 2026

Cachar College, Silchar

Cachar College, Silchar successfully organized a three-day Topical Research School (TRS) on "Recent Advances in Physical and Chemical Sciences." The programme was jointly organized by the Departments of Physics and Chemistry of Cachar College in collaboration with the S. N. Bose National Centre for Basic Sciences (SNBNCBS), Kolkata.

The Topical Research School was part of the outreach and academic training initiatives of SNBNCBS under the Theoretical Physics Seminar circuit (TPSC), which seeks to bridge the gap between advanced scientific research and undergraduate education. The event brought together eminent scientists, academicians, and researchers from premier institutions across India, providing students with a unique opportunity to interact with leading experts in contemporary scientific research.

The programme was conducted under the overall leadership of Dr. Apratim Nag, Principal of Cachar College, while Dr. Avijit Chowdhury, Associate Professor, S.N. Bose National Centre of Basic Science Research, Kolkata and Dr. Gayatri Ghosh, Head of the Department of Physics, acted as the Programme Convenor. Dr.Rahul Kanti Nath, Dr. Dipyaman Mohantao Assistant Professor, Department of Chemistry, Cachar College served as joint convenor of Topical Research School.

Participation and Academic Impact

The Topical Research School witnessed enthusiastic participation from approximately 50 students and research scholars representing various institutions, including:

- Assam University
- NIT Silchar
- S. S. College



3-day seminar on advances in chemistry, physics concludes

CHRONICLE NEWS SERVICE

SILCHAR: The three-day seminar on recent advances in chemistry and physics, which began on Wednesday at Cachar College here, concluded on Friday. The programme was supported by the S. N. Bose National Centre for Basic Sciences. The seminar was organised jointly by the Topical Research School of the S. N. Bose National Centre for Basic Sciences and the departments of Physics and Chemistry of Cachar College.

The inaugural session was attended by Prof. Parthankar Choudhury, president, Topical Research School, and professor of Environmental Science at Assam University, Prof. Asim Roy, Registrar, NIT Silchar, Prof. Animesh Kole of the Indian Institute of Science, Prof. Himadri Shekhar Das, head, Physics Department, Assam University, and Dr. Abhijit Choudhury, joint convener, S. N. Bose National Centre for Basic Sciences.

Cachar College principal Dr. Apratim Nag, programme convener and head of the Physics Department Dr. Gayatri Ghosh, and joint convener from the Chemistry Department Dr. Rahul Kanti Nath were also present.

In her welcome address, Dr. Gayatri Ghosh said the seminar aims to familiarise students with recent developments in physics and chemistry and promote interdisciplinary research. She expressed hope that the discussions would help students understand new trends in science. Dr. Apratim Nag said the Topical Research School of the S. N. Bose National Centre for Basic Sciences has played an important role in scientific research in India. He said the students and researchers attending the seminar would benefit in their future research work. Experts and academicians from different parts of the country and abroad are expected to present their research during the programme.

Prof. Asim Roy said such academic discussions help students learn about modern directions in scientific research beyond classroom teaching. Prof. Himadri Shekhar Das encouraged students to take interest in scientific research and said the seminar would create curiosity about recent developments in science.

Prof. Parthankar Choudhury said environmental science, physics and chemistry are closely connected and that scientific progress should aim at protecting people, nature and the environment. Dr. Abhijit Choudhury said the seminar would help students understand new trends in chemistry and physics and how research priorities change with time and environmental needs.

After the inaugural session, the technical session began with Prof. Animesh Kole as the keynote speaker. Dr. Pradip Pachhale, assistant professor at the S. N. Bose National Centre for Basic Sciences, also delivered an online lecture titled "The Porous World with Nearly Nothing".

Prof. Kole spoke on "Plasma Physics and its Application to Limitless Clean Energy". He explained that plasma is known as the fourth state of matter after solid, liquid and gas. Natural examples include the sun, stars, lightning and auroras. He said scientists are trying to produce clean and unlimited energy using controlled plasma through nuclear fusion. On Earth, strong electromagnetic fields are used to ionise gases at very high temperatures, creating plasma that can conduct electricity efficiently. Such technology, he said, may open new possibilities for sustainable energy in the future.

The programme was jointly conducted by guest faculty members of the Physics Department Manali Chakraborty and Anushka Roy. The vote of thanks was delivered by Dr. Rahul Kanti Nath, while Dr. Dipyaman Mahanta of the Chemistry Department assisted in organising the event. Around 50 students and research scholars from Assam University, S. S. College, Karimganj College, NIT Silchar, Gurucharan University and Cachar College participated in it.

কাছাড় কলেজে আধুনিক রসায়ন ও পদার্থ বিজ্ঞানের অগ্রগতি নিয়ে আলোচনা

- Karimganj College
- Gurucharan College
- Cachar College

The event provided students with valuable insights into modern scientific research, interdisciplinary collaboration, and emerging technological developments in areas such as:

- Plasma physics
- Energy materials
- Nanotechnology
- Sustainable materials
- Astrophysics and cosmology
- Advanced spectroscopy and materials characterization



Manik Banik

Manik Banik
Convener, Theoretical Physics Seminar Circuit

REGISTRAR



Report on Administrative Matters

The Centre has rendered administrative support to its academic activities through its administrative and technical staff members who have professionally and sincerely carried out their duties for making the various events held in the Centre in year 2025-2026 successful. The Centre has 23 permanent staff, 7 in temporary status and 20 staff members in contractual category as on 31st March 2026, who have performed their duties efficiently under the able leadership of the Director and the Registrar. The smooth running of the day to day activities of the Centre including upkeep and maintenance of its various facilities like guest house (Bhagirathi), creche (Kishalay), security, EPABX, transport, canteen, electrical maintenance, AC maintenance, campus maintenance etc throughout the year have been made possible due to the professional services rendered by the manpower force the Centre employs through service agencies, working closely with the Administration. The Centre has maintained close liasion with the Department of Science and Technology and other ministries and have complied to all time-bound queries and reports sought. Various Parliament Questions, parliament information/reports, compliance reports, queries regarding Audit Paras, generation of reports regarding GEM, LIBMS are submitted on time to DST. The Centre has also timely replied to queries raised by CAG Audit Team, IAW-DST Audit Team and etc and successfully handed visits of the Audit Team. The Hindi Cell of the Centre has been functioning effectively and the Centre has undertaken substantial administrative work in hindi and made sincere efforts to implement and follow the provisions of Official Language Act in the year 2025-26.

The following Meetings of the Statutory Committees were held in FY 2025-26:

(i) The 72nd and 73rd Governing Body (GB) meetings of the Centre were held on 29.04.2025 and 10.09.2025 respectively.

(ii) The 49th and 50th Finance Committee (FC) meetings of the Centre were held on 28.04.2025 and 09.09.2025 respectively.

(iii) The 36th Academic & Research Programme Advisory Committee (ARPAC) meeting of the

Centre was held during 12th – 13th March 2026 respectively.

Right to Information (RTI) Act:

The Centre has adhered to the norms of the Right to Information Act and received sixteen (16) cases under the said Act in the period under consideration, all of which have been processed within stipulated time and successfully disposed off. All quarterly / annual progress reports pertaining to Rajbhasha, Vigilance & RTI have been submitted on time.

Celebrating Vigilance Awareness Week:

The Centre celebrated the Vigilance Awareness Week 2025 during 27th October 2025 to 2nd November 2025, by taking The Vigilance Pledge and arranged an Essay Competition (Topic: "Vigilance: Our Shared Responsibility"). The essay competition carried a cash award of Rs.5,000/- (1st prize), Rs.3,000/- (2nd prize) and Rs.1,000/- (3rd prize) with winners as:

- 1st Prize – Ms. Tanya Chaturvedi, Office Assistant (Hindi).
- 2nd Prize – Mr. Sutanu Mukhopadhyay, Senior Research Fellow.
- 3rd Prize – Mr. Supriyo Ganguly, Jr. Engineer (Electrical).

No cases related to vigilance were reported during 2025-2026.

Celebrating Swachhta Pakhwada:

The Centre celebrated 'Swachhta Pakhwada' from 1st May 2025 to 15th May 2025. As part of the Pakhwada on 01.05.2025, the Centre organised the Swachhta pledge taking ceremony and carried out mass cleaning of its premises and office buildings. Collection of wastes at different points and awareness campaign about no use of plastics was carried out. Posters titled "Zero Plastic, Green Campus" were displayed on all notice boards and all prominent places of the Centre. A motivational talk on the occasion of 'World Technology Day' titled "Biological Waste and its Disposal" was delivered by Dr. Amarnath Pal, PDRA-I, Dept. of Chemical Biological Sciences of the Centre. An Essay Writing Competition on "Swachhata Everyone's Business" was organised alongwith an invited lecture/workshop by Shri Chhandak Chakraborty, Rentokil Initial Hygiene India Pvt. Ltd. on 'Personal Hygiene'. A Health Check-up Camp for the Community Helpers of the Centre was organised by Techno India Dama Hospital, Kolkata. A special lecture was organised on health awareness "Beat Bad Cholesterol" by Dr. Aditya Verma, Consultant (Cardiologist), Techno India Dama Hospital, Kolkata. The staff and students of the Centre presented a short drama "Gobordhaner Goartumi" with the pledge to keep the environment clean and hygenic.

The Centre also observed "Swachhata Hi Seva" Special Campaign 5.0 with the theme "Swachhotsav" from 17th September 2025 – 2nd October 2025 in its premises. Swachhata Pledge was taken on 17.09.2025 as a part of the Special Campaign 5.0. The following activities were carried out during the above period viz. Preventative Health Check-up for Safai Mitras of the Centre, Plantation of trees, "Swachhotsav" Quiz, Shramdaan at Target Area, Cleaning and Beautification of the Centre, LED light installation, Exhibition cum Awareness Campaign "Waste to Art", Eye Check-up camp for the Community Helpers, Nationwide observance of "Ek din, Ek Ghanta, Ek Saath" campaign, In-house Lecture By Mr. Arghya Sardar, Scientist F on "The Growing Threat of Electronic Waste and Solutions", disinfection of sewage lines/manhole/drains of the Centre. The Centre carried out massive old records and documents weeding out.

Integrated Government Online Training (IGOT) Karmayogi Platform

The employees of the Centre have enthusiastically participated and completed certificate courses with great zeal available in the Integrated Government Online Training (IGOT) Karmayogi Platform throughout the year 2025-26 as per the directives received from DST, New Delhi. The Centre timely submitting quarterly reports and annual reports to DST regarding the Karmayogi Platform. The Centre also celebrated the 'National Learning Week'.

The Department of Science & Technology, Govt. Of India, in collaboration with the S.N.Bose National Centre for Basic Sciences, successfully organised a specialized 3-day training programme for the Karmayogi Coaches of the Eastern Zone. The programme held during 20th to 22nd January, 2026. This initiative was part of Phase-II of the Rashtriya Karmayogi-Large Scale Jan Seva Programme.

An in-house One-Day Training Programme under Phase-II of the "Rashtriya Karmayogi-Large Scale Jan Seva Programme" was held on 29.01.2026 at Fermion Hall of the Centre. All the permanent employees of the Centre participated in this programme. The programme was conducted by Deputy Registrar (Administration) and Deputy Registrar (Academic) as Master Trainers from the

Centre. The programme was designed to empower participants with enhanced administrative capabilities, a reinforced citizen-centric approach and insights into implementing digital governance solutions for effective and responsive public service delivery.

Celebration of World Environment Day:

A small programme preceded by a mass pledge taking ceremony was organised on the occasion of World Environment Day on 5th June 2025.

International Yoga Diwas:

The Centre celebrated the International Yoga Day; with the Theme: "Yoga for One Earth, One Health" on 20th June 2025 through a yoga session.

Special Days of Celebration:

The Centre celebrated the following events:

- The national flag was hoisted by the Director on 77th Republic Day on 26th January 2026 and 79th Independence Day on 15th August 2025. Both the occasions were attended by staff and students of the Centre and national anthem was sung to mark the occasions.
- On 1st January 2026, the Centre celebrated 132nd Birth Anniversary of Prof. Satyendra Nath Bose by garlanding the bust of the eminent scientist. The Centre organised 'Open Day' on 2nd January 2026 to commemorate the 132nd birth anniversary of Prof. Satyendra Nath Bose. Several visitors from outside attended the 'Open Day' Programme. To celebrate the occasion, popular talk by astrophysicist and science communicator, Dr. Debiprosad Duari on 'Concepts and Challenges in Astrophysics and Astronomy' was organised followed by visits to the Research Labs, SNBose Archive and Planet & Star watching in the evening were organised.
- Swachhta Pledge on 1st May 2025 & 17th September 2025;
- E-Pledge on "Vikasit Bharat Ka Mantra, Bharat ho Nashe se Swatantra" in Nasha Mukht Bharat Abhiyan (NMBA) on 12th August 2025;
- Vigilance Pledge on 27th October 2025;
- Rashtriya Ekta Diwas Pledge on 31st October 2025;
- Constitution Day (Samvidhan Diwas) Pledge on 26th November 2025.
- Foundation Day of the Centre was celebrated on 13th June 2025. The occasion started with welcome address by Prof. B.N.Jagatap, Chairman, Governing Body and address by Prof. Tanusri Saha-Dasgupta, Director, SNBNCBS followed by Scientific Talk on "Quantum Geometry of Electrons in 2D Materials: Proposald of GQuES Spectroscopies and Anomalous Hall Transistor" by Prof. Umesh V Waghmare, JNCASR, Bengaluru. The Research Scholars of the Centre also gave talk. The programme ended with Prize Distribution Ceremony and a sarod performance by renowned artist, Shri Indrayuddh Majumder.
- 'BOSE FEST 2026' held during 23rd March 2026 – 25th March 2026 was celebrated through Oral & Poster presentations by the students and scientific talks also took place.

Facilities

The Centre follows Contributory Medical Scheme (CMS) under which the Centre extends medical facilities (both outdoor and indoor) to all its staff members and their dependents (for permanent staff members) and to the scholars and contractual staff members (as individuals) has its own medical unit for the CMS beneficiaries where allopathic and homeopath physicians are available for regular consultation First Aid Treatments and facilities like oxygen, wheel chair, rest bed etc. are available in the Medical Cell. The Centre has cashless tie ups with some of the renowned hospitals in and around Kolkata viz. B.M. Birla Heart Research Centre, Medica Superspeciality Hospital, Peerless Hospitex Hospital and Research Centre Limited, Desun Hospital & Heart Institute, North City Hospital & Neuro Institute (P) Ltd., Suraksha Diagnostic Private Limited, Institute of Neurosciences, Kolkata, Techno India Dama Healthcare & Medical Centre etc. for indoor hospitalisation. These hospitals also extends OPD treatments to CMS members as per CGHS rates.

The Centre has collaborated with YourDOST, a Wellness Partner for creating / safeguarding awareness about mental health of its members. On 12.02.2026 the Centre hosted the "Workshop on Enriching Research Life" at the Silver Jubilee Hall of the Centre. YourDOST, the Wellness Partner of the Centre organised this event. The interactive event was organized for guiding the students and staff for mental well-being and balance in academia.

The Centre houses a modern Guest House by the name of 'Bhagirathi' comprising of 57 air conditioned rooms

(including Single Bed, Double Bed & Transit rooms), 5 air conditioned suites and a fully AC Seminar cum Dining Hall and Kitchen with modern facilities and Seminar room. 'Bhagirathi' also has an equipped Doctor's chamber and two Air Conditioned office rooms. The Centre has two hostels - 'Radhachura' and 'Krishnachura' which provides hostel accommodation to 160 students and small flatlets named 'Subarnarekha' providing accommodation to students and emergency staff. The students residing inside the campus run their own mess. The hostels have facilities like dining room, common room, games room etc. The Centre also houses a gymnasium. The Centre has limited accommodation for faculty members and Post Doctoral Fellows at 'Basundhara'. 'Basundhara' also houses facilities for larger groups, stay of students and summer students, administrative offices, offices of Post Docs etc. The Bose Archive dedicated to the life of Professor S.N. Bose, has personal artefacts and collections donated by the family of S.N.Bose. It also exhibits the life of Prof. Bose. The Archive is visited throughout the year by many people. There is also a virtual tour of the Archive available in the Centre's website.

The Centre has modernly equipped Lecture Halls / Seminar Halls namely : Silver Jubilee Hall (120 sitting capacity), BOSON (60 sitting capacity) and FERMION (80 sitting capacity) with lecture facilities to cater to the various events organised by the Centre viz. Lectures, Seminars, Colloquiums, Symposiums, Training programmes, Cultural Programmes, etc. throughout the year. These facilities are available for external users on rental basis.

The recreation hub of the Centre, 'Muktangan' hosted the following events in 2025-26:

- Rabindrajayanti' was celebrated on 8th May 2025;
- An Intra-Institute Chess Tournament on 10th & 11th July 2025;
- Fresher's Welcome on 25.09.2025;
- An Intra-Institute Football Tournament on 19th & 20th November 2025;
- An Intra-Institute Table Tennis Tournament on 26th & 27th November 2025;
- An Intra-Institute Carrom Tournament on 1st & 2nd December 2025;
- An Intra-Institute Cricket and Badminton Tournament on 10th & 11th January 2026 and 14th & 15th January 2026 respectively.

While concluding, I express my sincere thanks to the Deputy Registrars in the Administration, Finance and Academic Sections, the Section Incharges and the administrative and academic staff members of the Centre for their enthusiasm, dedication and cooperation in successfully organising the various activities and programmes throughout the year and for facilitating day to day smooth functioning of the administration. I am also grateful to Prof. Tanusri Saha-Dasgupta, Director for her valuable guidance and advice on administrative matters.



Shohini Majumder
Registrar



Staff Members of the Centre



Staff Members, Administrative Section



Staff Members, Purchase Section



Staff Members, Technical Cell

Hindi (Rajbhasha) Implementation in the Centre

In accordance with the Official Language Policy of the Government of India, several effective initiatives were undertaken during the year 2025–26 to promote the progressive use of Hindi in the Institute. Continuous efforts were made to encourage the use of Hindi in administrative and official work, resulting in increased awareness and participation among employees regarding the use of Hindi.

Replies to official correspondence were provided in Hindi as far as possible, and priority was given to bilingualism in office work. Nameplates, letterheads, visiting cards, seals, office orders, notifications, notices, and other administrative documents of the Institute were prepared in bilingual format. All information available on the Centre's website is displayed bilingually, and documents covered under Section 3(3) of the Official Languages Act have also been uploaded on the website.

Internal remarks and signatures in the attendance register are made in Hindi on the first day of every month. All administrative staff members and several academic staff members possess working knowledge of Hindi, and Hindi training is also being imparted through programmes conducted by the Department of Official Language, Government of India.

Quarterly progress reports related to Official Language implementation were submitted on time, and active participation of the Centre in meetings of the Town Official Language Implementation Committee (TOLIC) was ensured. All Official Language-related work in the Centre was carried out in accordance with the Official Language Policy and Rules of the Government of India. Continuous efforts were also made to increase the use of Hindi on the Centre's website, publications, and various informational materials.

To ensure effective implementation of Official Language Hindi, various meetings, workshops, training programmes, and competitions were organized throughout the year. These activities motivated employees to work in Hindi and further strengthened the use of Hindi in official work.

Meetings of the Official Language Implementation Committee

During the year 2025–26, meetings of the Official Language Implementation Committee were held on 18 June 2025, 19 August 2025, 30 December 2025, and 23 March 2026. In these meetings, the proceedings of previous meetings were reviewed and discussions were held on the effective implementation of suggestions received from the Department of Science and Technology.

Important decisions were taken regarding making all nameplates bilingual/trilingual, preparing bilingual salary slips, reviewing the status of Hindi training, and increasing the use of Hindi on the Centre's website and publications. Detailed discussions were also held regarding the organization of Hindi Month 2025.

In addition, five employees were nominated for Official Language Hindi training. Emphasis was laid on sending more quality articles and entries in Hindi for the forthcoming issue of the Department of Science and Technology's house magazine “Vitaan 2026”. All members were encouraged to contribute articles in Hindi or in their mother tongue.

Workshops and Training Programmes

Several workshops were organized during the year to promote the effective use of Official Language Hindi.

On 24 June 2025, a workshop on the topic “Use of Translation Tools in Official Work – How to Work Smoothly in Hindi” was organized, in which Mr. Pramod Rajak, Assistant Director (Official Language), Hindi Teaching Scheme (Eastern Region), guided the participants regarding the effective use of modern translation tools.

On 11 September 2025, a workshop on “Note and Draft Writing” was organized. On this occasion, Smt. Kavyanjali Mohanty, Director (Official Language), provided important insights into official drafting procedures, style, and practical aspects.

On 12 December 2025, a workshop titled "Official Language Laboratory – Accurate Words, Accurate Usage" was organized, in which Mr. Vijay Kumar Shaw, Assistant Director (Official Language), Directorate General of Income Tax (Investigation), West Bengal, Sikkim & North-East Region, Kolkata, guided participants on the precise use of official Hindi.

Further, on 27 March 2026, a workshop on "Implementation of Official Language in Offices and Our Responsibility" was organized, in which Mr. Ramesh Shaw, Assistant Director (Official Language), Employees' State Insurance Corporation, Barrackpore Sub-Regional Office, Salt Lake, Kolkata, delivered an informative lecture on effective implementation of the Official Language Policy.

Hindi Month 2025

Hindi Month was celebrated enthusiastically in the Centre during September 2025. Various literary, cultural, and knowledge-oriented programmes were organized with active participation from employees. The Hindi Day Inaugural Ceremony was organized on 01 September 2025. On 04 September 2025, a Hindi Essay Writing Competition was conducted on the topic "Increasing Use of AI: Advantages and Disadvantages". The main Hindi Day function was organized on 15 September 2025, in which the chief guests included Dr. Anindya Gangopadhyay, Head of the Hindi Department, Presidency University, and Shri L. K. Singh, Professor (Official Language Department). In addition, a Hindi Extempore Speech Competition was organized on 19 September 2025 and a Hindi Quiz Competition on 24 September 2025. Employees participated enthusiastically in all the programmes and showcased their creative interest in Hindi.

Winners of Competitions

Hindi Essay Writing Competition

- First Prize – Ajay Sharma (₹5000)
- Second Prize – Sakshi Chaudhary (₹4000)
- Third Prize – Ankit Kumar Shah (₹3000)

Hindi Extempore Speech Competition

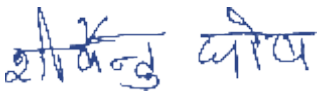
- First Prize – Dibyashree Chakraborty (₹1000)
- Second Prize – Lina Mukherjee (₹800)
- Third Prize – Arpan Rai (₹500)

Hindi Quiz Competition

- First Prize (₹6000)- Swapan Ghosh, Sunny Ahmed Molla, Lina Mukherjee, Shashank Shekhar Pandey (₹1500 each)
- Second Prize (₹5000)- Sanchari Dasgupta, Aman Das, Mahesh Singh Yadav, Rozina Parveen (₹1275 each)
- Third Prize (₹4000)- Supriya Ganguly, Lakshmi Sampui, Aditya Maitra, Amit Ghosh (₹1000 each)

The various activities, workshops, training programmes, and competitions organized during the year 2025–26 significantly promoted the use of Official Language Hindi in the Centre. A positive attitude towards working in Hindi was developed among employees, and the use of Hindi in official work witnessed steady growth.

The Centre remains committed to the effective implementation of the Official Language Policy in the future as well and will continue its efforts to establish Hindi as a strong language for administrative and scientific work.



Sirsendu Ghosh
In-charge Hindi Cell

COMMITTEES (As on 31.03.2026)

Governing Body

Prof. G.D.Yadav Former Vice - Chancellor Institute of Chemical Technology (ICT)	Chairman
Secretary Department of Science & Technology Government of India, New Delhi	Member
Dr. Venu Gopal Achanta CSIR-National Physical Laboratory (NPL), New Delhi	Member
Prof. Kamal Lochan Panigrahi Department of Physics, IIT, Kharagpur	Member
Prof. Chandrabhas Narayana Director, IBRIC-Rajiv Gandhi Centre of Biotechnology Thiruvananthapuram	Member
Prof. Santanu Bhattacharya Director, IISER, Tirupati	Member
Financial Advisor Department of Science & Technology Government of India, New Delhi	Member
The Chief Secretary Govt. of West Bengal	Member
Director Indian Association for Cultivation of Science Kolkata	Member
Director Bose Institute, Kolkata	Member
Prof. Tanusri Saha-Dasgupta Director S. N. Bose National Centre for Basic Sciences Kolkata	Member
Ms. Shohini Majumder Registrar S. N. Bose National Centre for Basic Sciences Kolkata	Non-Member Secretary

Finance Committee

Prof. Tanusri Saha-Dasgupta Director S. N. Bose National Centre for Basic Sciences Kolkata	Chairperson
Additional Secretary & Finance Advisor Department of Science & Technology Government of India, New Delhi	Member
Prof. Somak Raychaudhury Vice-Chancellor, Ashoka University (One Nominee of the Academic & Research Programme Advisory Committee	Member
Prof. Pallab Banerjee Professor Materials Science Centre, IIT, Kharagpur	Member
Ms. Shohini Majumder Registrar S. N. Bose National Centre for Basic Sciences Kolkata	Member Secretary

Academic & Research Programme Advisory Committee

Prof. D.D.Sarma Professor, Indian Institute of Science, Bengaluru	Chairman
Prof. Shobhana Narasimhan Professor, Jawaharlal Nehru Centre For Advanced Scientific Research, Bengaluru	Member
Prof. Arindam Ghosh Professor, Indian Institute of Science, Bengaluru	Member
Prof. Annapurni Subramaniam Director, Indian Institute of Science, Bengaluru	Member
Prof. Jayanta Kumar Bhattacharjee Distinguished Visiting, Professor, IACS, Kolkata	Member
Prof. Srabani Taraphder Professor, IIT, Kharagpur	Member
Prof. Amitava Raychaudhuri Professor Emeritus, University of Calcutta, Kolkata	Member
Prof. Kaushik Biswas Professor, Bose Institute, Kolkata	Member
Prof. Bushra Ateeq Joy Gill Chair Professor, IIT, Kanpur	Member
Prof. Tanusri Saha-Dasgupta Director S. N. Bose National Centre for Basic Sciences Kolkata	Member
Prof. Anjan Barman Dean (Faculty) S. N. Bose National Centre for Basic Sciences Kolkata	Member
Prof. Ranjit Biswas Dean (Academic Programme) S. N. Bose National Centre for Basic Sciences Kolkata	Member
Ms. Shohini Majumder Registrar S. N. Bose National Centre for Basic Sciences Kolkata	Non –Member Secretary
Prof.Sunandan Gangopadhyay Head, Department of Astrophysics and High Energy Physics S. N. Bose National Centre for Basic Sciences Kolkata	Permanent Invitee
Prof. Punyabrata Pradhan Head, Department of Physics of Complex Systems S. N. Bose National Centre for Basic Sciences Kolkata	Permanent Invitee
Prof. Manoranjan Kumar Head, Department of Condensed Matter and Materials Physics S. N. Bose National Centre for Basic Sciences Kolkata	Permanent Invitee
Prof. Rajib Kr. Mitra Head, Department of Chemical and Biological Sciences S. N. Bose National Centre for Basic Sciences Kolkata	Permanent Invitee

Building Committee

Prof. Tanusri Saha-Dasgupta Director S. N. Bose National Centre for Basic Sciences Kolkata	Chairperson
Mr. Asim Sinha Chief Engineer (Retired), Electrical, CPWD	Member
A nominee of the DST Autonomous Institution Division Department of Science & Technology, New Delhi	Member
Dr. Tapash Kr. Roy Associate Professor, Dept. of Civil Engineering and Superintending Engineer (Acting), Indian Institute of Engineering Science and Technology Shibpur.	Member
Ms. Shohini Majumder Registrar S. N. Bose National Centre for Basic Sciences Kolkata	Member- Secretary
Campus Engineer cum Estate Officer, SNBNCBS, Kolkata	Special Invitee
Mr. Suman Saha Deputy Registrar (Finance) SNBNCBS, Kolkata	Special Invitee

Consultative Advisory Committee

Prof. Tanusri Saha-Dasgupta Director S. N. Bose National Centre for Basic Sciences Kolkata	Chairperson
Prof. Anjan Barman Dean (Faculty) S. N. Bose National Centre for Basic Sciences Kolkata	Member
Prof. Ranjit Biswas Dean (Academic Programme) S. N. Bose National Centre for Basic Sciences Kolkata	Member
Prof. Punyabrata Pradhan Head, Department of Physics of Complex Systems S. N. Bose National Centre for Basic Sciences Kolkata	Member
Dr. Sunandan Gangopadhyay Head, Department of Astrophysics and High Energy Physics S. N. Bose National Centre for Basic Sciences Kolkata	Member
Prof. Rajib Kr. Mitra Head, Department of Chemical and Biological Sciences and Macromolecular Sciences S. N. Bose National Centre for Basic Sciences Kolkata	Member
Prof. Manoranjan Kumar Head, Department of Condensed Matter and Materials Physics S. N. Bose National Centre for Basic Sciences Kolkata	Member
Ms. Shohini Majumder Registrar S. N. Bose National Centre for Basic Sciences Kolkata	Member
Mr. Debashish Bhattacharjee Deputy Registrar (Administration) S. N. Bose National Centre for Basic Sciences Kolkata	Member
Mr. Suman Saha Deputy Registrar (Finance) S. N. Bose National Centre for Basic Sciences Kolkata	Member
Ms. Nibedita Konar Deputy Registrar (Academic) S. N. Bose National Centre for Basic Sciences Kolkata	Member - Secretary

Official Language Implementation Committee

Prof. Tanusri Saha-Dasgupta Director S. N. Bose National Centre for Basic Sciences Kolkata	Chairperson
Ms. Shohini Majumder Registrar S. N. Bose National Centre for Basic Sciences Kolkata	Member
Prof. Manoranjan Kumar Professor & Head, Department of Condensed Matter and Materials Physics S. N. Bose National Centre for Basic Sciences Kolkata	Member
Dr. Nitesh Kumar Assistant Professor S. N. Bose National Centre for Basic Sciences Kolkata	Member
Mr. Debashish Bhattacharjee Deputy Registrar (Administration) S. N. Bose National Centre for Basic Sciences Kolkata	Member
Ms. Nibedita Konar Deputy Registrar (Academic) S. N. Bose National Centre for Basic Sciences Kolkata	Member
Mr. Suman Saha Deputy Registrar (Finance) S. N. Bose National Centre for Basic Sciences Kolkata	Member
Campus Engineer cum Estate Officer S. N. Bose National Centre for Basic Sciences Kolkata	Member
Mr. Sirsendu Ghosh In-charge, Hindi Cell S. N. Bose National Centre for Basic Sciences Kolkata	Member

ACADEMIC MEMBERS 2025-26

ACADEMIC MEMBERS (REGULAR FACULTIES): 2025-2026 [01.04.2025 - 31.03.2026]		
Sl. No.	**Name of the faculty**	**Designation**
1.	Tanusri Saha Dasgupta	Director & Senior Professor : CMMP
2.	Archan S Majumdar	Senior Professor : AHEP
3.	Priya Mahadevan	Senior Professor : CMMP
4.	Ranjit Biswas	Senior Professor : CBS
5.	Samir Kumar Pal	Senior Professor : CBS
6.	Anjan Barman	Senior Professor : CMMP
7.	Jaydeb Chakrabarti [Retired on 31.12.2025]	Senior Professor : PCS
8.	Rajib Kumar Mitra	Senior Professor : CBS
9.	Soumen Mondal	Senior Professor : AHEP
10.	Manik Pradhan	Senior Professor : CBS
11.	Prosenjit Singha Deo	Professor : PCS
12.	Punyabrata Pradhan	Professor : PCS
13.	Manoranjan Kumar	Professor : CMMP
14.	Sakuntala Chatterjee	Professor : PCS
15.	Sunandan Gangopadhyay	Professor : AHEP
16.	Ramkrishna Das	Professor : AHEP
17.	Suman Chakrabarty	Professor : CBS
18.	Atindra Nath Pal	Associate Professor : CMMP
19.	Thirupathaiah Setti	Associate Professor : CMMP
20.	Manik Banik	Associate Professor : PCS
21.	Urna Basu	Associate Professor : PCS
22.	Shubhasis Haldar	Associate Professor : CBS
23.	Tapas Baug	Associate Professor : AHEP
24.	Avijit Chowdhury	Associate Professor : CMMP
25.	Pradip S Pachfule	Associate Professor : CBS
26.	Arghya Sardar [Joined on 18.06.2025]	Scientist F : CBS
27.	Sanjoy Choudhury	Scientist 'E'
28.	Nitesh Kumar	Associate Professor : CMMP
29.	Arijit Haldar	Associate Professor : PCS
30.	Saquib Shamim	Assistant Professor : CMMP
31.	Parijat Dey	Assistant Professor : AHEP
32.	Barun Ghosh	Assistant Professor : CMMP
33.	Chayan Mondal [Joined on 08.09.2025]	Assistant Professor : AHEP
AHEP : Department of Astrophysics and High Energy Physics		PCS : Department of Physics of Complex Systems
CBS : Department of Chemical and Biological Sciences		CMMP : Department of Condensed Matter and Materials Physics

ADMINISTRATIVE AND TECHNICAL STAFF MEMBERS

Shohini Majumder	Registrar
Suman Chakrabarty	Part-time Chief Vigilance Officer
Debashish Bhattacharjee	Public Information Officer

OTHER MEMBERS

Nibedita Konar	Deputy Registrar (Academic)
Debashish Bhattacharjee	Deputy Registrar (Administration)
Suman Saha	Deputy Registrar (Finance)
Saumen Adhikari	Librarian cum Information Officer
Mithilesh Kumar Pande	Campus Engineer cum Estate Officer *[released w.e.f. 10.12.2025]*
Santosh Kumar Singh	Assistant Registrar (Purchase)
Sirsendu Ghosh	Programme Coordinating Officer
Achyut Saha	Personal Assistant to Director
Swapnamoy Datta	Stenographer
Sanchari Dasgupta	Assistant (General)
Jaydeep Kar	Programme Assistant
Prosenjit Talukdar	Programme Assistant
Subham Paul	Pump Operator
Bhupati Naskar	Library Stack Assistant
Siddhartha Chatterjee	Upper Division Clerk
Swarup Dutta	Project Assistant
Arpan Roy	Guest House Assistant *[joined w.e.f. 04.06.2025]*
Tufan Maitra	Driver
Amit Ghosh	Attendant
Swapan Ghosh	Attendant
Rajarshi Barman	Attendant
Suprobhat Naskar	Attendant
Anirban Bhattacharya	Attendant

PERSONNEL WITH TEMPORARY STATUS

Dulal Chatterjee	Attendant (Maintenance) *[superannuated on 28.02.2026]*
Sudhanshu Chakraborty	Attendant (Technical Cell)
Hiralal Das	Cleaner
Kartick Das	Cleaner
Motilal Das	Cleaner
Prakash Das	Cleaner
Ramchandra Das	Cleaner
Nimai Naskar	Gardener

PERSONNEL ON CONTRACTUAL APPOINTMENT

B.S.Panda	Consultant (Legal)
Sutapa Basu	PS to Registrar
Deblina Mukherjee	Junior Computer Engineer
Amit Roy	Technical Assistant (Library)
Gurudas Ghosh	Technical Assistant (Library)
Ananya Sarkar	Technical Assistant (Library)
Shakti Nath Das	Technical Assistant
Urmi Chakraborty	Technical Assistant
Amit Kumar Chanda	Technical Assistant

Joy Bandopadhyay	Technical Assistant
Ganesh Gupta	Junior Engineer (Electrical)
Supriyo Ganguly	Junior Engineer (Electrical)
Amitava Palit	Junior Engineer (Civil)
Lakshmi Chattopadhyay	Junior Engineer (Civil)
Chandrakana Chatterjee	Office Assistant
Rupam Porel	Office Assistant
Mitali Bose	Office Assistant
Suvodip Mukherjee	Office Assistant
Lina Mukherjee	Jr. Office Assistant
Sani Amed Ali Molla	Technician (AC & Refrigeration)
Suranjan Deb	Telephone Technician

PERSONNEL ON CONTRACTUAL APPOINTMENT

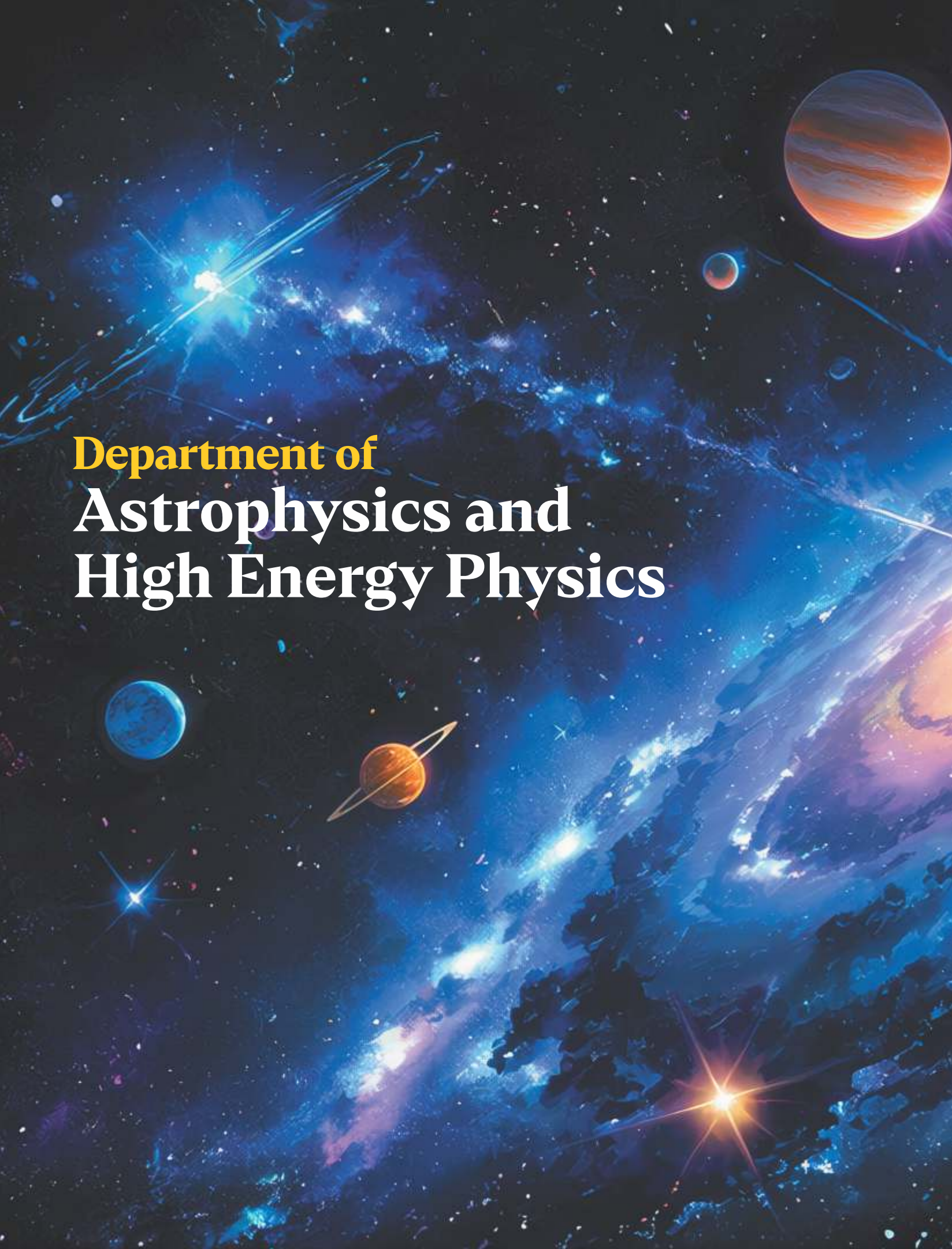
(hired through outsourced agency).

Mr. Krishnendu Patra	Clerk (Accounts)
Ms. Sanchari Chatterjee	Clerk (Accounts) *[resigned w.e.f. 05.05.2025]*
Ms. Renu Singh	Office Assistant (Hindi) *[resigned w.e.f. 03.10.2025]*
Ms. Tanya Chaturvedi	Office Assistant (Hindi) *[joined w.e.f. 04.10.2025]*

Mr. Arnab Saha	Project Associate II
Mr. Jagadish Prasad Sahoo	Project Associate II
Mr. Debarghya Ghosh	Project Associate II
Mr. Sushanta Sutradhar	Project Associate II
Mr. Sourav Sinha	Technical Assistant
Mr. Aditya Maitra	Technical Assistant
Mr. Subhabrata Das	Mechanic
Mr. Gobinda Das	Driver
Mr. Prabir Patra	Caretaker
Mr. Subhajit Das	Clerk (Record Keeper)
Mr. Ankit Shah	Clerk (Purchase)
Mr. Sudipta Paul	Clerk (Academic)
Mr. Sandeep Das	Accounts Clerk *[joined w.e.f. 18.08.2025]*
Ms. Kankana Barua	Accounts Clerk *[joined w.e.f. 03.11.2025]*

MEDICAL CELL (CONSULTANT PHYSICIANS)

Dr. Chayan Bhattacharya	Authorised Medical Officer
Dr. Sarbani Bhattacharya	Medical Officer
Dr. Tridib Kumar Sarkar	Doctor of Homeopathy



Department of
Astrophysics and High Energy Physics





Archan Subhra Majumdar

Senior Professor
Astrophysics and High Energy Physics
archan@bose.res.in

Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Shashank Shekhar Pandey; Gravitation and Cosmology; Thesis Submitted
2. Bivas Mallick; Quantum Information; Thesis Submitted
3. Saheli Mukherjee; Quantum Information; Under Progress
4. Pritam Roy; Quantum Information; Under Progress
5. Sudip Chakrabarty; Quantum Information; Under Progress
6. Subhadeep Mukherjee; Gravitation and Cosmology; Under Progress
7. Subhankar Bera; Quantum Information; Awarded
8. Arun Kumar Das; Quantum Information; Thesis Submitted

b) Post-Docs

1. Amit Kundu; Quantum Information and Foundations
2. Sumit Mukherjee; Quantum Information and Foundations

Teaching

1. Autumn Semester; Project Research II PHY 509; Integrated PhD; 1 student
2. Spring Semester; Project Research III PHY 502; Integrated PhD; 1 student
3. Spring Semester; Astrophysics and Astronomy; Integrated PhD; 8 students; Shared

Publications

a) In journals

1. Subhadeep Mukherjee, Shashank Shekhar Pandey and **A. S. Majumdar**, *Constraining the Hubble parameter with the 21-cm brightness temperature signal in a universe with inhomogeneities*, Physical Review D, 112, 063520, 2025
2. Subhankar Bera, Soumyakanti Bose, Hyunseok Jeong, and **A. S. Majumdar**, *Sharing quantum nonlocality and teleportation over long distances using optical hybrid states*, Journal of the Optical Society of America B, 42, 2505-2513, 2025
3. Bivas Mallick, Ananda G. Maity, Nirman Ganguly and **A. S. Majumdar**, *Higher-dimensional-entanglement detection and quantum-channel characterization using moments of generalized positive maps*, Physical Review A, 112, 012416, 2025
4. Saheli Mukherjee, Bivas Mallick, Sahil Gopalkrishna Naik, Ananda G. Maity and **A. S. Majumdar**, *Detecting genuine multipartite entanglement using moments of positive maps*, Physical Review A, 112, 062428, 2025
5. Arun Kumar Das, Saheli Mukherjee, Debashis Saha; Debarshi Das, **A. S. Majumdar**, *Classifying measurement incompatibility under classical pre-*

and post-processing operations, Proceedings of the Royal Society A, 482(2329), 20250045, 2026

6. Bivas Mallick, Saheli Mukherjee, Nirman Ganguly and **A. S. Majumdar**, *Detection of nonabsolute separability in quantum states and channels through moments*, Physical Review A, 113, 012433, 2026
7. Pritam Roy, Subhankar Bera & **A. S. Majumdar**, *Secure one-sided device-independent quantum key distribution under collective attacks with enhanced robustness*, Quantum Information Processing, 25, 46, 2026
8. Pritam Roy, Subhankar Bera, **A. S. Majumdar** and Shiladitya Mal, *Robust certification of quantum instruments through a sequential communication game*, Physical Review A, 113, 022611, 2026
9. Soumyabrata Hazra, Debashis Saha, Anubhav Chaturvedi, Subhankar Bera and **A. S. Majumdar**, *Efficient Computation of Generalized Noncontextual Polytopes and Quantum violation of their Facet Inequalities*, Quantum, 10, 2015, 2026

Independent publications of student/s

10. Saheli Mukherjee, Bivas Mallick, Arun Kumar Das, Amit Kundu and Pratik Ghosal, *Measurement-device-independent Schmidt number certification of all entangled states*, Physical Review A, 112, 062434, 2025
11. Komal Kumar, Bivas Mallick, Tapaswini Patro & Nirman Ganguly, *Fidelity of entanglement and quantum entropies: unveiling their relationship in quantum states and channels*, The European Physical Journal Plus, 140, 989, 2025
12. Sudip Chakrabarty, Bivas Mallick, Saheli Mukherjee and Ananda G. Maity, *Probing Kirkwood-Dirac nonpositivity and its operational implications via moments*, Physical Review A, 113, 032434, 2026

Talks / Seminars Delivered in reputed conference / institutions

1. International Symposium on Quantum Information and Quantum Computation; 02/04/2025; CQuERE, TCG Crest; 45 mins
2. International Quantum Day Seminar; 14/04/2025; CQST, SOA University; 30 mins
3. Summer School on Quantum Foundations; 06/06/2025; Biswa Bangla Convention Center; 40 mins
4. 22nd Lomonosov Conference on Elementary Particle Physics; 26/08/2025; Moscow State University; 25 mins
5. International Conference on Quantum Optics and related topics; 03/10/2025; Online; 60 mins
6. Young Astrophysicists of Today's India: Workshop; 08/10/2025; ICSP, Kolkata; 30 mins
7. Quantum Foundations and Technological Applications; 07/12/2025; IISER Mohali; 35 mins
8. International Conference on Quantum Information Science and Technology; 10/12/2025; TCG Crest; 30 mins
9. Exploring the 2025 Nobel Prize in Physics; 29/12/2025; RKMVERI; 60 mins
10. National Symposium on Quantum Information and Foundations; 17/03/2026; PAMU, ISI Kolkata; 40 mins

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Department of Physics and Astronomy, Seoul National University; Sl. No. 2; International
2. Okinawa Institute of Science and Technology; Sl. No. 3, 4; International
3. IISER Thiruvananthapuram; Sl. No. 5, 9; National
4. BITS Pilani Hyderabad; Sl. No. 3, 6, 10; National
5. CIT Chennai; Sl. No. 8; National
6. Gdansk Institute of Science and Technology; SL. No. 9; International

Outreach program organized / participated

1. Invited Talk Delivered in National Science Day Symposium at Rani Rashmoni Green University on 02.03.2026

Areas of Research

Gravitation & Cosmology

Quantum Information & Foundations

We consider the 21cm brightness temperature as a probe of the Hubble tension in the framework of an inhomogeneous cosmological model. Employing Buchert's averaging formalism to study the effect of inhomogeneities on the background evolution, we calibrate the effective matter density using MCMC analysis using Union 2.1 Supernova Ia data. Our results show that a higher Hubble constant (∼73 km/s/Mpc) leads to a shallower absorption feature in the brightness temperature versus redshift curve. On the other hand, a lower value (∼ 67km/s/Mpc) produces a remarkable dip in the brightness temperature. Such a substantial difference is absent in the standard LCDM model. Our findings indicate that large-scale inhomogeneities could significantly affect the 21cm signal, and may shed further light on the different measurements of the Hubble constant.

We analyze sharing Bell-type nonlocal correlation between two distant parties with optical hybrid states comprising a single photon polarization state and a multiphoton coherent state. By deploying entanglement swapping over the coherent state parts at the middle station, we show that the optical hybrid states can efficiently generate a polarization-entangled state that violates Bell-inequality well over a metropolitan distance. Our results with realistic devices, embedding detection inefficiency and transmission losses, indicate the viability of faithful quantum teleportation over large distances.

We propose experimentally feasible schemes for detecting higher dimensional and genuine multipartite entanglement, based on the truncated moments of positive maps. Our method avoids the need for full state tomography, making it scalable for larger systems. We provide illustrative examples to demonstrate the efficacy of our formalism in detecting bound entanglement and also inequivalent classes of tripartite genuine entanglement. We further present an operational implication of our proposed moment criterion through its manifestation in channel discrimination tasks. Our protocol is moreover extended for channel detection as well as detection of non-absolutely separable states.

We propose a communication game in the sequential measurement scenario, involving a sender and two receivers with restricted communication among the latter parties. In the framework of the prepare-transform-measure scenario, we show that our protocol enables a more robust certification of the unsharp measurement parameter. We generalize our game to higher-dimensional systems, revealing greater quantum advantage with increase in dimensions.

We present an operational approach that leverages classical operations on the inputs (pre-processing) and outputs (post-processing) of measurement devices to explore different layers of incompatibility among the measurements performed by the devices, illustrating incompatibility witnesses for classical operations.

Finding a set of empirical criteria fulfilled by any theory satisfying the generalized notion of noncontextuality is a challenging task of both operational and foundational importance. We present a methodology for constructing a polytope whose facet inequalities can be obtained in a computationally efficient manner, uncovering several hitherto unexplored noncontextuality inequalities. Our method enables applications of quantum contextual correlations in quantum key distribution, certification of non-projective measurements, witnessing the dimension of quantum systems, and randomness certification.

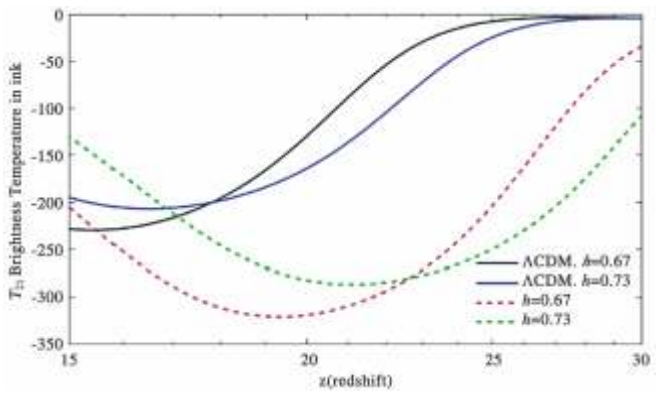


Fig. 1. 21-cm brightness temperature T_{21} as a function of redshift in the range 15 £ z £ 30 for different H_0 values. The plot shows that for H0 = 67 km/s/Mpc (Planck), the absorption dip in T_{21} is deeper and more consistent with EDGES observations, compared to H_0 = 73 km/s/Mpc (SH0ES) for the backreaction model.

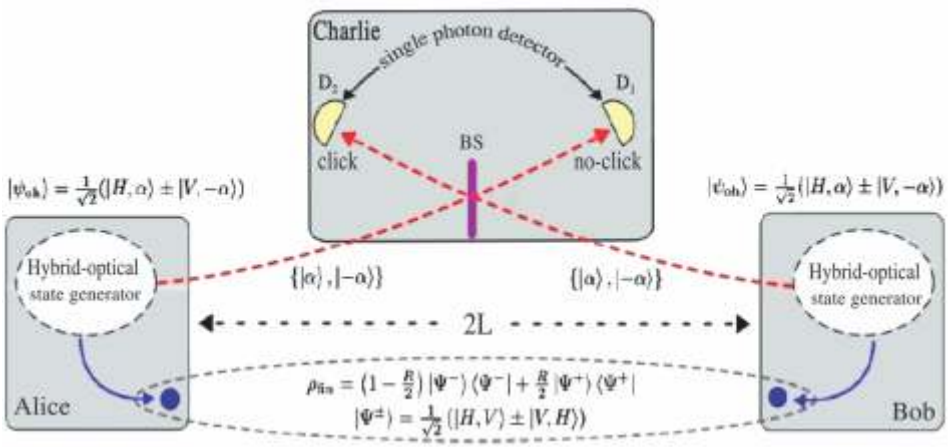


Fig. 2. Schematic for sharing distant DV Bell pair using optical hybrid states. Two parties, say, Alice and Bob, send the coherent states [|a>, |–a>] to a third party in the middle, say, Charlie, Subsequently, Charlie mixes the incoming signals through a balanced beam splitter, followed by photon measurement by two on-off detectors. Upon receiving the information about which detectors click, Alice and Bob post-select the overall state to the desired form.

Plan of Future Work Including Project

Quantum networks enable forms of nonlocality beyond the standard Bell scenario, with a multitude of potential applications. Continuous-variable (CV) platforms are particularly attractive for large-scale networks, offering deterministic entanglement generation and favorable prospects for long-distance distribution. Here we present a formalism to study CV network nonlocality using pseudospin measurements. Considering the linear chain and star configurations, we derive the maximal violations of the corresponding network locality inequalities for arbitrary two-mode states. Using two-mode squeezed vacuum states, we show that the strength of nonlocality in the star configuration remains independent of the network size. Moreover, the nonlocal correlations persist even at arbitrarily high temperatures provided the squeezing exceeds a critical threshold. Further, we demonstrate non-Gaussianity as an enhancer of network nonlocality through illustrations of various classes of non-Gaussian resources. Remarkably, a coherent superposition of single-photon subtractions across modes achieves maximal violation for vanishing squeezing. Finally, we provide schematics of an experimentally feasible implementation of CV network nonlocality based on the isomorphism between pseudospin and spatial parity observables.

Quantifying multipartite entanglement in quantum many-body systems and hybrid quantum computing architectures is a fundamental yet challenging task. In recent years, thermodynamic quantities such as the maximum extractable work from an isolated system (the ergotropy) have allowed for entanglement measures that are operationally more accessible. However, these measures can be restrictive when applied to systems governed by Hamiltonians with strong collective or interparticle interactions. Motivated by advances in quantum simulators, we propose a framework that circumvents these restrictions by evaluating global and local ergotropy either through controlled quenching of interactions or by measuring suitable local observables only. We show that this formalism allows us to correctly estimate genuine multipartite entanglement in both stationary and time-evolved states of systems with strong interactions, including parametrized quantum states simulated on a quantum circuit with varying circuit depth and noise. We demonstrate its applicability to realistic physical models-namely, the Tavis-Cummings model, the three-level Dicke model, and the transverse-field Ising model-highlighting its potential as a versatile tool for characterizing entanglement in near-term quantum simulators.

Replacing the task of retrieval with exclusion changes how preparation contextuality manifests operationally under parity-oblivious constraints, with exclusion showing a quantum advantage where retrieval does not. We introduce the parity-oblivious random exclusion code (POREC) and show that for prime symbol size "m", classical and preparation-noncontextual encodings provide a tight noncontextual bound. For the first nontrivial case (two digits, three symbols) our derived exact qubit optimum violates this bound, in contrast to parity-oblivious retrieval which displays no quantum advantage. This characteristic difference is absent without parity constraints. For general prime "m", qubit strategies

achieve a quantum-to-noncontextual gap that grows linearly relative to the random exclusion code (REC) gap, exceeding both parity-oblivious retrieval and standard REC. The exact qubit bound yields a sharp semi-device-independent certification of dimension $d > 3$. Our analysis of noise robustness demonstrates POREC to be amenable for experimental implementation on existing prepare-and-measure platforms, establishing parity-oblivious exclusion as a distinct operational probe of preparation contextuality, as well as a practical information processing protocol with wide applications.

We study the optical depth to reionization in a cosmological setting that includes backreaction from matter inhomogeneities, using the Buchert averaging formalism. We consider a spacetime model consisting of multiple inhomogeneous domains, hereafter referred to as the backreaction model, characterized by a set of parameters. We first examine how these parameters influence the computation of the optical depth to reionization. Next, we carry out a Markov Chain Monte Carlo (MCMC) analysis based on the Pantheon Plus + SH0ES Type Ia supernova sample to infer the best-fit values of the model parameters, and then use these to evaluate the optical depth to reionization, obtaining a value which is closer to the observational estimates compared to the value predicted by the standard cosmological model. We further demonstrate that the backreaction model leads to a modest reduction of the Hubble tension, while avoiding the need for exotic or non-standard physics.

We explore the stochastic fluctuation paradigm of spacetime geometry aimed at investigating quantum gravity-induced decoherence. Specifically, we examine the impact of kappa-Minkowski-type quantum spacetime on neutrino oscillations, revealing that stochastic fluctuations in quantum spacetime give rise to a distinctive energy-dependent power law in the decoherence effect for relic neutrinos. This effect is particularly pronounced for low-energy neutrinos, such as those from the cosmic neutrino background. Our results highlight the potential for developing new models of low-energy quantum gravity-induced decoherence, which could inform future experiments like IceCube-Gen2 and KM3NeT in further constraining the deformation parameter.

The dimensionality of entanglement, quantified by the Schmidt number, is a valuable resource for a wide range of quantum information processing tasks. In this work, we introduce the notion of the absolute Schmidt number, referring to states whose Schmidt number cannot be increased by any global unitary transformation. We provide a characterization of the set of arbitrary-dimensional states whose Schmidt number is invariant under all global unitaries. Our approach enables us to develop both witness-based and moment-based techniques to detect nonabsolute Schmidt number states which could provide significant operational advantages through Schmidt number enhancement by global unitaries. We next formulate two resource-theoretic measures of nonabsolute Schmidt number states, based respectively on Schmidt number witness and robustness, and demonstrate an operational utility of the latter in a channel discrimination task. Finally, we extend our analysis to quantum channels by introducing a new class of channels that possess the absolute Schmidt number property. We derive a necessary and sufficient condition for identifying when a channel has the absolute Schmidt number property, confining our analysis to the class of covariant channels.



Chayan Mondal

Assistant Professor
Astrophysics and High Energy Physics
cmondal@bose.res.in

Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Saptarshi Dutta; Probing polycyclic aromatic hydrocarbon (PAH) dust in star-forming and quiescent galaxies; Under Progress

b) External Project Students / Summer Training

1. Ankit Kumar Bera (external - MS thesis project); Galaxy evolution in cluster environment: exploring through AstroSat UV Deep field observation of MACSJ0416.1-2403; IISER Berhampur
2. Surjo Ghosh (SNBNCBS summer project); Understanding nebular emission in galaxies through synthetic models; IISER Kolkata
3. Barnisha Ghosh (external - summer internship); Impact of stellar feedback in galaxy evolution; Adamas University

Teaching

1. Spring Semester Astrophysics & Astronomy (PHY 504); Integrated PhD; 10 students; Shared
2. Spring Semester Research Project I (PHY 494); Integrated PhD; 2 students
3. Spring Semester Project Research III (PHY 502); Integrated PhD; 2 students
4. Certificate course on Observational Astronomy (Semester II 2025, Semester I 2026)

Talks / Seminars Delivered in reputed conference / institutions

1. Invited talk at the Platinum Jubilee Conference on Contemporary Physics, IIT Kharagpur; 29/03/2026; IIT kharagpur, Kharagpur, India; 30 minutes
2. Invited Talk at Topical Research School, Cachar College, Silchar (organised jointly by S. N. Bose National Centre for Basic Sciences and Cachar college); 13/03/2026; Remote presentation 60 minutes
3. Contributed talk at the AstroSat Conference (AC-2026) on 'A Decade of AstroSat Observations: Science Outcomes and Future Prospects'; 31/01/2026; U R Rao Satellite Centre (URSC), Bangalore, India; 15 minutes

Administrative duties

1. Admission interview committee (IPhD: June 2026; PhD: June 2026, December 2025)
2. PDRA selection committee (November 2025 Cycle)
3. JRF to SRF upgradation committee (October 2025)
4. Annual evaluation committee (December 2025)
5. Evaluation committee for Oral presentation - Bose Fest 2026

Scientific collaborations with other national / international institutions

1. Collaborative visit to the Indian Institute of Astrophysics, Bangalore during 2-3 February, 2026 to discuss ongoing work on nearby star-forming galaxies, dynamical evolution of collisional galaxies, Panchet Observatory project "; An FUV-optical Approach for Studying Hierarchical Star Formation in Nearby Galaxies

with UVIT", Ananthu, Sanal; Shashank, Gairola; Subramanian, Smitha; Jayanth, Rao C.; Menon, Shyam H.; Mondal, Chayan; Muraleedharan, Sreedevi; Astrophysical Journal (ApJ), Volume 1002, Issue 2, id.220, 17; National

2. Collaborative visit to the Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), Taiwan during 6 - 12 June, 2026 to discuss ongoing work on PAH emission in distant galaxies, spectral modeling of Population III galaxies, and to attend the JCMT user meeting; MIRI probes PAH emission from star-forming and quiescent galaxies at z = 0.5-0.8, Mondal et al. (in preperation); International

Outreach program organized / participated

1. Participated in sky watching (rooftop at the SNBNCBS) on the Open Day 2026 (January 2, 2026) in Commemoration of Prof. S. N. Bose's 132nd Birth Anniversary
2. Presented an invited Talk (remote - March 13, 2026) at Topical Research School, Cachar College, Silchar (organised jointly by S. N. Bose National Centre for Basic Sciences and Cachar college)
3. Presented an invited Talk (remote - October 15, 2025) at the National Astronomy Network of IAPT (NASNI), a dedicated platform under the Indian Association of Physics Teachers (IAPT), designed to foster interest and engagement in astronomy and sky watching among students, educators, and the general public

Areas of Research

The primary goal of my research work is to understand the physical, chemical, and structural evolution of galaxies at different cosmic times. I use multi-wavelength imaging and spectroscopic observations of Deep fields acquired with different telescopes (eg. AstroSat/UVIT, HST, JWST, MUSE, Keck, Spitzer, Herschel) and study distant galaxies to understand: (i) the formation and evolution of interstellar dust particles in diverse galaxy populations, and (ii) to find and characterize Lyman Continuum leakers at intermediate redshift (i.e., z ~ 1-3) to indirectly probe the nature of galaxies that have contributed in the cosmic reionization. The two primary deep fields that I have been working on are AstroSat UV Deep Field South (AUDFs) and north (AUDFn), which respectively cover the HST GOODS-S and GOODS-N fields. I am particularly investigating the nature of polycyclic aromatic hydrocarbon (PAH) dust molecules in both star-forming and quiescent galaxies at redshifts around 0.5 - 0.8 using the JWST MIRI observations. The primary goal is to understand how energetic UV photons from young stars can regulate the heating or destruction of PAHs in galaxies. Related to the LyC leakers, we have identified one galaxy at z = 2.98 that shows HeII1640 emission along with physical properties favourable to galaxies that leak LyC photons. We have been conducting follow up searches to understand any potential link between He+ ionization and LyC leakage in galaxies. At the local universe, I study the nature of recent star formation and young star-forming clumps in irregular and spiral galaxies using multi-wavelength observations. I extensively use UV observations from the Ultra-Violet Imaging Telescope onboard India's first space observatory, AstroSat, for these studies. Two primary questions that I aim to answer are: What regulates star formation in massive spiral and low-mass dwarf galaxies?, and how can the external and internal environment affect the evolution of a galaxy? I also study the dynamical evolution of galaxies by probing one of the unique systems known as collisional ring galaxies. The goal is to understand whether galaxies can retain their structural component (eg, bulge, bar) after going through a collision.

(I) Research work: I have been leading a work to understand PAH emission in both star-forming and quiescent galaxies at redshift $\sim$ 0.65. We use photometric data from AstroSat/UVIT, KPNO U band, HST (WFC3 UVIS, ACS, WFC3 IR), JWST (NIRCam, MIRI), and Herschel PACS telescopes to constrain the PAH mass fraction, galaxy stellar mass, star formation rate, UV continuum slope, and several other properties (Fig-1). Three key results that came out from this study are: (i) stellar mass is the most fundamental parameter that decides the PAH mass fraction in star-forming galaxies (Fig-1), (ii) quiescent galaxies show lower PAH abundance when compared to star-forming galaxies of similar mass (Fig-1), and (iii) exposure to harder ISM radiation can destroy PAH molecules in galaxies. The major part of the analysis was conducted during the last six months. I have now completed the draft manuscript, which has been shared with the

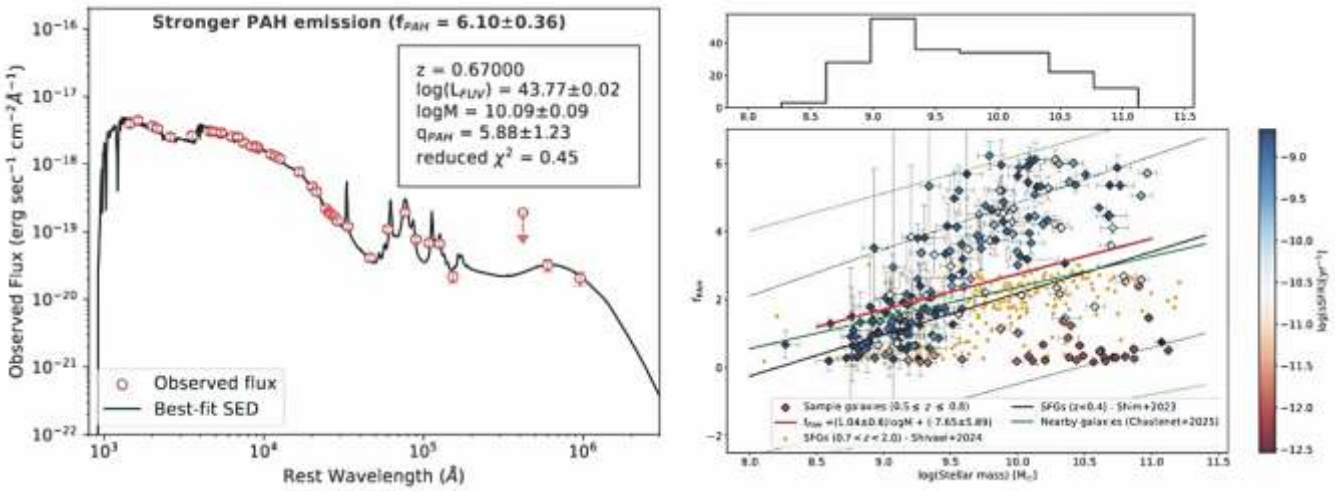


Fig. 1. *Left:* The observed flux and CIGALE best-fit SED of one selected galaxy. *Right:* The SED-derived stellar mass and observed f_{PAH} of 224 galaxies, showing stellar mass as the fundamental parameter to decide PAH abundance in galaxies (Mondal et al. (in prep)).

collaborators for internal review. As a follow-up project of this ongoing work, I submitted a proposal to observe 23 selected galaxies using the Atacama Large Millimeter Array (ALMA) telescope as the Principal Investigator (PI). During this academic period, I have visited the S. N. Bose Astronomical Observatory at Panchet multiple times to acquire data regarding site characterization and scientific observations. I have contributed significantly to prepare external funding proposals regarding future observing facilities at the observatory. I have also worked on multiple other projects in collaboration: Understanding hierarchical star formation in nearby galaxies (Sanal et al. 2026 ApJ; Shashank et al. 2026 - under revision in ApJS), cloud-scale star formation and gas scaling relations in the Milky Way (Sarkar et al. 2026 - under revision in ApJ), two luminous [OIII] 88μm emitter at $z>8$ (Algera et al. 2026 - under revision in OJAp). In addition, I have served as a reviewer of one manuscript in the Astrophysical Journal and as a reviewer of 10 ALMA proposals.

Plan of Future Work Including Project

The future plans for multiple ongoing projects are as following:

(i) PAH emission in SFGs and QGs: The primary plan is to identify candidate galaxies from 224 samples that show clumpy resolved structures in the JWST MIRI bands and conduct a detailed study to probe PAH emission morphology across the galaxy. We will utilize HST UVIS and MUSE data to understand the role of ISM ionizing conditions in controling PAH abundance/ excitation in diverse galaxy populations. We plan to utilize molecular CO observations of the identified galaxies to know how PAH (dust) and CO (molecular gas) correlates in both star-forming and quiescent galaxies with varying gas-phase metallicity. In summary, our proposed plan would provide a more clear picture on the interplay between inter stellar dust and ISM radiation field which affects dust abundance in galaxies. In our follow-up work, we plan to analyse sample galaxies with identified rest-frame extreme FUV emission to understand the role of energetic Lyman Werner photons in controling/exciting PAH molecules in star-forming galaxies.

(ii) Lyman continuum leaker at z∼1-3: I plan to utilize deep wide-field FUV imaging data in two fields (AEGIS and MACSJ0416.1-2403), conducted with the UVIT, to coordinate a large-scale search of LyC leakers at z∼ 1 - 3. The detection of more than 10 leakers with SNR (LyC) $>$ 3.0 in both GOODS fields (having an exposure time $\sim$ 35 ksec (AUDFn) and 64 ksec (AUDFs) in F154W) allows us to expect more detections in other UV deep fields where we have acquired/awarded more than 100 ksec time (eg.,

AEGIS). The initial plan is to produce FUV source catalogs for both fields, similar to the AUDFn and AUDFs. Each field has excellent spectroscopic data from different surveys, which will be used to characterize the physical properties of the identified leakers. In MACSJ0416.1-2403, we will utilize the advantage of lensing magnification to push the detection limit to fainter magnitudes, which would improve the efficiency of LyC detection. This study would probe the ionizing continuum of LyC leakers spanning a larger wavelength range from $\sim 200 - 750$ \AA, which has not been explored well. By understanding leakers at intermediate ($z \sim 1 - 2$) to higher ($z > 2$) redshift, this study will shed more light on the intrinsic properties of galaxies that are believed to have reionized the universe.

(iii) S. N. Bose Astronomical Observatory: Utilizing the existing data acquired with 12-inch and 14-inch telescopes (including the last observing cycle) at the S. N. Bose Astronomical Observatory, Panchet, I aim to produce a comprehensive chart of seeing measurements conducted during the last several years. These would allow us to draft a manuscript on seeing and weather parameters at the observatory site. In the coming cycle, we further aim to take more observations for constraining sky brightness at the site and also monitor selected variable sources. I plan to monitor a few variable sources utilizing telescopes at Panchet as well as in other parts of India to improve the time cadence and demonstrate the importance of more frequent observations to study transient objects.

(iv) Collisional ring galaxies: Based on our studies on two nearby collisional ring galaxies, I am also leading a search to identify similar systems at higher redshifts. We are utilizing deep JWST imaging and spectroscopic observations for this project. Initial searches have resulted in a few promising candidates, which will be analyzed to understand how collisions lead to morphological transitions in galaxies at earlier epochs.

Any other Relevant Information including social impact of research

Additional academic activities:

1. Participated as the external examiner for the PG project presentation in School of Astrophysics, Presidency University (May 30 & June 1, 2026)
2. Invited to serve as a jury member in evaluating posters in the Astronomical Society of India (ASI) 2026 meeting for 'Galaxies and Cosmology (GAC)' category (May 15-19, 2026)
3. Invited to participate as a discussion panelist in Neighbourhood meeting hosted by the Saha Institute of Nuclear Physics (March 11, 2026)
4. Contributed in planning the 'extragalactic astrophysics' section of the proposal for the National Large Optical Telescope (NLOT) project



Parijat Dey

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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Dipyendu Dhar; Conformal field theory, holographic methods; Under Progress
2. Anirban Dalui; Renormalisation group flow near wedge CFT; Under Progress

b) Post-Docs

1. Semanti Dutta; Holographic duality, Conformal field theory
2. Arun Kumar Das; Quantum Information theory

c) External Project Students / Summer Training

1. Anirban Dalui; Renormalisation group flow near wedge CFT
2. Tamanna Khanna; Aspects of General Relativity

Teaching

1. Autumn Semester; Nuclear and Particle Physics PHY 507; Integrated PhD; 11 students; Shared with Dr. Tapas Baug
2. Autumn Semester; Summer Project Research I (PHY 494); Integrated PhD; 1 student

Publications

a) In journals

1. **Parijat Dey**, Zhongjie Huang & Arthur Lipstein, *de Sitter locality from conformal field theory*, Journal of High Energy Physics, 2025, 166, 2025
2. **Parijat Dey**, Nirmalya Kajuri and Rhitaparna Pal, *Bulk reconstruction in 2D multihorizon black hole*, Physical Review D, 111, 126003, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Invited talk at TIFR Mumbai on "de Sitter locality from conformal field theory"; 04/12/2025; Pre-ISM workshop, TIFR, Mumbai; December 1-5, 2025
2. Invited talk at IIT Kanpur on "Constraints on dS from CFT"; 07/10/2025; CFT focused workshop, IIT Kanpur; October 6-11, 2025
3. Invited talk at University of Cambridge on "Imprints of de Sitter locality in conformal field theory"; 30/10/2025; Diving deeper into defects workshop, Issac Newton Institute for Mathematical Sciences, University of Cambridge; October 27-31, 2025
4. Invited talk at Kyoto University on "Towards bootstrapping de Sitter correlators"; 12/11/2025; Progress of theoretical bootstrap, YITP, Kyoto University; November 10-26, 2025

Administrative duties

1. IPhD interview committee member, 2025
2. Annual evaluation and Project evaluation committee member of several research scholars
3. Syllabus modification committee member

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Prime Minister Early Career Research Grant ANRF; Anusandhan National Research Foundation (ANRF); 3 years; PI

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Published a paper titled "Bulk reconstruction in 2D multi horizon black hole" in Physical Review D with Nirmalya Kajuri and Rhitaparna Pal from IIT Mandi; Sl. No. 2; National
2. Published a paper titled "de Sitter locality from conformal field theory", in the Journal of High Energy Physics with Arthur Lipstein from Durham University, England and Zhongjie Huang from Zhejiang University, China; Sl. No. 1; International

Outreach program organized / participated

1. Delivered a lecture on "Ising model of ferromagnets" in the C K Majumdar Memorial Summer Workshop in Physics , held at SNBNCBS in July 2025
2. Delivered a seminar on "From boiling water to quantum gravity" at the Reunion of Lady Brabourne College Physics Alumni - on January 31, 2026 at Lady Brabourne College

Areas of Research

Theoretical High Energy Physics: Conformal field theory, Holographic duality, Cosmology

An important insight from the study of AdS/CFT is that bulk locality can be derived from crossing symmetry of the boundary CFT. In our work we take the first steps in extending this statement to de Sitter background by demonstrating how to reconstruct a conformally coupled scalar effective field theory (EFT) with higher derivative interactions in four-dimensional de Sitter space from its in-in correlators. The latter can be computed from a certain EFT in Euclidean Anti-de Sitter space involving two scalar fields, which we derive from crossing symmetry of boundary correlators along with two novel constraints arising from unmixing anomalous dimensions of degenerate operators and equating them in different OPE channels. To facilitate the analysis, we work in Mellin space and apply dispersion relations to extract anomalous dimensions more efficiently.

We study bulk locality in a scalar effective field theory (EFT) in AdS background in presence of an end-of-the-world (EOW) brane. The holographic dual description is given in terms of a boundary conformal field theory (BCFT). We compute the two point correlation function of scalar operators in the BCFT using the one-loop Witten diagrams and compare its analytic structure with the constraints imposed by boundary conformal symmetry. We find that the loop-corrected correlator derived from a local bulk description is not fully compatible with BCFT expectations. This result places nontrivial constraint on bulk locality in holographic BCFT constructions and identifies BCFT correlators as sensitive probes of quantum bulk dynamics in presence of boundaries.

Holographic black holes exhibit a striking relation between thermal boundary one-point functions and bulk geodesic lengths. In the large conformal-dimension limit, the one-point function of a primary operator is given by the exponential of the geodesic length from its boundary insertion point to the horizon. We test the robustness of this relation under perturbations by considering a class of deformations of an Euclidean BTZ black hole and working to first order in the perturbation.We find that, at leading order in the large conformal-dimension limit and to first order in the radial horizon-preserving perturbation, the logarithmic variation of the one-point function is governed by the variation of the renormalized boundary-to-horizon geodesic length. The result is established using WKB and saddle point methods, and WKB expressions at large conformal dimension are checked against the exact Green function and bulk-boundary propagator.

We are working on understanding the dynamics of strongly coupled conformal systems in deformed geometries with corners and wedge using the framework of quantum field theory and renormalisation group. Our goal is to characterise the nature of renormalisation group flow that connects different conformal field theories living in wedge shaped geometries, where the wedge angle plays the role of a parameter. This work is in preparation with Dipyendu Dhar and Anirban Dalui.

We study the time evolution of semiclassical entanglement entropy in coherent states of the global conformal algebra in a large c conformal field theory in 2 spacetime dimensions. We employ the replica method to find the reduced density matrix in the short distance limit.

Plan of Future Work Including Project

1. We aim to investigate how entanglement entropy evolves in a conformal field theory (CFT) subjected to periodic driving. These driven CFTs provide a simplified framework for studying black hole scrambling, thermalization in quantum systems, and quantum circuit complexity. Such systems exhibit three distinct dynamical phases: a heating phase, a non-heating phase, and a critical phase transition point. Using holographic methods, we seek to analyze the entanglement properties in each of these regimes. Specifically, we interpret the entanglement entropy through its dual geometric description in the bulk, where it corresponds to the area of a minimal surface. Furthermore, we explore quantum corrections to this entropy-as proposed by Faulkner, Lewkowycz, and Maldacena-from the bulk perspective. This involves computing holographic entanglement entropy for time-dependent surfaces in the gravitational dual.

2. Many body quantum systems with restricted geometries appear in different physical systems. Such deformed geometry leads to partial breaking of translational invariance which makes it challenging to predict the dynamics in a controllable way. These systems are described by conformal field theories (CFTs) with intersecting boundaries that capture the corner and edge effects at criticality. This setup is known as wedge CFT (WCFT). In addition to bulk observables, the wedge-shaped geometry gives rise to new set of observables localised on the edge or surface. The dynamics of WCFT is captured by the spectrum and expansion coefficients of local operators, known as wedge CFT data. The interplay between bulk, surface and edge observables makes the structure richer than the usual CFT without boundaries or edges. The WCFT data can be computed by probing the correlation functions of local operators. This area of research is largely unexplored and general results related to edge observables are missing. We aim to explore WCFT using the framework of quantum field theory and renormalisation group. We consider scalar fields in the bulk perturbed by a relevant interaction on the edge or the boundary. The goal is to identify the fixed points of WCFTs and how they are connected by RG flows from ultaviolet to infrared. The renormalisation of the Lagrangian can be studied using dimensional regularisation. The running of the edge coupling constant, namely the beta function and fixed point can be computed. This will help us compute the correlation functions in presence of running edge couplings using the Feynman diagrams. From the explicit expressions of the bulk one point functions and bulk-edge two point functions we can extract the WCFT data. We will also tune boundary interactions and understand the dependence of the interplay between edge and boundary renormalizations. We would like to understand if these RG flows are irreversible.

3. We plan to understand whether the observed breakdown of sharp bulk locality in boundary CFT persists for fields with spin, in particular for gauge fields and gravitons, where boundary conditions are more constrained by symmetry. Another important direction is to investigate whether the incompatibility can be resolved by introducing explicit boundary degrees of freedom or brane-localized interactions and how such modifications are encoded in BCFT data. Extending the analysis to higher-loop corrections, other geometries with defects, or to time-dependent and Lorentzian setups may further clarify the interplay between boundaries, quantum corrections and bulk locality. It would also be interesting to include dynamical gravity and examine whether gravitational backreaction or induced gravitational dynamics on the brane modify the loop-level analytic structure of BCFT correlator. Moreover, semiclassical and geodesic approximations to the relevant Witten diagrams may provide useful geometric insight into the origin of the non-analytic structures and help connect exact loop results with an effective spacetime picture.

Any other Relevant Information including social impact of research

1. Referee for the journal "Journal of High Energy Physics", "Physics Letters B", "SciPost Physics"



Ramkrishna Das

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Astrophysics and High Energy Physics
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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Swastik Sardar; Multi-wavelength study of Wolf-Rayet stars; Under Progress
2. Shakshi Chaudhary; Dust and Molecules in Novae; Under Progress
3. Trisha Mishra; Super Novae; Under Progress
4. Promita Ghosh; Novae; Under Progress

b) External Project Students / Summer Training

1. Purnendu Khamrui; Variable Stars; S N Bose National Centre for Basic Sciences

Teaching

1. Spring Semester; Astrophysics; PhD; 5 students; Shared with Dr. Tapas Baug
2. Spring Semester; Observational Techniques in Astronomy; PhD; 5 students; Shared with Dr. Tapas Baug
3. Spring Semester; Advanced Laboratory Course (Astronomy); Integrated PhD; 10 students

Publications

a) In journals

1. Diya Ram, Soumen Mondal, Anandmayee Tej, Tapas Baug, **Ramkrishna Das**, Dusmanta Patra, Samrat Ghosh, and Rajib Kumbhakar, *Magnetic Activities of GJ 1151: Flares in TESS Data and Radio Observation in uGMRT*, Astrophysical Journal, 994, 120, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. 'Molecules in space'; 08/05/2025; Department of Chemistry, Siuri Vidyasagar College, Birbhum, West Bengal; 1 hour
2. 'Planets around other stars'; 23/12/2025; Sir Rajendra Nath Mukherjee Government Polytechnic College, Basirhat, West Bengal; 1 hour

Administrative duties

1. Liason Officer & Chairperson of the Reservation Cell, SNBNCBS
2. Chairperson, Outreach Programme for the students of SC/ST community, SNBNCBS
3. Member, Conference Workshop and Extension Programmes (CWEP), SNBNCBS
4. Member, Newsletter Committee, SNBNCBS
5. Member, Media Cell, SNBNCBS
6. Member, Library Committee, SNBNCBS

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Development of a 1-meter class Optical Telescope at the S. N. Bose Astronomical Observatory, Purulia, West Bengal (submitted); Department of Science & technology (submitted); Five Years; PI

Scientific collaborations with other national / international institutions

1. Collaboration with Dr Subhajit Kar, Post-Doctoral Fellow, IUCAA, for investigating the WR stars; National
2. Collaboration with Dr Ruchi Pandey, Associate Research Scientist, Johns Hopkins University, for investigating dust formation phenomena in Novae; International

Outreach program organized / participated

1. Organized an outreach program titled 'Bringing Sciences to Underexposed Areas', 8th May 2025, Department of Chemistry, Siuri Vidyasagar College, Birbhum, West Bengal
2. Organized a 'Two days Science Outreach Program & Science Exhibition'; 22-23 December, 2025; Sir Rajendra Nath Mukherjee Government Polytechnic College, Basirhat, West Bengal

Areas of Research

My primary research interests are observational study of transient objects (e.g., novae, supernovae), variable stars, planetary nebulae, massive stars etc. I am also deeply involved in the Centre's Telescope project to set up an Astronomical Observatory on Panchet hill-top, Purulia, West Bengal.

The Centre has taken an initiative to build S. N. Bose Observatory at Panchet Hilltop, Purulia, in which I am working as one of the Principal Investigators. Already an Automatic Weather Station, a Mobile Observatory and a Differential Image Motion Monitor (DIMM) system have been installed on the Panchet hilltop for detailed site characterization. We will analyze the data and working towards publication of the research paper on the observatory site characteristics. We have also completed T-Pointing for the 14-inch telescope and started taking scientific data.

1. Over the past year, we focused on the spectral analysis and atmospheric modelling of Wolf-Rayet (WR) binary systems. A primary focus has been spectral disentangling, successfully isolating the constituent WR and O-star spectra. Utilizing the isolated spectral components, we extracted radial velocities from specific emission and absorption features (He II 5411 and O III 5592) to get reliable velocity measurements, established constraints on fundamental orbital characteristics and determined the true dynamical masses. We also used the Potsdam Wolf-Rayet (PoWR) non-LTE code to independently fit (Figure 1) these parameters and derive accurate mass-loss rates. Work is currently ongoing to optimize the spectral fits and make plan for further phase-resolved spectroscopic campaigns.
2. We conducted photoionization study of the classical nova V476 Scuti during its post-outburst phase to investigate its physical and chemical properties. Archival optical light-curve data were analyzed and showed no significant optical dip. Near-infrared JHK observations revealed an excess about 18-19 days after the outburst, indicating the formation of optically thin dust. The observed spectra, containing prominent H I, O I, C I, and N I emission lines, were modeled using CLOUDY under single- and double-component configurations. The modeling constrained ejecta density structure and elemental abundances, while dust luminosity and carbon dust masses, size, and density were also estimated.
3. We conducted a detailed investigation of the spectroscopic and photometric evolution of V1405 Cas, one of the slowest nova (t_2 = 164 days) ever recorded. Using the photoionization code Cloudy, we modeled the observed spectra to derive key physical and chemical parameters of the system. The persistent overabundance of helium across all epochs suggests significant enrichment, likely resulting from nuclear processing during the outburst. Such an enhancement may also indicate mixing between the accreted hydrogen-rich envelope and the underlying helium layer of the white dwarf (WD), a process commonly referred to as He-mixing.

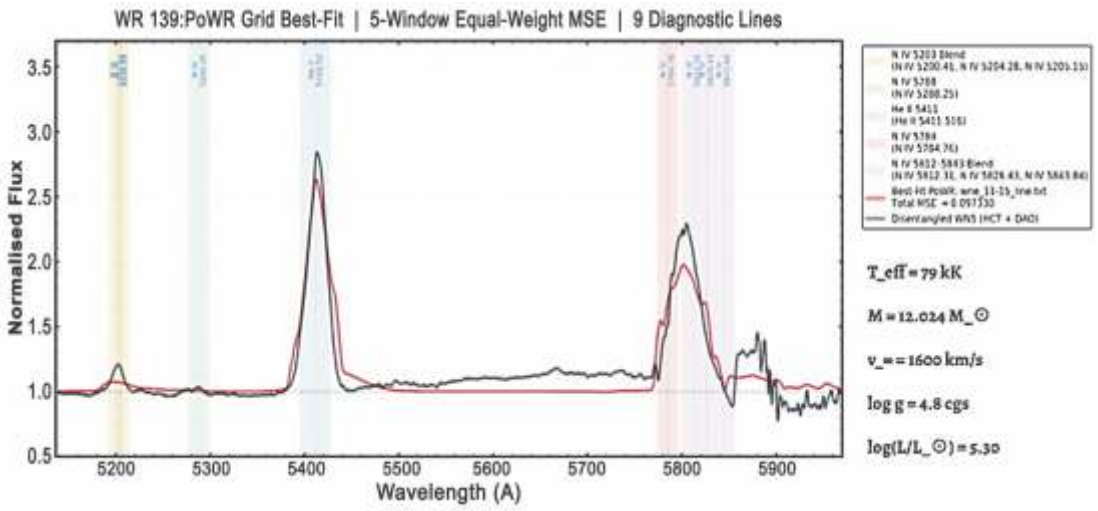


Fig. 1. The separated WR-dominated spectrum has been used for an initial non-LTE PoWR model comparison, providing first-order constraints on the physical parameters of the WR component. The preliminary fit suggests an effective temperature of about 79,00 K, 2.36solar radius, luminosity ~ 5.30 solar luminosity, terminal wind velocity of about 1600 km/s, and a clumped mass-loss rate of the order of 10^{-5}, solar mass/year.

Plan of Future Work Including Project

We will continue observing novae, planetary novae and massive stars using the national facilities. We already have observed and collected spectroscopic data of those objects. Currently, we are modeling the spectra to understand the system and the related phenomena. We are expecting to complete the analysis and publish the paper soon.

We are working to test and install other back end instruments (CCD and spectrograph) to the 14-inch telescope which will be used with the telescopes installed at Panchet for regular scientific observations.

Any other Relevant Information including social impact of research

1. Member of the PhD Committee, Presidency University, Kolkata
2. Coordinator of the Certificate Course in Observational Astronomy introduced by SNBNCBS in association with Sidho-Kanho-Birsha University, Purulia
3. Invited to review Observational proposals submitted to the national facilities, e.g. Giant Metre Radio Telescope (GMRT), 2-m Himalaya Chandra Telescope (HCT) and 3.6-m Devesthal Optical Telescope (DOT)
4. Actively participated in the base line survey in the villages around Panchet hill< Purulia, in association with Indian Institute of Bio Social Research and Development (IBRAD)



Soumen Mondal

Professor
Astrophysics and High Energy Physics
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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Aman Das (CSIR); M Dwarfs and their planetary Companion's atmospheric characterization in JWST and TESS era; Under Progress
2. Avirup Chakraborty; Mechine Learning on Determination of Stellar Fundamental Parameters; Under Progress
3. Diya Ram (CSIR); Understanding Stellar Activity in M dwarfs; Thesis Submitted
4. Dorothy Museo Mwanzia (TWAS-Bose); Understanding the Atmospheric Properties of Brown Dwarfs and Low Mass Stars; Under Progress; Dr, Geoffrey Okeng'o, University of Nairobi, Supervisor; Dr. Snehlata, ARIES, Co-Supervisor; Dr. John Buers, University of Nairobi, Co-Supervisor
5. Rajib Kumbhakar (Inspire); Studies of Atmospheric Properties of Brown Dwarfs and Low Mass Stars; Thesis Submitted
6. Siddhartha Biswas (Inspire); Multiwavelength Studies on the Galactic Star-forming Regions; Under Progress
7. Soumita Chakraborty; Understanding of Galactic Star forming Region with Multiwavelength Data; Under Progress

b) Post-Docs

1. Suman Kumar Mondal; Physical properties and chemical complexity of Young Stellar Objects in star-forming regions

c) External Project Students / Summer Training

1. Ayantika Mahanty, M.Sc. (Physics); Variability and atmospheric properties of low mass stars using TESS data; National Institute of Technology, Rourkela

Teaching

1. Autumn Semester; SNB-SKBU Certificate course in Observational Astronomy - Instruments and Basic Data Analysis (SDOAP104); 10 students; Shared with Dr. Sushanta Mondal (SKBU)
2. Spring Semester Astrophysics and (PHY 604); PhD; 5 students; Shared with Prof. Ramkrishna Das
3. Spring Semester; Astrophysics and Astronomy (PHY 504); Integrated PhD; 10 students; Shared with Prof. A. S. Majumdar and Dr. Chayan Mondal
4. Spring Semester; SNB-SKBU Certificate course in Observational Astronomy - Instruments and Basic Data Analysis (SDOAP104); 5 students; Shared with Prof. Ramkrishna Das

Publications

a) In journals

1. Rajib Kumbhakar, **Soumen Mondal**, Samrat Ghosh, Diya Ram, and Dorothy M. Mwanzia, *Probing Starspot Dynamics on the Active M Dwarf TIC 272272592: A Multiyear TESS Study*, Astrophysical Journal, 994, 150, 2025
2. Suman Kumar Mondal, Takashi Shimonishi, **Soumen Mondal**, Prasanta Gorai, Kei E. I. Tanaka, Kenji Furuya, and Ankan Das, *ALMA*

Observations of Cold Methanol Gas in the Large Magellanic Cloud: N79 South Giant Molecular Cloud, Astrophysical Journal, 998, 2, 2026

3. Dorothy M. Mwanzia, Sneh Lata, W. P. Chen, **Soumen Mondal**, Geoffrey Okeng'o, John Buers, Samrat Ghosh, Athul Dileep, Arjav Jain, Alisher S. Hojaev, and Santosh Joshi, *Stellar Variability toward the Galactic Open Cluster NGC 7209*, Astrophysical Journal, 985, 985, 2025
4. Diya Ram, **Soumen Mondal**, Samrat Ghosh, and Rajib Kumbhakar, *Magnetic Activities of Wolf 359: Starspot Distribution and Quasiperiodic Pulsation Using TESS Data*, Astrophysical Journal, 988, 2, 2025
5. Diya Ram, **Soumen Mondal**, Anandmayee Tej, Tapas Baug, Ramkrishna Das, Dusmanta Patra, Samrat Ghosh, and Rajib Kumbhakar, *Magnetic Activities of GJ 1151: Flares in TESS Data and Radio Observation in uGMRT*, Astrophysical Journal, 994, 120, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. An invited talk on "Astronomical Instrumentation for key question in Astrophysics" at National Seminar on scientific Innovation Skill Development for Societal Advancement; 18/03/2026; ISDRC, Department of Physics, Jadavpur University; 60 minutes
2. An invited talk on "Astrophysics using Space Technology" at National Space Day; 22/08/2025; Unified Campus, Bose Institute, Salt Lake, Kolkata; 60 minutes

Administrative duties

1. External Committees: Member of Academic committee (Board of Studies), School of Astrophysics, Presidency University, Kolkata
2. Internal Committees: Chairman of Internal Standing Technical Committee (ISTC); Chairman of the Medical Cell; member in the Project and Patent Cell

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Development of 1-meter class Optical Telescope at the S. N. Bose Astronomical Observatory, Purulia, West Bengal (Jointly with IIA, Bengaluru); for funding to the DST; 5 years; PI
2. Technical Research Centre - Phase II; DST; 5 years (2021 -2026); PI

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Anandmayee Tej, IIST, Trivandrum; Sl. No. 5; National
2. Buers, John, University of Nairobi, Kenya; Sl. No. 3; International
3. Das, Ankan, Institute of Astronomy Space and Earth Science, Kolkata; Sl. No. 2; National
4. Furuya, Kenji, RIKEN Pioneering Research Institute, 2-1 Hirosawa, Japan; Sl. No. 2; International
5. Okeng'o, Geoffrey, University of Nairobi, Kenya; Sl. No. 3; International
6. Samrat Ghosh, ARIES, Nainital; Sl. No. 1, 3, 4, 5; National
7. Shimonishi, Takashi, Institute of Science and Technology, Niigata University, Japan; Sl. No. 2; International
8. Sneh Lata, ARIES, Nanital; Sl. No. 3; National
9. Tanaka, Kei E. I., Department of Earth and Planetary Sciences, Institute of Science, Tokyo, Japan; Sl. No. 2; International
10. Wen-Ping Chen, National Central Univ., Taiwan; Sl. No. 3; International

Areas of Research

M dwarfs are are the smallest cool hydrogen-burning objects, with masses in the range of 0.075-0.60 mass of the Sun, and effective temperatures in the range 2400 - 3800 K, and the most abundant and long-lived objects , comprising ~75% of the total stellar population in the Milky Way. M dwarfs are interesting targets in thesearch for habitable planets and life beyond our solar system.

Starspots, analogous to Sunspots, are regarded as a result of strong localized magnetic fields produced by the stellar dynamo, and observable manifestation of stellar activity in M dwarfs are starspots, stellar flares, and longterm variability. Such studies are crucial for advancing our understanding of active M dwarfs . The magnetic field generation of stars is mainly governed by the complex interaction of plasma motion due to the convection and differential rotation of the object.

We present an analysis of temporal starspot evolution and its distribution on an active M3.0 rapid rotator (Prot = 1.22 days) , TIC 272272592, using high-precision time-series photometry from the Transiting Exoplanet Survey Satellite (TESS) spanning over 3 yr. The primary objective

of this work is to study the distribution pattern of starspots across the stellar surface and to investigate the spot evolution over time (Kumbhakar, Rajib, et al., The Astrophysical Journal, 994, 26 pp, 2025).

Planets in close-in orbits are immersed in the magnetized stellar wind generated by the expanding stellar corona. As they move through this wind, short-period planets can perturb its flow, transferring significant energy to the host star via sub-Alfvenic interactions. This energy can heat the star's chromosphere, creating a hot spot that varies with the planet's orbit. Such chromospheric variability is observed in hot Jupiter systems, pointing to star–planet interactions. Similar SPIs have also been proposed for M dwarf systems with close-in rocky planets, such as TRAPPIST-1. GJ 1151 is a nearby (8 pc) , quiescent mid-M dwarf (M 4.5V) of older age, made especially interesting by the hypothesized presence of a close-in planet invoked to explain its low-frequency radio emission. We analyzed the flaring activity of GJ 1151 to investigate its stellar atmosphere and magnetic properties using 2 minute short-cadence photometry from the TESS and radio observations from the upgraded Giant Metrewave Radio Telescope (uGMRT) . Analysis of TESS Sector 48 revealed three flare events, with bolometric flare energies estimated in the range of 10^{30} –10^{31} erg, showing that GJ 1151, previously regarded as optically inactive, does in fact exhibit flare activity, placing it in the lower-to-intermediate activity regime (Ram, Diya et al., The Astrophysical Journal, 994, 9 pp., 2025)

Wolf 359 is the fifth closest (~ 2.4 pc) star to Earth and a candidate exoplanet-hosting M6 dwarf. We studied the distribution of starspots and flaring activities of Wolf 359 to understand its stellar atmosphere and magnetic activities. Using 2 minute short-cadence TESS data on this highly active star, we found 48, 46, and 32 flares in Sectors 45, 46, and 72, respectively. The rotation period

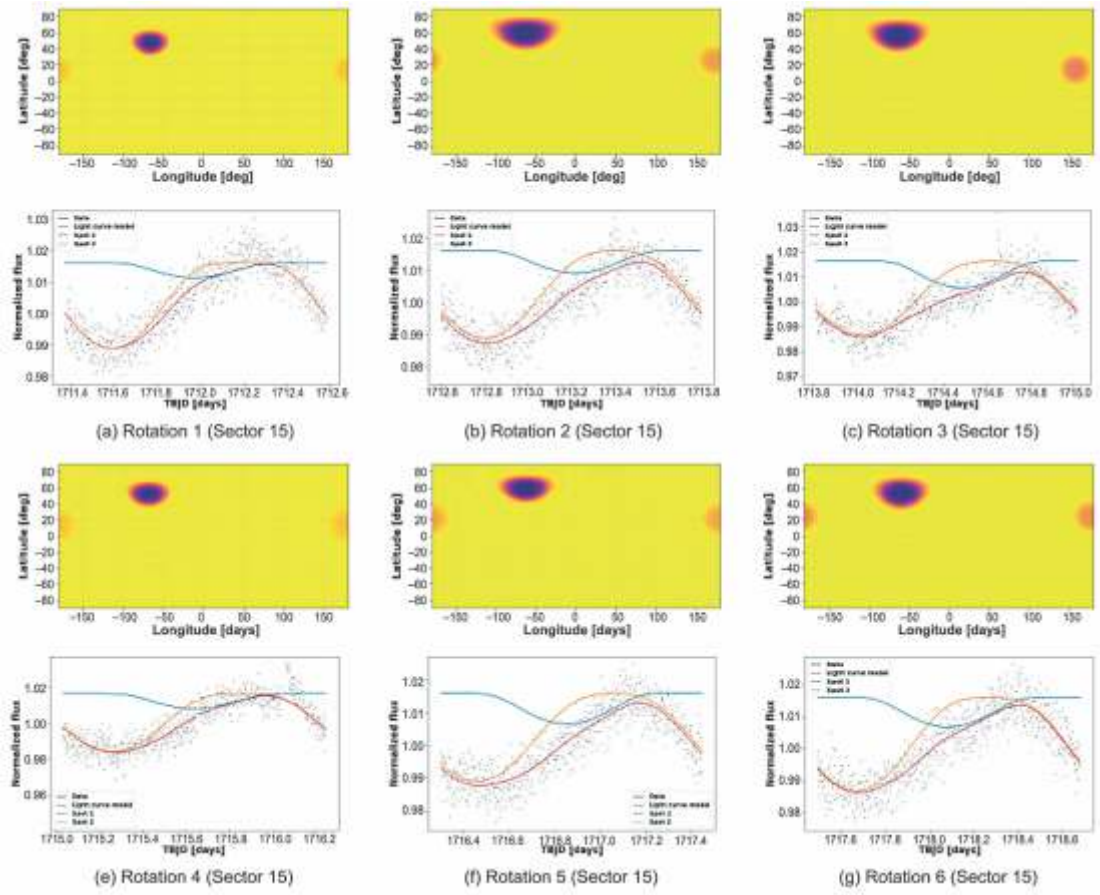


Figure 1: The positional distributions of starspots and model-fitted light curves of sector 15 of TESS data on TIC 272272592, are shown here. The first and third rows represent the spot distribution on the stellar surface reconstructed from the light curve, and the second and fourth rows show the contribution of Spot1 and Spot2 to the light curve and the fitted model. The blue and orange curves are the light curves due to Spot1 and Spot2, respectively, and the red curve is the resultant curve from modeling. For example, the light curve up to the first six rotations is shown here. In the spot distribution plots, latitude ranges from –90Â° to 90Â° and longitude from –180° to 180° (Figure 7 of Kumbhakar, Rajib, et al., The Astrophysical Journal, 994, 2025)

from TESS is estimated to be 2.69 days with negligible error, which matches well with the previous literature values. We estimated the bolometric flare energy in the range of 10^{30}–10^{32} erg. A high magnetic field strength of 0.18 kG is required to produce such a high flare. Interestingly, we first detect two complex flare events with oscillation periods of 104.56 ± 0.59 minutes and 39.22 ± 0.42 minutes in Sectors 45 and 46, probably caused by periodic motions of the emitting plasma or oscillatory reconnection (Ram. Diya et al. The Astrophysical Journal, Volume 994, 9 pp., 21, 2025).

We present the flaring properties and magnetic activity of an active flaring M3 dwarf PM J11183+ 1347 based on the optical light curves from the TESS space mission, and has been found to exhibit strong activity. We analyzed high-cadence TESS mission light curves across four sectors to investigate rotational modulation and flare properties. The periodogram analysis of the light curves showed periods ranging from 4.59 to 6.34 days, which may be attributed to differential rotation and evolving starspots. The variability in spot-induced modulation across sectors indicates strong surface activity, which further supports the star's magnetically active nature. A total of 21 flare events were detected, with bolometric energy estimate values ranging from 1.59 × 10^{32} to 1.05 × 10^{34} erg and durations of 15–455 minutes. The flares were found to show mixed morphologies, including classical single-

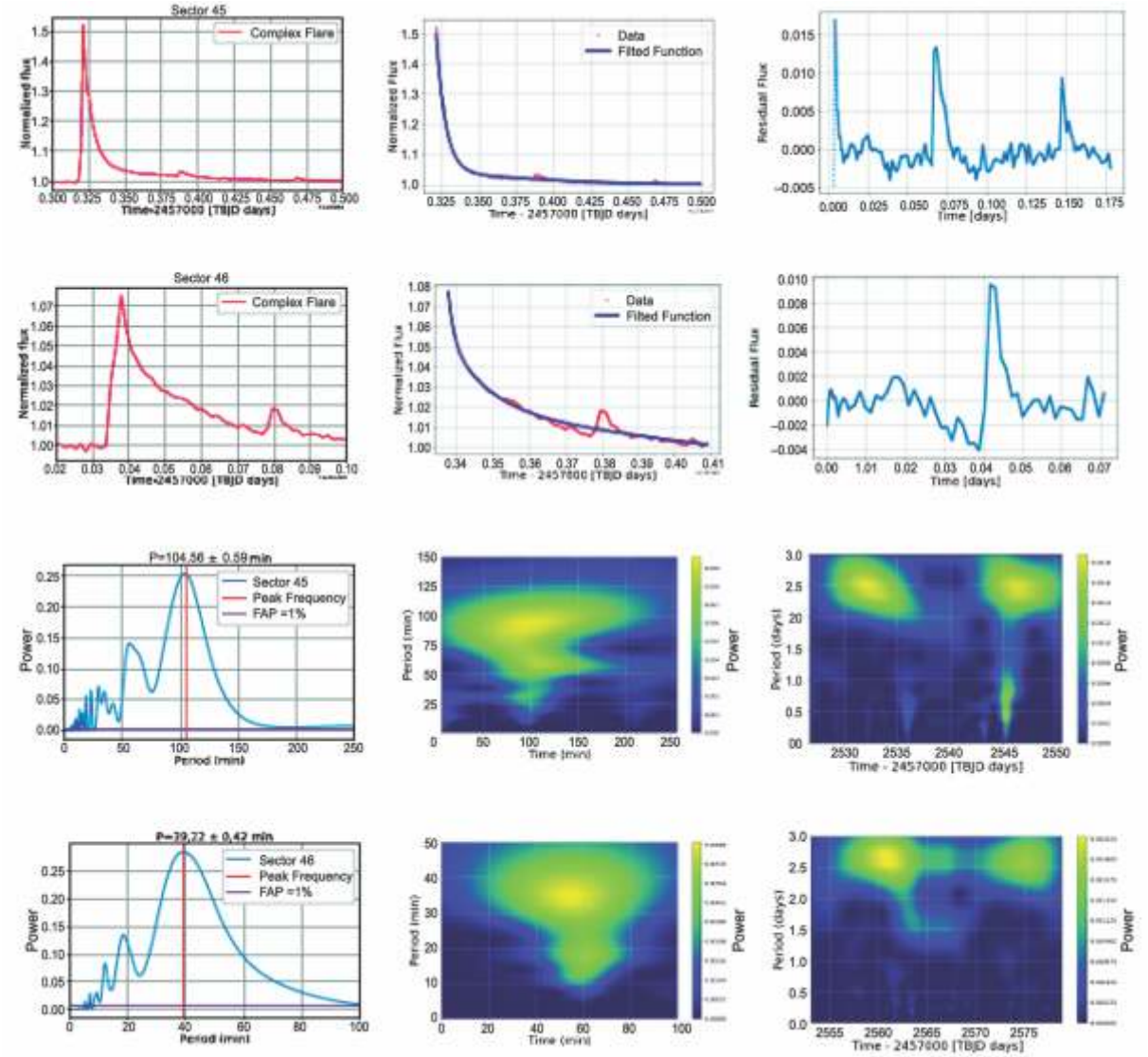


Figure 2: (a) and (b): complex flare events. (c) and (d): the blue line denotes the best fitting of the flare decay phase. (e) and (f): residual light curve of the flare decay stage subtracted by the fitting line. (g) and (h): power–period diagram calculated with the LS method, with an FAP = 1% indicated by the horizontal magenta line in the periodogram plots. (i) and (j): the resulting wavelet spectrum of two complex flares. (k) and (l): the resulting wavelet spectrum for the whole range of data in the two sectors after removing the flares and outliers (Fig. 3 of Ram. Diya et al. The Astrophysical Journal, Volume 994, 9 pp., 21, 2025).

peaked flares, complex multipeaked flares, and peak-bump structures, which are characteristic of sympathetic flaring or multiloop reconnection events. We detected several superflares having energies greater than 10^{33} erg, which further adds to the star's high magnetic activity Mwanzia, Dorothy M., et al., The Astrophysical Journal, Volume 1001, 13 pp., 2026).

Plan of Future Work Including Project

1. Scientific programs in observational Astronomy :
   i. Time-domain Astronomy in Low-mass stars, brown dwarfs, and extra-solar planets: Low-mass stars represent a vital test of theoretical models of stellar evolution, structure, and atmospheres. Time-domain astronomy and Optical/Near-IR spectroscopic studies of these classes of objects are undertaken to understand their atmospheres, exoplanets, and pulsation.
   ii. Multi-wavelength studies of Galactic star-forming regions: Multi-wavelength studies of such regions provide a census of Young Stellar Objects, their fundamental parameters and star-formation. Variability in young Very Low Mass (VLM) objects and brown dwarfs provide information on their atmospheres.
   iii. Astronomical Instrumentation: With our expertise in the Optical/IR instrument design and building, we are working for building the state-of-art backend instruments for our National and own telescopes collaborating with other Institutes.
2. Establishment of the S. N. Bose Astronomical Observatory at Panchet Hilltop, Purulia:

   The S. N. Bose Astronomical Observatory project, a new professional Astronomical observing facility at the eastern part of India, is planned at Panchet Hill, West Bengal to install a 1-m observatory class telescope. Since 2012, the efforts were undertaken to acquire the forest land at Panchet hill-top for the observatory project, and I am working as a lead role with other faculties at the Department of Astrophysics and High Energy Physics. The forest land of two hectares were sanctioned by the Forest department of the Govt. of India and the state Govt. of West Bengal. Recently, a project joint funding proposal with IIA, Bengalore for the new observatory with the 1.2-meter telescope and backend instruments was submitted to the Department of Science and Technology (DST), Govt. of India for approval and funding. The site characterization is being conducted at hill-top over the years. An automated weather is installed at the site during November 2022, and data is collected regular basis at 24 x 7 since then. A small observatory with a roll-off-roof including a telescope control cabin is already installed at the site. The installation of the DIMM system with the 12-inch telescope for measuring the Astronomical seeing for site characterization is done and seeing data is recorded more than 6 months . A 14-inch telescope with a backend CCD camera for time-domain as well as transient science operation is installed at the roll-off-roof observatory. All these activities are related for building the professional observatory project in the near-future.

Any other Relevant Information including social impact of research

1. A societal upliftment project on "Establishment of science technology and innovation (STI) hubs for development of Scheduled caste (SC) communities is being formulated by collaborating with Indian Institute of Bio Social Research and Development, Kolkata and Sidho-Kanho-Birsha University, Purulia for submitting to the SEED, DST for funding.
2. Scientific awareness programs like "Astro-Quest" is organized for college, school students, and the public.
3. A spectroscopic-based low-cost instrument "Mil-Q-Way" and "LOPA" is being developed under the Technical Research Centre (TRC), SNBNCBS for the detection of adulteration of milk. The prototype instruments have already been developed at the Centre, which is looking for potential technology takers. Such a project is intended for societal benefit and valuable Knowledge resources for the food sector and security.
4. For community services : time-to-time reviewing of scientific telescope proposals were carried out for the upgraded Giant Meter Radio Telescope (uGMRT) of NCRA-TIFR; 3.6-m Devasthal Optical telescope (DOT) of ARIES, and 2-m Himalayan Chandra Telescope (HCT) of IIA.
5. For community services : Reviewed the Ph.D. thesis of of IIT Gandhinagar (PRL); Pondichery University (IIA) and Sidho-Kanho University (SKBU) and external expert in those thesis Viva-Voce examinations.



Sunandan Gangopadhyay

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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Gopinath Guin; Physical cosmology; Under Progress
2. Ritam Mahanta; Gauge/gravity duality; Under Progress
3. Jayarshi Bhattacharyya; Statistical Mechanics; Under Progress (Gautam Gangopadhyay, Supervisor)
4. Anirban Roy Chowdhury; Gauge/gravity duality; Thesis Submitted
5. Arnab Mukherjee; Relativistic quantum information; Thesis Submitted
6. Soham Sen; Quantum gravity phenomenology; Awarded
7. Manjari Dutta; Noncommutative quantum systems; Awarded
8. Souvik Paul; Gauge/gravity duality; Under Progress
9. Arpita Jana; Relativistic quantum systems; Under Progress

b) Post-Docs

1. Ashis Saha; Gauge/gravity correspondence

c) External Project Students / Summer Training

1. Sreedevi Ajikumar; Basics of General theory of relativity; S.N.Bose National Centre for Basic Sciences
2. Junik Sengupta; Quantum field theory in curved spacetime; Sister Nivedita University
3. Tuhin Chatterjee; Quantum gravity; S.N. Bose National Centre for Basic Sciences

Teaching

1. Spring Semester; Quantum Field Theory (PHY 512); Integrated PhD; 12 students
2. Autumn Semester; Mathematical Methods (PHY 401); Integrated PhD; 14 students; Shared
3. Spring Semester Statistical Mechanics (PHY 404); Integrated PhD; 14 students; Shared

Publications

a) In journals

1. Ashis Saha, Anirban Roy Chowdhury and **Sunandan Gangopadhyay**, *A holographic realization of correlation and mutual information*, Physics Letters B, 870, 139933, 2025
2. Arpita Jana, Soham Sen and **Sunandan Gangopadhyay**, *Inverse logarithmic correction in the horizon brightened acceleration radiation entropy of an atom falling into a renormalization group improved charged black hole*, Physical Review D, 111, 085017, 2025
3. Souvik Paul and **Sunandan Gangopadhyay**, *Noncommutative p-wave holographic superconductors*, Classical and Quantum Gravity, 42, 185016, 2025
4. Ashis Saha, Anirban Roy Chowdhury & **Sunandan Gangopadhyay**, *Investigating the role of mutual information in the Page curve for a functional*

renormalization group improved Schwarzschild black hole, European Physical Journal C, 85, 837, 2025

5. Aslam Halder, **Sunandan Gangopadhyay** and Anirban Saha, *Gauge-invariant description of a Dirac electron moving in a noncommutative gauge field background*, Europhysics Letters, 149, 60001, 2025
6. Souvik Paul, Gopinath Guin & **Sunandan Gangopadhyay**, *Holographic entanglement entropy and complexity for the cosmological braneworld model*, Journal of High Energy Physics, 2025, 164, 2025
7. Ashmita Das, Anjana Krishnan, Soham Sen and **Sunandan Gangopadhyay**, *Derivative coupling in horizon brightened acceleration radiation: A quantum optics approach*, Physical Review D, 112, 065006, 2025
8. Gopinath Guin, Souvik Paul and **Sunandan Gangopadhyay**, *Barrow holographic dark energy interacting model in the presence of radiation and matter*, Journal of Cosmology and Astroparticle Physics, 2025, DOI: 10.1088/1475-7516/2025/11/048
9. Soham Sen, Manjari Dutta and **Sunandan Gangopadhyay**, *Density matrix analysis of systems with periodic Hamiltonians*, European Physical Journal D, 79, 118, 2025
10. Ashis Saha, Rabin Banerjee & **Sunandan Gangopadhyay**, *Gauge interactions and the Galilean limit*, European Physical Journal C, 85, 1140, 2025
11. Ashis Saha, Rabin Banerjee & **Sunandan Gangopadhyay**, *Null reduction and dynamical realization of Carrollian conformal symmetries*, European Physical Journal C, 86, 72, 2026
12. Arpita Jana, Soham Sen & **Sunandan Gangopadhyay**, *Black hole as coherent signal amplifier*, European Physical Journal C, 86, 183, 2026

b) Other Publications

i) Conference proceedings / Reports / Monographs

1. Sukanta Bhattacharyya, Soham Sen, Sunandan Gangopadhyay, Resonant Bar Gravitational Wave Detectors in the Generalized Uncertainty Principle Framework, Springer Proceedings in Physics, 432, 518, (2026)
2. Sunandan Gangopadhyay, Noise of Gravitons and the Uncertainty Principle, Springer Proceedings in Physics, 432, 463, (2026)
3. Manjari Dutta, Soham Sen, Sunandan Gangopadhyay, Berry Phase for a Harmonic Oscillator Interacting with a Gravitational Wave, Springer Proceedings in Physics, 432, 490, (2026)
4. Anirban Roy Chowdhury, Ashis Saha, Sunandan Gangopadhyay, Mutual Information and the Page Curve, Springer Proceedings in Physics, 432, 472, (2026)
5. Soham Sen, Sunandan Gangopadhyay, Bose-Einstein Condensate as a Graviton Detector, Springer Proceedings in Physics, 432, 467, (2026)
6. Arnab Mukherjee, Sunandan Gangopadhyay, A.S. Majumdar, Fulling-Davies-Unruh Effect Through Atom-Field Interactions, Springer Proceedings in Physics, 432, 476, (2026)
7. Ashis Saha, Sunandan Gangopadhyay, Chaos, Nonconformality and Holography, Springer Proceedings in Physics, 432, 459, (2026)
8. Souvik Paul, Sunandan Gangopadhyay, Ashis Saha, Gauss-Bonnet AdS Black Hole Thermodynamics and Holography, Springer Proceedings in Physics, 432, 514, (2026)

Talks / Seminars Delivered in reputed conference / institutions

1. Invited Lecture given in C.K. Majumdar Memorial Summer Workshop in Physics 2025, on "Schwinger's source theory"; A set of two lectures were delivered; 20/07/2025; S.N. Bose National Centre for Basic Sciences, Salt Lake, Kolkata; 10 days
2. Invited Talk given in "International Conference on Advanced Physics: Innovations for a Sustainable Future (IEMPHYS-26)" on "Holography, black holes, and quantum information"; 11/01/2026; Institute of Engineering and management (IEM); 3 days
3. Invited Talk given in "Trends in Gravity Research" on "Holography, black holes, and quantum information"; 06/02/2026; Jadavpur University, Physics department; 1 day
4. Invited Talk given in "Neighborhood Workshop on Gravity" on "Mutual information as an information theoretic probe for holography and

black hole interiors"; 12/02/2026; Indian Statistical Institute (ISI), Kolkata; 2 days

Administrative duties

1. Head of the Department of Astrophysics and High Energy Physics
2. Chairman of the Library Committee
3. Member of the Consultative Advisory Committee (CAC)
4. Permanent Invitee of the Academic and Research Programme Advisory Committee (ARPAC)
5. Member of Advanced Postdoctoral Research Programme (APRP)

Areas of Research

Applications of gauge/gravity correspondence, quantum gravity phenomenology, black hole physics, cosmology

My research work during this assessment year has primarily been in the following areas , namely, applications of gauge/gravity correspondence, quantum gravity, and black hole physics. I have also started to study problems related to open quantum systems.

In the area of gauge/gravity correspondence, we have investigated the status of the inequality existing between mutual information and (normalized) thermal two-point connected correlation function explicitly probed by using the gauge/gravity correspondence. In the holographic analysis, the geodesic approximation for heavy operators has been used. We observe that the study leads to some non-trivial insights.

We have also studied the effects of noncommutative geometry on the properties of p-wave holographic superconductors with massive vector condensates in the probe limit. To arry out the study, we have applied the Stürm-Liouville eigenvalue approach to analyze the model. In this model, we have calculated the critical temperature and the value of the condensation operator. We have also shown how the influence of noncommutative geometry modifies these quantities. Finally, by applying a linearized gauge field perturbation along the boundary direction, we calculated the holographic superconductor's AC conductivity using a self-consistent approach and then carried out a more rigorous analysis. The noncommutative effects are also found to be present in the result of AC conductivity. We have also found that just like the commutative case, that the DC conductivity diverges due to the presence of a first order pole in the frequency regime.

In a recent study, the time-dependent entanglement entropy of the universe undergoing expansion according to various power laws has been analyzed within the framework of the braneworld model. The results of the entanglement entropy there take into account only the effects of a radiation and a matter-dominated universe. We have computed the time-dependent entanglement entropy and complexity of the FLRW universe in the presence of different matter sources (radiation, matter and some exotic matter). In contrast to the earlier approach. All the calculations in have been carried out in a perturbative manner in the framework of braneworld model of cosmology. According to this model, our universe is situated on a brane and different matter sources appear on the brane due to the back reaction of different p-brane gas configurations in the bulk spacetime. By considering the bulk spacetime as a black brane geometry, we have considered different blackening factors corresponding to radiation, matter, and exotic matter and calculated entanglement entropy and complexity holographically. In the braneworld model, the universe's expansion is described by the brane's time-dependent radial position. This position is determined using the second Israel junction condition for various matter sources. The time evolution of entanglement entropy and complexity is then obtained by substituting this brane position.

We have also shown the dependence of entanglement entropy and complexity on the cosmological time.

Plan of Future Work Including Project

In future, I wish to investigate the effects of classical as well as quantum gravity in quantum systems. The quantum systems in which we want to see these effects are Unruh-de Witt detectors, gravitational wave detectors, and quantum batteries. The idea is to explore how gravitational effects may manifest in these systems, with the environment arising from quantization of linearized gravity, or thermal baths arising from the uniform acceleration of the Unruh-DeWitt detectors. The methodology would be first to model these physical scenarios analytically and then apply the techniques of open quantum systems, and quantum field theory in curved spacetime, to solve these models analytically. The analysis that we would like to carry out would involve both operatorial, namely, master equation approach, as well as path integral, namely, the Feynman-Vernon influence functional. The motivation of analyzing quantum systems in gravitational backgrounds is because they lead to phenomena which are remarkable in nature. The union of general theory of relativity and thermodynamics led to surprising results such as

Bekenstein-Hawking black hole entropy, emission of particles from a black hole, and acceleration radiation. It was shown that the virtual processes in which atom jump to an excited state while emitting a photon is an alternative way to see Unruh acceleration radiation. The fact that radiation is emitted when atoms fall into a black hole has been an important area of research in recent times. The remarkable observation made in the problem of atoms falling into a black hole is that the acceleration radiation emitted has a similar form to Hawking radiation. The entropy of this radiation has been termed as horizon brightened acceleration radiation (HBAR) entropy. The objectives that we want to get in this project are as follows. We would like to look at the problem of atoms falling into a black hole by including quantum gravity effects in the matter sector. So far the research has been to see the phenomenon of acceleration radiation by an atom falling into a quantum corrected Schwarzschild black hole. It has been observed in this analysis that the excitation probability of an atom with the simultaneous emission of a photon satisfies the equivalence principle when it is compared to the excitation probability of a mirror accelerating with respect to an atom. The horizon brightened acceleration radiation entropy for this quantum corrected black hole geometry was calculated. It was observed that the horizon brightened acceleration radiation entropy has a form identical to the Bekenstein-Hawking black hole entropy along with universal quantum gravitational corrections. We intend to carry out a similar analysis by incorporating the effects of quantum gravity in the quantum matter field sector. This we intend to do by incorporating modified dispersion relations that has additional terms in the relation connecting energy, momentum and rest mass coming from Planckian considerations. By carrying out these additions in our models, we would like to revisit the problem of a two-level atom freely falling near the outer horizon of a renormalization-group- improved Schwarzschild black hole. Our investigation in this context would involve the computation of the atom-field excitation probability and the calculation of the rate of change of the HBAR entropy. We would like to look into the calculated excitation probability to carefully understand the effects of quantum gravity included in the field sector by comparing our results with those already obtained in the literature. The first thing that we would like to check is whether Einstein's equivalence principle holds. Another important aspect that we would like to explore is the master equation of the problem in consideration.

Any other Relevant Information including social impact of research

The areas of research in which I am engaged in along with my Ph.D. students and post-doctoral fellows are related to the understanding of the fundamental laws of nature that govern our universe. The problem of quantizing gravity remains an unsolved and most important problem in theoretical physics. Our research makes an attempt to understand this problem and in the process get some insights. Fundamental studies are important in their own right as they may find applications later in the development of advanced technology. Research in theoretical physics also leads to the development of human resource which is extremely important for the development of our country.



Tapas Baug

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Astrophysics and High Energy Physics
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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Ariful Hoque; Protostellar outflows in Galactic star-forming regions; Under Progress
2. Muhammad Usman Shehu; Role of filaments in Galactic star formation; Under Progress
3. Tunir Kundu; Study of Galactic star-forming cores; Under Progress
4. Antara Dey; Application of machine learning on astronomical data; Under Progress
5. Subhanker Dutta; Study of exoplanet atmosphere; Under Progress
6. Alphesunny Sarkar; Star formation rate and efficiency from Galactic to extra-galactic scale; Under Progress; shared with Dr. Suchetana Chatterjee, Presidency University, Supervisor

b) Post-Docs

1. Arijit Manna; Chemistry of star-forming cores

c) External Project Students / Summer Training

1. Joydeep Das; The student worked on estimating the star formation rate in a resolved dwarf galaxy where the student analysed ultraviolet data obtained from the space-based AstroSat observatory; IISER Thiruvananthapuram

Teaching

1. Autumn Semester; Nuclear and Particle Physics; Integrated PhD; 11 students; Shared with Dr. Parijat Dey
2. Spring Semester; Observational Techniques in Astronomy; PhD; 5 students; Shared with Dr. Ramkrishna Das
3. Spring Semester; Observational Techniques; 18 students (Certificate course in collaboration with SKBU, Purulia); Shared with Dr. Ramkrishna Das
4. Spring Semester; Hands-on observations; 18 students (Certificate course in collaboration with SKBU, Purulia); Shared with Dr. Ramkrishna Das, Dr. Sushanta K. Mondal and Dr. Chiranjib Barman

Publications

a) In journals

1. Diya Ram, Soumen Mondal, Anandmayee Tej, **Tapas Baug**, Ramkrishna Das, Dusmanta Patra, Samrat Ghosh, and Rajib Kumbhakar, *Magnetic Activities of GJ 1151: Flares in TESS Data and Radio Observation in uGMRT*, Astrophysical Journal, 994, 120, 2025
2. A. Koley, A. M. Stutz, F. Louvet, F. Motte, A. Ginsburg, R. Galván-Madrid, R. H. Álvarez-Gutiérrez, P. Sanhueza, **Tapas Baug**, N. Sandoval-Garrido, J. Salinas, G. Busquet, J. Braine, H.-L. Liu, T. Csengeri, A. Gusdorf, M. Fernández-López, N. Cunningham, L. Bronfman and M. Bonfand, *ALMA-IMF: XIX. $C^{18}O$ (J = 2–1): Measurements of turbulence in 15 massive protoclusters*, Astronomy & Astrophysics, 702, A133, 2025
3. **Tapas Baug** et al., *The ALMA-QUARKS Survey. III. Clump-to-core Fragmentation and Searches for*

High-mass Starless Cores, Astrophysical Journal, 280, 1, 2025

4. Ariful Hoque, **Tapas Baug**, Tirthendu Sinha et al., *The ALMA-ATOMS Survey: Exploring Protostellar Outflows in HC_3N*, Astrophysical Journal, 987, 2, 2025
5. Shivani Gupta, **Tapas Baug**, Archana Soam, Tie Liu, Fengwei Xu, Satyajeet Moharana, Guido Garay, Chang Won Lee, Siju Zhang, Ariful Hoque, Puja Porel, Lei Zhu, Dongting Yang, HongLi Liu, Wenyu Jiao, Xunchuan Liu, Alik Panja, Xiaofeng Mai, Yankun Zhang, and Shinyoung Kim, *ATOMS-QUARKS Survey: Inflow and Infall in Massive Protocluster G318.049+00.086- Evidence of Competitive Accretion*, Astrophysical Journal, 999, 2, 2026
6. Tarak Chand, Saurabh Sharma, Koshvendra Singh, Joe P. Ninan, Arpan Ghosh, Devendra K. Ojha, **Tapas Baug**, D. K. Sahu, Bhuwan C. Bhatt, Pramod Kumar, Ram K. Yadav, Neelam Panwar, Aayushi Verma, Harmeen Kaur, Mamta, Manojit Chakraborty, Kartik Gokhe, and Ajay Kumar Singh, *Unveiling the Dual Nature of V1180 Cas: UXor-like Dips and EXor-like Bursts across a Decade*, Astrophysical Journal, 998, 2, 2026
7. Dongting Yang, Hong-Li Liu, **Tapas Baug** et al., *The ALMA-QUARKS Survey: Evidence of a Candidate High-mass Prestellar Core Aside a Bright-rimmed Cloud IRAS 18290-0924*, Astrophysical Journal, 995, 193, 2025
8. Jiahang Zou, Tie Liu, Fengwei Xu, Xindi Tang, Dezhao Meng, Yan-Kun Zhang, Aiyuan Yang, **Tapas Baug**, Chang-Won Lee, L. Viktor Tóth, Ariful Hoque, Sami Dib, Pablo Garcia, Hong-Li Liu, Prasanta Gorai, Swagat R. Das, Guido Garay, Patricio Sanhueza, Li Chen, Di Li, Jihye Hwang, Dongting Yang, and The ATOMS-QUARKS collaboration, *The ALMA-ATOMS-QUARKS Survey: Resolving a Chemically Rich Massive Protostellar Outflow*, Astrophysical Journal, 995, 1, 2025

b) Other Publications

i) Conference proceedings / Reports / Monographs

1. Arijit Manna, Sabyasachi Pal, Tapas Baug, "Detection of comet 3I/ATLAS in radio wavelength during closest approach to Earth using uGMRT", The Astronomer's Telegram, No. 17571, 2026

Talks / Seminars Delivered in reputed conference / institutions

1. Invited talk at Kavli Institute for Astronomy and Astrophysics, Beijing, China; 17/09/2025; Kavli Institute for Astronomy and Astrophysics, Beijing, China; 1 hour

Administrative duties

1. Committee Member of Computer Service Cell-Working Group
2. Member of Technical Cell Working Group
3. Member of SCOLP Committee and managing DAHEP seminars
4. Member of "Syllabus modification Committee" (for IPhD and PhD courses)

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. L. K. Dewangan (Physical Research Laboratory, Ahmedabad, India); Sl. No. 1, 5, 7; National
2. Anandamayee Tej (Indian Institute of Space Science and Technology, Thiruvananthapuram, India); Sl. No. 1, 3, 5, 7; National
3. Tie Liu (Shanghai Astronomical Observatory, Shanghai, China); Sl. No. 1, 2, 5, 6, 7; International
4. Amelia Stutz (Universidad de Concepcion, Chile); Sl. No. 4, 5, 7; International

Outreach program organized / participated

1. 2026 January 2, "Sky-watching Program", Open Day, SNBNCBS, Kolkata

Areas of Research

My group also conduct extensive research on protostellar outflows and jets, which are ubiquitous signatures of active accretion during the earliest stages of stellar evolution. These bipolar flows provide a unique window into the mass-accretion history of protostars and the mechanisms through which angular momentum is removed from collapsing systems. Using molecular line observations and imaging data, I investigate the morphology, kinematics, energetics, and feedback effects of stellar outflows. Particular emphasis is placed on understanding how outflows interact with their natal environments, inject turbulence into molecular clouds,

and regulate subsequent star formation. Outflows also serve as powerful diagnostics for identifying deeply embedded protostars that may otherwise remain undetected at optical and infrared wavelengths.

In recent years, my group has started incorporating machine learning methodologies into astrophysical research. The rapid growth of astronomical survey data from ground-based and space-borne observatories necessitates advanced analytical tools capable of identifying complex patterns and extracting scientifically meaningful information. My group utilizes machine learning techniques for the automated detection and classification of structures in the molecular clouds and several other parameters. I also explore deep-learning approaches for image segmentation, source identification, and the prediction of physical parameters from large multi-dimensional datasets. These data-driven methods complement traditional astrophysical analyses and enable the efficient exploration of increasingly large and complex astronomical archives.

The Centre has started the initial foundation to build S. N. Bose Astronomical Observatory at Panchet Hilltop, Purulia. Recently, a weather station and a mobile observatory have been installed at the hilltop. We already have gathered observational data for astronomical seeing measurements. We have also started scientific operation of mobile observatory. I would like to keep on contributing in the development of this telescope project.

A significant component of my research concerns Galactic filaments, which have emerged as one of the most important structures in the interstellar medium following discoveries by missions such as Herschel Space Observatory. These elongated structures are ubiquitous within molecular clouds and appear to be intimately linked to the star-formation process. My studies focus on the morphology, density structure, kinematics, magnetic-field interactions, and gravitational stability of filaments. I investigate how filaments form through large-scale Galactic processes, how they fragment into dense cores, and how mass accretion along filamentary networks feeds hub regions where clusters and massive stars are formed. Understanding the lifecycle of filaments is essential for constructing a unified picture of star formation within the Galactic ecosystem.

The ALMA-ATOMS Survey: Exploring Protostellar Outflows in HC3N

The primary goal of this study was to identify a reliable tracer of the low-velocity component of protostellar outflows, which often contains a significant fraction of the outflow mass and energy. Using ALMA observations of 146 massive star-forming regions, we identified HC_3N (cyanoacetylene) as an effective tracer of low-velocity outflowing gas, which is often missed by traditional tracers such as CO and SiO.

The study detected numerous bipolar outflows and demonstrated that HC_3N can trace outflow activity across different evolutionary stages of massive star formation, including both highly collimated jets and wide-angle flows. Derived outflow properties, such as mass, momentum, and energy, show correlations with the mass and luminosity of the host clumps, indicating that more massive protostars drive more powerful outflows. This work establishes HC_3N as a powerful new tracer for studying protostellar feedback and massive star formation with ALMA (Hoque, Baug, et al. 2025, ApJ, 987, 197).

ATOMS-QUARKS Survey: Inflow and Infall in Massive Protocluster G318.049+00.086—Evidence of Competitive Accretion

We investigated the gas dynamics of the massive protocluster G318.049+00.086, a young star-forming region containing 12 prestellar core candidates and 4 protostellar cores. Using high-resolution ALMA observations, we studied how gas is transported from large-scale filaments into dense star-forming cores. The observations revealed a prominent hub–filament system,

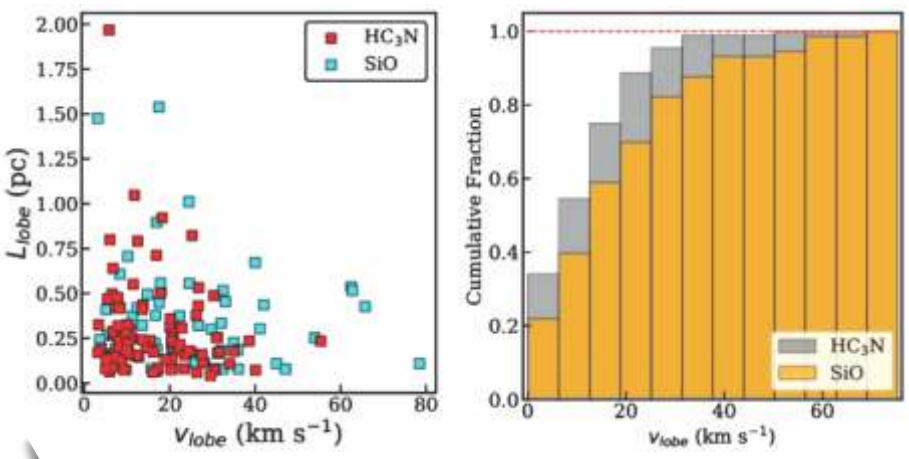


Figure 1. (Left) Comparison of length of outflow lobe (Llobe) with the outflow terminal veocity (vlobe) for outflows identified using HC_3N and SiO, (Right) Distribution of cumulative fraction of vlobe of outflows detected in HC_3N (in gray) and SiO (in orange). Overall these figures show that HC_3N is capable of identifying the low-velocity components of outflows compared to the traditional tracer like SiO.

where four molecular filaments converge into a dense central hub. Strong velocity gradients along the filaments indicate inward gas flow, with mass inflow rates exceeding 10^3 M Myr $^{-1}$, demonstrating that the filaments efficiently feed the central region. Most protostellar cores exhibit blue-asymmetric line profiles, a signature of gravitational infall and active accretion, while a few filamentary cores show red-asymmetric profiles, suggesting expansion or mass loss.

A key result is the identification of a hierarchical accretion process, in which gas flows from parsec-scale filaments into the hub and subsequently into the central protostellar cores. These observations provide strong evidence for the competitive accretion model of massive star formation, where centrally located protostars grow preferentially by accreting material from a common gas reservoir (Gupta, Baug, et al. 2026, ApJ, 999, 180).

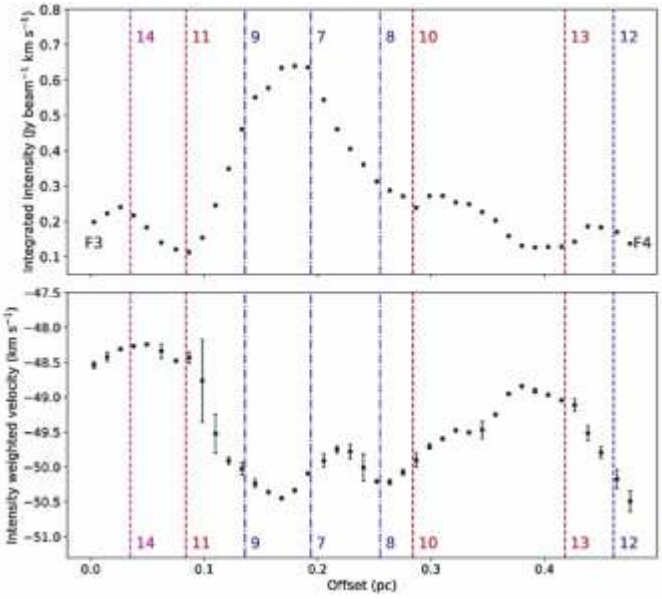


Figure 2. The upper panel shows the integrated intensity distribution along a filament, while the lower panel present the corresponding intensity-weighted velocity (PV) profile traced by H13CO+. Blue and red vertical lines mark the positions of dense cores with blue- and red-asymmetric profiles, respectively, and the magenta line indicates a core with a single-peaked profile. The dotted-dashed blue lines denote hub-associated cores. The blue-profile cores are located at the highest-density and lowest-velocity regions of the filament, supporting a competitive accretion scenario for star formation.

Plan of Future Work Including Project

Herschel Observations revealed ubiquitous elongated filamentary structures in Galactic molecular clouds. Although filaments are believed to play important role in star formation, the property of filaments in transporting gas varies with their length-scale (Hacar et al., 2022). The gas flow in filaments become more streamline and rapid at the sub-parsec scale. Exact length-scale and origin of such behavior of filaments should be verified in detail. Thus, I would like to study the role of filaments at sub-parsec scale using the mm/sub-mm data from Atacama Large Millimeter/submillimeter Aarray (ALMA). Identification of filaments in molecular clouds is not trivial. we are developing a method to identify and characterize the filaments from the 3D cube data of the Galactic molecular cloud.

Protosellar jets and outflows are ubiquitous phenomena in the early phase of star formation, irrespective of their mass. Probing these outflows may help us in understanding the finer details of the outflow parameters and their launching mechanisms. Our group is working on different aspects of outflows. For example, knots in the outflows help us to assess the accretion history of the protostars. Also, how the power of the bipolar jet is connected with the associated outflows, and hence, the entrained outflows mass.

The Centre has made a substantial progress to build S. N. Bose Astronomical Observatory at Panchet Hilltop, Purulia. A weather station and a mobile observatory have already been installed at the hilltop. We already have gathered observational data for astronomical seeing measurements. We have also started scientific operation with the 14-inch telescope at the observatory. I would like to keep on contributing in the development of this telescope project.

Any other Relevant Information including social impact of researcl.

1. Member of national committee for the proposal of National Large Optical Telescope, leading by Indian Institute of Astrophysics. A funding proposal for this telescope has been to submitted to DST
2. Member of national committee for the proposal of National Sub-millimeter Telescope, leading by Tata Institute of Fundamental Research
3. Reviewer of the observational proposals for 2-m Himalayan Chandra Telescope, 3.6-m Devasthal Optical Telescope and Giant Metrewave Radio Telescope

Department of
Chemical and Biological Sciences

















Ali Hossain Khan

Ramanujan Fellow
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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Sourik Dutta; Doped 2D Nanocrystals for Photonic Applications; Under progress, pre-PhD seminar done; shared with Prof. Rajib Kumar Mitra
2. Bikram Das; Heavy-Metal-Free Photonic Colloidal 2D Nanocrystals; Under progress; shared with Prof. Rajib Kumar Mitra

b) External Project Students / Summer Training

1. Shubhadeep Mandal (Summer Training 2025); InSe nanoplatelets and an approach towards its optoelectrical property enhancement; Ramakrishna Mission Vidyamandira, Belur
2. Subhajit Barman (Summer Training 2025); An Approach towards the synthesis of Size and Shape Controlled InP 2D Nanoplatelets; IIT Kanpur

Teaching

1. Spring semester 2025; "Surfaces & Interfaces" (Code: CB 641); PhD; 8 students; shared with Dr. Pradip S. Pachfule

Publications

a) In journals

1. Chandrasekhar Mutyala, **Ali Hossain Khan**, Jari Leemans, Carmelita Rodà, Zeger Hens, Iwan Moreels, *Impact of a CdS Crown on Optical Gain in CdSe/CdS Core/Crown Nanoplatelets*, Advanced Optical Materials, 13, 26, 2025
2. Purvi Kishore, Sourav Barman, Rimpa Dey, Ankita Jana, Malabika Ghosh, Pousali Bag, Tapas Ghatak, Partha Sona Maji, Chitrita Ghosh, Nayana Mukherjee, Ankan Dutta Chowdhury, Souvik Ghatak, Rupam Mukherjee, Arnab Basu, **Ali Hossain Khan**, Surya K. Ghosh, Sadananda Mandal, Amit Ranjan Maity, *Delivering Drugs to Cancer Cells and inside the Mitochondria Using a Dual-Ligand Installed Targeted Drug Delivery System*, ACS Applied Nano Materials, 8, 19668-19678, 2025
3. Debasrita RoyChowdhury, Soumyananda Chakraborti, Sukhendu Mandal, **Ali Hossain Khan**, Kunal Sikder, Dipak Manna, Abhrajyoti Ghosh, Subhash Haldar, Poulami Mukherjee & Arnab Basu, *Nitroxoline Shows Synergy with Colistin Potentiating its Bactericidal Efficacy in Opportunist Pathogen Pseudomonas aeruginosa*, Current Microbiology, 82, 587, 2025
4. Sujata Saha, Debasrita RoyChowdhury, **Ali Hossain Khan**, Sukhendu Mandal, Kunal Sikder, Dipak Manna, Amit Ranjan Maity, Soumyananda Chakraborti, Arnab Basu, *Harnessing the effect of iron deprivation to attenuate the growth of opportunistic pathogen Acinetobacter baumannii*, Antimicrobial Agents and Chemotherapy, 69, 5, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. 2nd International Conference on Advanced Materials and Manufacturing (ICAMM 2.0), Title

of the Invited Lecture: Donor-Bound Excitons and Intersubband Excitation-Driven Resistive Switching in Indium-Doped 2D CdSe Nanocrystals; January 8th & 9th, 2026; JIS Institute of Advanced Studies & Research (JISIASR), JIS University, WB, India; 30 minutes

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Doped 2D Nanocrystals for Photonic Applications; Ramanujan Fellowship, SERB, India; 5 years (01-04-2021 – 31-03-2026); PI
2. Heavy-Metal-Free Photonic Colloidal 2D Nanocrystals; CRG, SERB, India; 3 years (08-02-2023 – 07-02-2026); PI

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Ghent University, Belgium; Sl. No. 1; International
2. Amity University Kolkata, Kolkata; Sl. No. 2; National
3. Ramakrishna Mission Vivekananda Educational Research Institute, Belur Math, Howrah; Sl. No. 3, 4; National

Outreach program organized / participated

1. Contributed an invited expert perspective for "Science Factors" published by the Rosalind Franklin Council of Scientific Research (RFCSR). The article, "How Tiny Materials Can Control Light", is available at: https://factors.press/articles/how-tiny-materials-can-control-light/

   Science Factors is a monthly, open-access magazine published by RFCSR, widely read by researchers, faculty, and students across leading institutions, aiming to present rigorous science in an accessible format.

Areas of Research

2D nanocrystals

Controlling the electronic structure of semiconductor nanocrystals through impurity doping is essential for the development of next-generation optoelectronic and photonic devices. In this work, we achieved the first direct experimental observation of emissive donor-bound

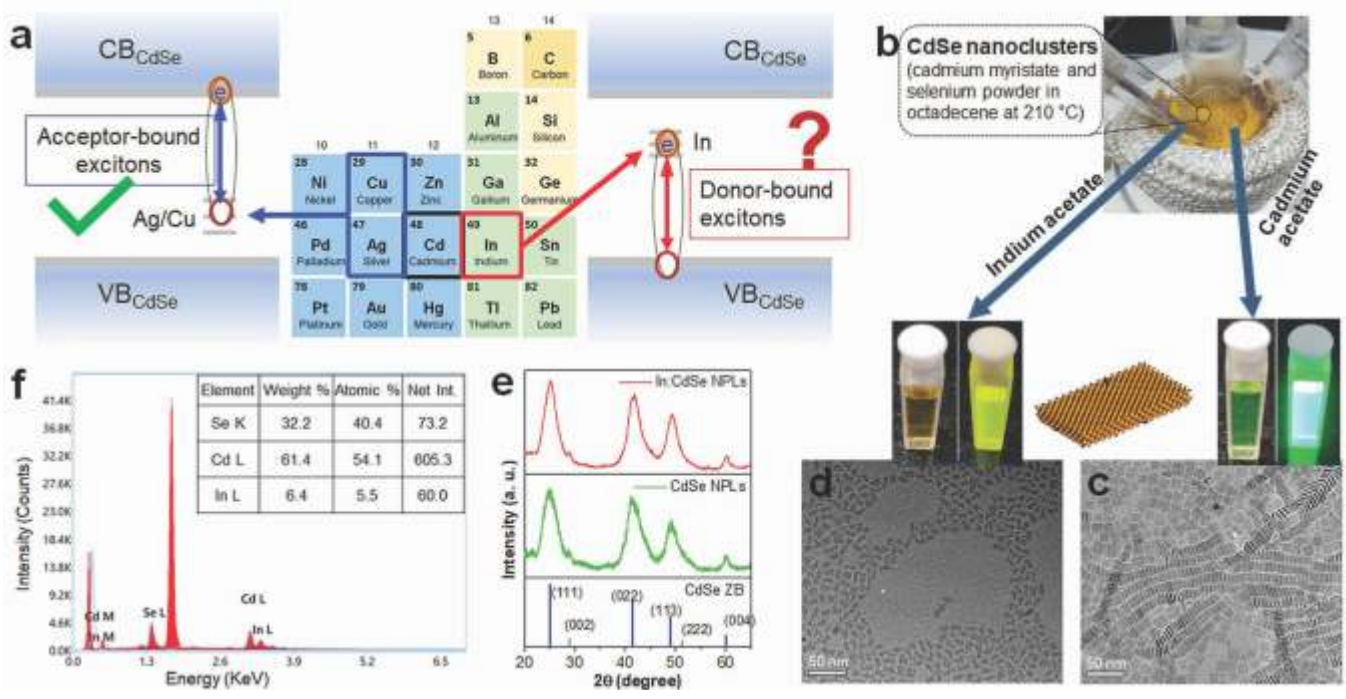


Figure 1 (a) Schematic illustration of acceptor-bound and donor-bound excitons in CdSe, through doping with heterovalent p-type (Ag and Cu) and n-type (In) impurities. **(b)** Schematic representation of the synthesis of CdSe and In:CdSe NPLs. TEM images of the **(c)** CdSe NPLs and **(d)** In:CdSe NPLs. **(e)** XRD patterns of CdSe and In:CdSe NPLs, are shown as green and red patterns, respectively. Vertical lines represent bulk zinc-blende CdSe (ICDD card no. 98-018-6011). **(f)** Energy-dispersive X-ray (EDX) spectra and quantified elemental percentages of Cd, Se, and In in In:CdSe NPLs.

excitons in n-type indium-doped CdSe nanoplatelets (NPLs). Although acceptor-bound excitons originating from p-type dopants have been extensively studied in colloidal semiconductor nanostructures, donor-bound excitons have remained experimentally unexplored. By employing ultrathin two-dimensional CdSe NPLs with atomically controlled thickness and exceptionally narrow emission linewidths, we successfully identified a stable indium-induced donor state positioned approximately 0.2 eV below the conduction band edge (Figure 1).

A combination of transient absorption spectroscopy, temperature-dependent photoluminescence, time-resolved fluorescence spectroscopy, and density functional theory (DFT) calculations revealed the formation of a distinct three-level electronic structure associated with donor-bound excitons (Figure 2). In contrast to conventional acceptor-bound excitonic systems, the donor-bound excitons exhibited remarkably narrow emission linewidths, small Stokes shifts, and ultrafast recombination dynamics with an average lifetime of ~14 ns, nearly two orders of magnitude faster than those typically observed in p-type-doped nanocrystals. Furthermore, the donor-state emission energy remained nearly invariant with increasing dopant concentration, highlighting the intrinsic robustness and spectral stability of the donor electronic state. These findings establish donor-state engineering as a promising strategy for tailoring ultrafast and spectrally stable light-emitting nanomaterials, offering new opportunities for advanced optoelectronic, photonic, and quantum-light applications. This work has been published in ***ACS Nano*** 20 (14), 11422-11433, 2026, IF: **16.1**

DOI: https://doi.org/10.1021/acsnano.6c01679

We further utilized the In:CdSe NPLs for device applications (Figure 3). In the above study, we observed that indium doping in CdSe NPLs creates a shallow donor state located ~0.2 eV below the conduction band, resulting in a well-defined three-level electronic system. This donor state enables voltage-driven intersubband excitation of localized electrons into extended conduction-band states at ultralow bias (±0.2 V),

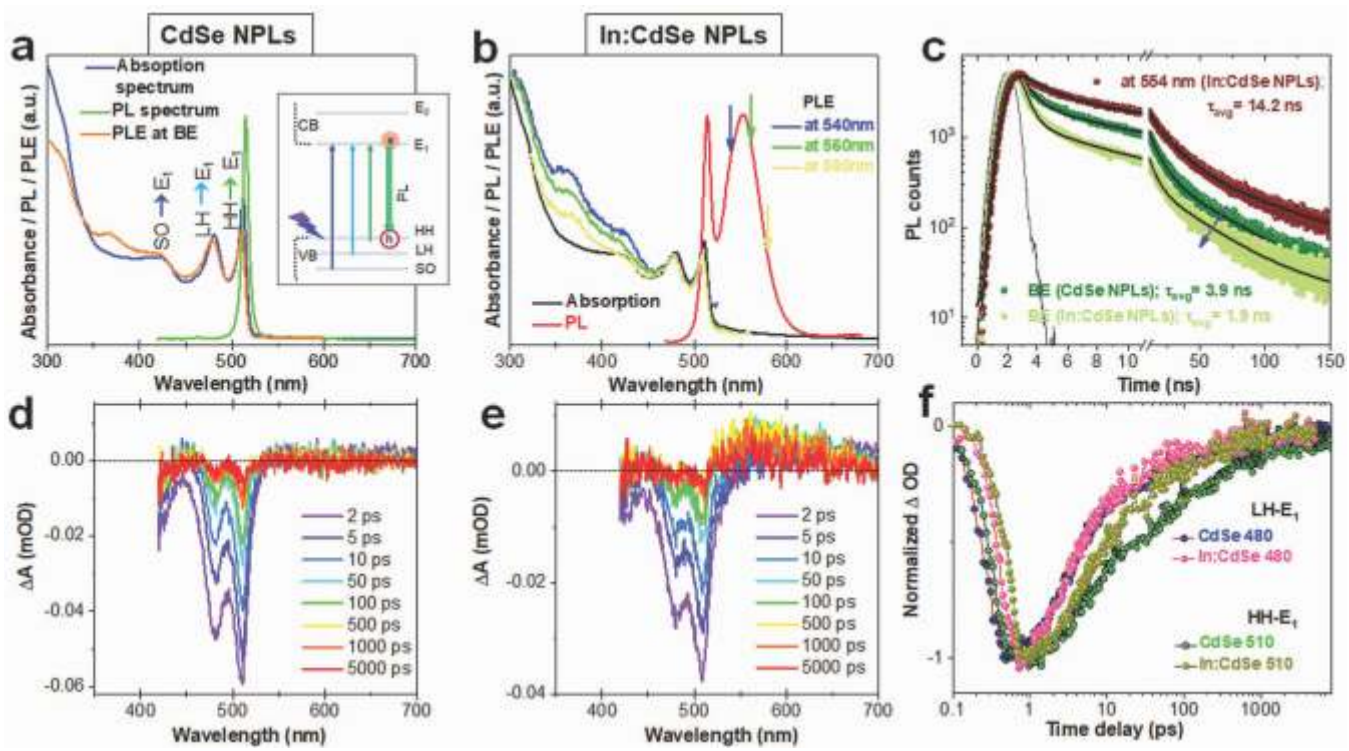


Figure 2 (a) Absorbance (blue lines), steady-state PL (green lines, excited at 400 nm), and PL excitation spectra (orange line, measured at 514 nm) of CdSe NPLs. Inset: schematic illustration of the conduction and valence band energy levels, and optical transitions in NPLs. **(b)** Absorbance (black lines), steady-state PL (red lines, excited at 400 nm), and PL excitation spectra (measured at three different monitoring wavelengths of the dopant emission) of In:CdSe NPLs. **(c)** Normalized time-resolved PL decay traces of CdSe NPLs and In:CdSe NPLs measured at band-edge emission and dopant emission (at 554 nm) using 3.34 eV excitation. Transient absorption spectra of **(d)** CdSe and **(e)** In:CdSe NPLs at varying time delays upon 400 nm pump excitation. **(f)** Comparison of the formation and decay kinetics of the bleaches at the 480 and 510 nm bands for CdSe and In:CdSe NPLs.

producing a purely electronic resistive switching response.

Unlike conventional memristive systems, where resistance switching typically arises from ion migration or conductive filament formation, the switching mechanism observed here is governed exclusively by the occupation and de-occupation of the donor state. Devices fabricated in an Al/In:CdSe/Au configuration exhibit symmetric bistable I-V characteristics with an ON/OFF ratio of $\sim 10^6$, switching speeds of $\sim 0.4\ \mu s$, endurance exceeding 10^3 cycles, retention times beyond 10^4 s, and an ultralow energy consumption of ~ 0.19 nJ per switching event.

The reversible transition between the high-resistance and low-resistance states originates from the redistribution of charge carriers between the localized indium donor level and the conduction band and is restored once the external bias is removed. This work introduces a fundamentally new resistive switching mechanism based on donor-to-conduction-band intersubband excitation, establishing a pathway toward low-voltage, solution-processed, non-ionic memristors. The findings further open new opportunities for multilevel memory storage and neuromorphic computing applications using doped colloidal semiconductor nanostructures. We are currently preparing this work for submission and are awaiting completion of the theoretical analysis from our collaborator.

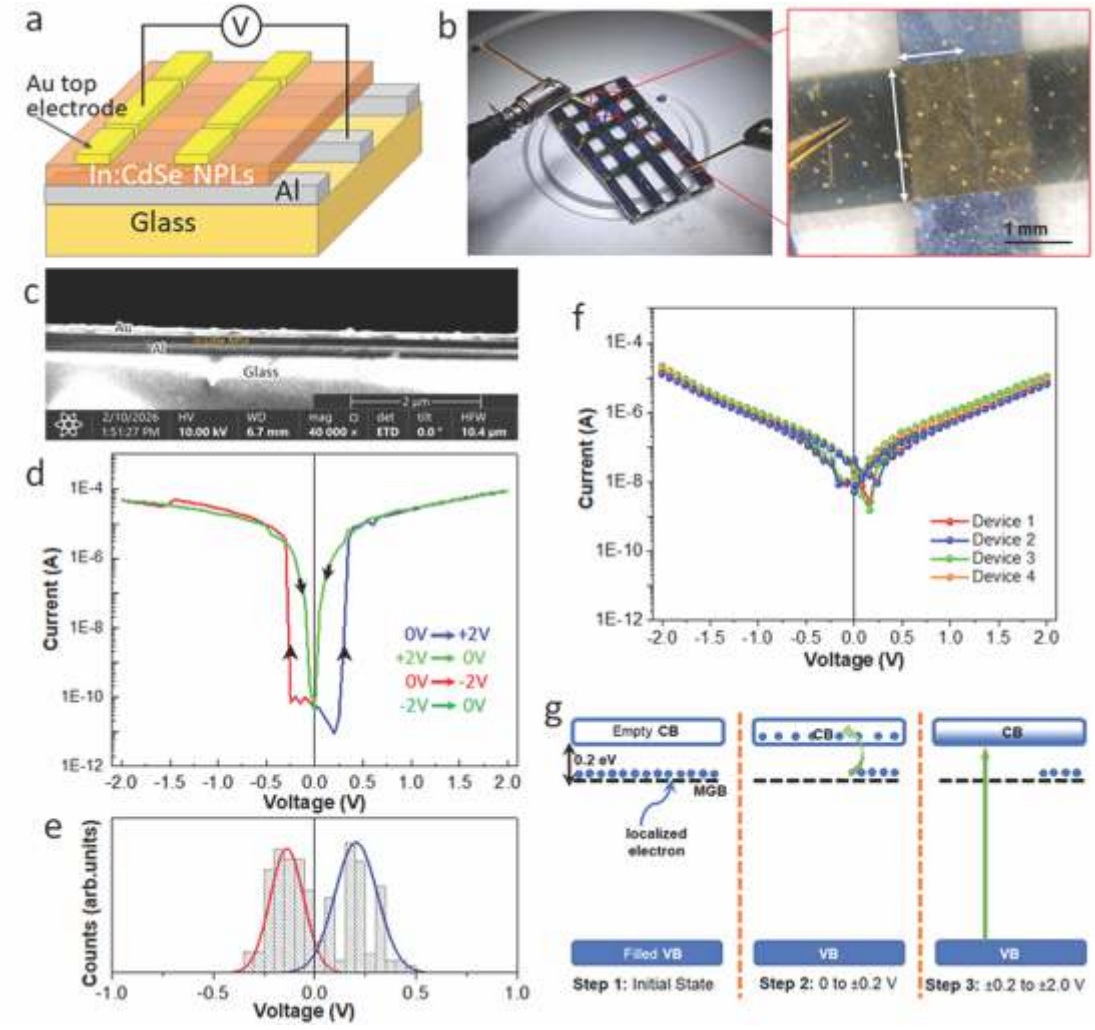


Figure 3 Observation of resistive switching behavior in In:CdSe NPLs for n-type donor states. (a) Schematic diagram of the Al/In:CdSe/Au device used in this study. (b) Top-view photograph of the device under test, showing the probe tips contacting the bottom and top electrodes. Inset: Zoomed-in microscopic image highlighting the active device region. (c) Cross-sectional SEM images of the devices showing the electrodes and the In:CdSe layers. (d) Semilogarithmic I-V curve of the Al/In:CdSe/Au device. (e) Histogram of the cycle-to-cycle distribution of the low-resistance state (LRS). (f) Semilogarithmic I-V curve of the Al/CdSe/Au device. (g) The schematic illustration depicts the mechanism of resistive switching.



Arghya Sardar

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Guidance of Students/Post-Docs/Scientists

Talks / Seminars Delivered in reputed conference / institutions

1. Talk titled "Electric Vehicle Technology Trend and Relevance of it for Hyperloop Development"; 27/09/2025; Vellore Institute of Technology, Vellore; 1 hour
2. Talk titled "EVs: Demystifying total cost of ownership"; 02/04/2025; Virtual (Centre for Science and Environment, New Delhi); 1 hour

Administrative duties

1. Member, Committee on Institute Archive.
2. Member, Committee for Beautification of the Court-yard
3. Liaison Officer of the Technical Cell
4. Drafted reply to several Parliament Questions

Membership of Learned Societies

1. Member, SAE India

Outreach program organized / participated

1. Participated as a judge in the students' Hyperloop Competition at VIT, Vellore during the event ELEVATE (Engineering LEVitation for Advanced Transport & Energy), held as part of graVITas 2025 on the 26th and 27th of September at the VIT Vellore campus

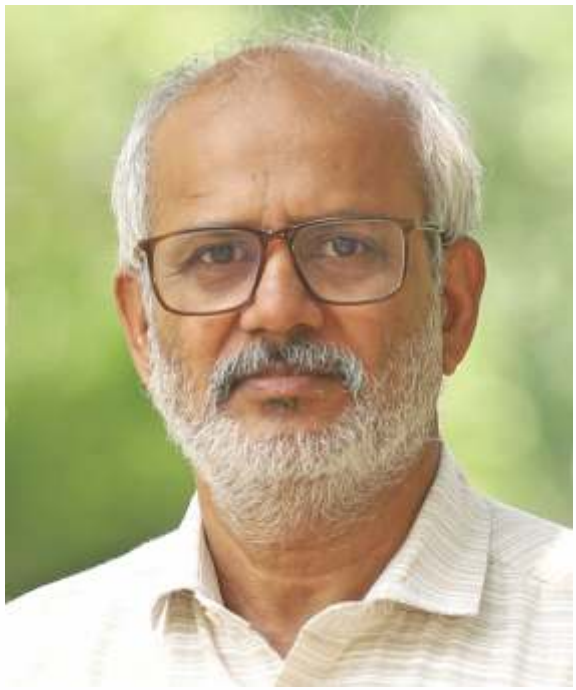
Areas of Research

1. I had been involved with technology foresight and assessment in the areas of advanced transportation and energy systems, with a major focus on electric vehicles prior to join the Centre.
2. Developed traffic microsimulation models, simulation models of vehicle drivetrain, as well as simulation models for analyzing impacts on electricity grid.
3. PhD work - Modelling of Electric Bus System: Developed a comprehensive methodology to evaluate the various combinations of charging strategies and energy storage systems for electric buses. This methodology includes a Genetic Algorithm based co-optimization of battery capacity, charging schedule and vehicle schedule for electric bus transport system considering the properties of the battery, traffic characteristics and vehicle attributes.
4. Catalyzing collaborative works with industry including framing of the required policies.

Plan of Future Work Including Project

The future plan is to explore the following two research tracks and initiate specific projects on them

1. Development of computational models for emerging materials for energy and green mobility systems bridging the gap between microscopic physical phenomena and macroscopic system level performance.
2. Utilization of the data generated at the Astronomical Observatory at Panchet, Purulia for application in energy sector research.



Gautam Gangopadhyay

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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Jayarshi Bhattacharya; Quantum Transport problems in bosonic and fermionic systems
2. Pallabi Roy; Stochastic Response of Some Biochemical and Biophysical Systems

Publications

a) In journals

1. Anirban Karmakar and **Gautam Gangopadhyay**, *Coherent control of steady state and dynamic ergotropy in bipartite quantum batteries*, Physica Scripta, 100, 105007, 2025

Conference / Symposia / Schools organized

1. A Symposium on Recent Advances in Physical Chemistry Research (SRAPCR 2025), at IACS, Kolkata, Session Chair, on 10-12 April, 2025

Outreach program organized / participated

1. A course delivered on Nonequilibrium Thermodynamics, delivered at RKVC, Rahara, West Bengal for MSc.(Physical Chemistry) students
2. Courses delivered on Quantum Mechanics and Numerical methods at Kalyani University, Kalyani, West Bengal for MSc.(Chemistry) students

Areas of Research

Stochastic Processes in biophysical and biochemical systems

Our general investigation is on the intricate dynamics of biochemical and biophysical systems, shedding light on their behaviour far from equilibrium. The application of stochastic dynamics to these systems offer a fruitful understanding of their complexities which can be extended to the study of the thermodynamic cost of energy and entropy. Our recent work is on the ultrasensitive transition dynamics in phosphorylation-dephosphorylation processes and cascading circuits.

Quantum batteries with model molecular systems

Our recent investigation is on the ergotropy of a bipartite quantum battery is examined within an open system setup, where the coupling between the holder component and the external energy supply is mediated by a two-level system charger. Special attention has been focused on ergotropy for a two-level system holder under steady state and dynamical regime. Although typical battery charging cycles and their long-term performance depends on various characteristics of the reservoir, we have exemplified that the ergotropy of a quantum battery is not solely determined by its microscopic details of the system but is governed by more fundamental thermodynamic principle that applies across various quantum models within Markovian framework. We have also demonstrated the intricate interplay of coherent charger-holder coupling, external driving and damping parameters which can be utilized to get an optimized two-level system quantum battery. An attempt has also been made to model a chargerless quantum battery with a predesigned source reservoir in a transport setup which is a novel example of reservoir assisted charging.



Manik Pradhan

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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Soumyadipta Chakraborty; High-resolution Laser Spectroscopy; Under progress
2. Indrayani Patra; Molecular Spectroscopy; Under progress
3. Anuradha Sett; Weak Measurements and Optical Beam Shifts; Under progress
4. Dinesh Chandra Dey; Geometric Phase and Weak Measurements; Under progress
5. Arup Biswas; Laser Spectroscopy; Under Progress

b) Post-Docs

1. Soumen Mandal; Optical Beam shifts and weak measurements

c) External Project Students / Summer Training

1. Upasana Das; Photonic Spin Hall effect and quantum weak measurement; IIT (ISM) Dhanbad
2. Bibhutibhusana Panda; Quantum cascade laser coupled with scanning Febry-Perot resonator; NIST University, Berhampur

Teaching

1. Autumn Semester; Molecular Physics and Spectroscopy (CB-627); PhD; 7 students; Shared
2. Spring Semester; Project Research III (PHY 502); Integrated PhD; 1 student
3. Autumn Semester; Atomic and Molecular Physics (PHY 501); Integrated PhD; 11 students; Shared

Publications

a) In journals

1. Soumen Mandal, Abdul Rehman, Dinesh C. Dey, Anuradha Sett, Mark W. Horn, **Manik Pradhan**, and Akhlesh Lakhtakia, *Transmission-mode geometric phases and photonic-spin-dependent splitting characteristics of circular Bragg phenomenon through quantum weak measurements [Invited]*, Optical Materials Express, 16, 359-374, 2026
2. Soumyadipta Chakraborty, Indrayani Patra, Arup Biswas and **Manik Pradhan**, *High-resolution cavity ring-down spectroscopic investigation of the fundamental symmetric stretch ($_1$) band of $^{14}N^{15}N^{16}O$ isotopologue in the 7.8 m mid-IR region,* Journal of Molecular Spectroscopy, 413-414, 112056, 2025
3. Soumen Mandal, Dinesh Chandra Dey, Anuradha Sett and **Manik Pradhan**, *Photonic spin splitting with orbital angular momentum pointer states via modified weak measurement*, Physical Review A, 112, 033511, 2025
4. Anuradha Sett, Soumen Mandal, Dinesh Chandra Dey and **Manik Pradhan**, *Investigation of orbital angular momentum sidebands in anisotropic few-layered ReS_2*, Journal of Optics, 27, 085401, 2025
5. Soumyadipta Chakraborty, Jayeta Banerjee, Indrayani Patra, Puspendu Barik and **Manik Pradhan**, *Gold Nanoparticle Aggregation Pathways Probed by Evanescent Wave Cavity Ringdown Spectroscopy: The Role of Guanidine Hydrochloride and $_L$-Tryptophan*, Analytical Chemistry, 97, 17296-17306, 2025

6. Dinesh Chandra Dey, Soumen Mandal, Anuradha Sett, Jayeta Banerjee, and **Manik Pradhan**, *Observation of the non-cyclic Pancharatnam–Berry phase in monolayer $ReSe_2$*, Journal of the Optical Society of America B, 42, 1746-1752, 2025
7. Indrayani Patra, Soumyadipta Chakraborty, Biswajit Panda and **Manik Pradhan**, *Simultaneous measurement of NO_2 and NH_3 using a quantum cascade laser coupled wavelength modulation spectrometer in the mid-IR region*, Laser Physics, 35, 055701, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Seminar on the Occasion of National Science Day; 27/02/2026; Department of Physics, Aliah University, Kolkata; 27th February, 2026
2. International Workshop on Spin-Orbit and Chiral Nano-photonics; 07/03/2026; Royal Bengal Room, City Centre1, Kolkata; 7th March, 2026
3. Advances and Innovations in Chimerical Sciecnes-2025; 11/12/2025; Vedic Village Resort, Kolkata; 11-13, December, 2025
4. Interdisciplinary Horizons of Physical Chemistry (IHPC)-2025; 17/07/2025; Bose Institute, Kolkata; 17-19 July, 2025

Administrative duties

1. Member of Technical Cell Advisory Committee
2. Member of Works Committee
3. Convener of Pest Control Monitoring Committee
4. Co-Convener of Project and Patent Cell
5. Member of Reservation Cell

Awards, Recognitions, if any

1. Research work on Evanescent-wave Cavity Ring-down Spectroscopy has been highlighted by the Analytical Chemistry, American Chemical Society (ACS) Journal
2. Highlighted Research work and press release on "A tug of war in gold nanoscale assembly can help produce better biosensors" by the Ministry of Science & Technology, DST

Membership of Learned Societies

1. Fellow of the Linnean Society of London (FLS), London, UK
2. Member of Chemical Research Society of India (CRSI)
3. Member of Indian Physics Association (IPA)
4. Member of Indian Laser Association (ILA)
5. Member of Indian Society of Chemistry and Biology (ISCB)
6. Member of Research Society for the Diabetes in India (RSSDI)
7. Fellow of the Royal Society of Chemistry (FRSC), London, UK
8. Fellow of the Institute of Physics (FInstP), IOP, London, UK

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Soumen Mandal, Abdul Rehman, Dinesh C. Dey, Anuradha Sett, Mark W. Horn, Manik Pradhan, and Akhlesh Lakhtakia. "Transmission-mode geometric phases and photonic-spin-dependent splitting characteristics of circular Bragg phenomenon through quantum weak measurements": Optical Materials Express, 16, 359 (2026); Sl. No. 1; International

Outreach program organized / participated

1. Participated on the Occasion of national Science Day and delivered an invited lecture at Aliah University, Kolkata on 27th February, 2026
2. Participated at the International SPARC Workshop on Nano-photonics organized by IISER Kolkata and delivered an invited talk on 7th March, 2026

Areas of Research

1. Gold Nanoparticle Aggregation Pathways Probed by Evanescent Wave Cavity Ringdown Spectroscopy:

   Gold nanoparticles (GNPs) are widely utilized in biomedical sensing, environmental monitoring, and imaging due to their tunable localized surface plasmon resonance, which is highly sensitive to aggregation dynamics. Understanding the factors governing GNP aggregation is crucial for optimizing plasmonic sensors and enhancing detection methodologies. Guanidine hydrochloride (GdnHCl), a strong chaotropic agent, influences nanoparticle stability and aggregation, yet its direct role in modulating GNP assembly remains largely unexplored. While guanidine-functionalized GNPs have been studied for controlled aggregation, the impact of

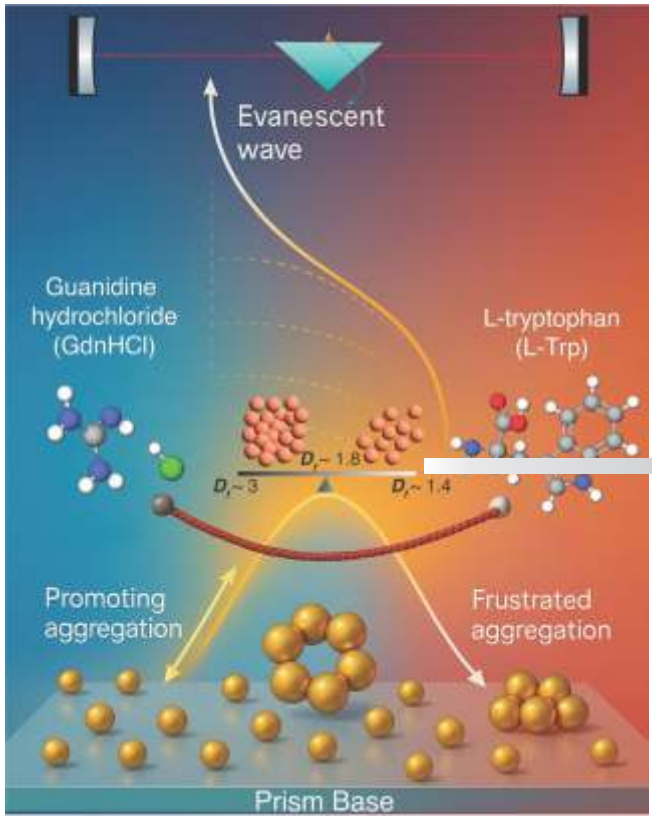


Figure1: Gold Nanoparticle Aggregation

free GdnHCl in solution has not been systematically investigated. In this study, we employ evanescent wave cavity ringdown spectroscopy to probe GdnHCl-induced GNP aggregation kinetics in real-time with high sensitivity. Additionally, we explore the influence of l-tryptophan (l-Trp) on this aggregation process, revealing a distinct phenomenon of "frustrated aggregation", where the interplay between guanidinium ions and aromatic amino acids alters the conventional aggregation pathway. This study provides critical insights into the physicochemical interactions governing nanoparticle stability, which can inform the development of advanced nanobiosensors. Our findings contribute to a deeper understanding of GNP aggregation mechanisms and offer new perspectives for designing responsive plasmonic systems for biomedical and analytical applications.

2. Photonic spin splitting with orbital angular momentum pointer states via modified weak measurement:

We report an experimental demonstration of generalized photonic spin splitting (PSS) using arbitrary linearly polarized higher-order orbital angular momentum (OAM) pointer states supported by a modified weak measurement model. The experimental findings show the dependence of longitudinal and transverse PSS on linear polarization angle, postselection angle, and azimuthal index (??) of OAM states. PSS rises as ?? increases, reaching a maximum of roughly 300 μ?m and 120 μ?m for the transverse and longitudinal shift values, respectively. Considering ??=0, 1, and 2, the polarization-controlled variation of both shifts at three distinct angles of incidence is investigated for a fixed postselection angle. All the experimental results agree well with the developed theoretical model, proving the model's accuracy. This model is valid for both external and internal reflection of arbitrary linearly polarized incident light reflecting from absorbing as well as nonabsorbing mediums, considering arbitrary coupling strength and a very small postselection angle. The manipulation of PSS using higher-order OAM light beams shown in this study will have a wide range of applications in wavefront manipulation, optical sensors, and nanophotonics.

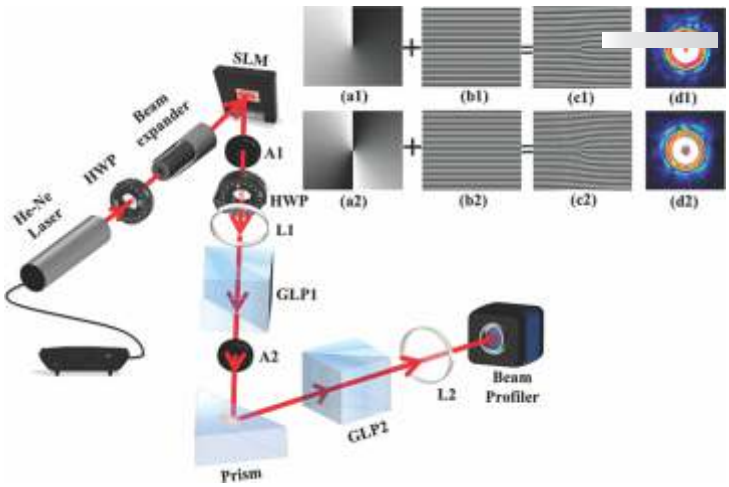


Figure2: Photonic Spin Splitting Setup

Plan of Future Work Including Project

1. Development of quantum weak measurements using single photon light source for studying spin Hall effect and optical bema shifts
2. Exploration of geometric phase and spin splitting of light in various exotic materials
3. High resolution molecular spectroscopy in various isotopic molecules



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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Bikash Mishra; Covalent organic frameworks for energy storage; Under Progress
2. Bidhan Kumbhakar; Covalent organic frameworks for energy storage and catalysis; Under Progress
3. Avanti Chakraborty; Hydrogen peroxide generation using Covalent organic frameworks as photocatalysts; Under Progress
4. Supriti Dutta; Organic transformation using Covalent organic frameworks as photocatalysts; Under Progress
5. Tuhin Das; Ionic covalent organic frameworks for water splitting; Under Progress
6. Harshal Rohidas Patil; Covalent organic frameworks for photocatalytic organic transformation; Under Progress
7. Asis Sethi; Carbon-based materials for electrocatalysis; Awarded

b) Post-Docs

1. Pekham Chakrabortty; Nitrogen-rich Covalent Organic Frameworks for Heterogeneous Photoreduction of Carbon Dioxide
2. Pampa Jhariat; Anionic Covalent Organic Frameworks for Uranium Extraction from Seawater: Synergistic Adsorption and Photocatalytic Approaches

c) External Project Students / Summer Training

1. Chowdhury Ismat Nurani (External Project Student - TRC Project); Covalent organic framework-based photocatalysts for water-spitting and energy storage
2. Taufique Ali (Summer Training); Metal complex Immobilized Covalent Organic Frameworks for Catalysis
3. Aparna Tiwari (Summer Training); Covalent organic frameworks for photocatalytic organic transformation

Teaching

1. Spring Semester; Surfaces & Interfaces; PhD; 5 students
2. Spring Semester; Methods of Experimental Physics; Integrated PhD; 10 students; Shared equally with Atindra Nath Pal, Ramkrishna Das, Nitesh Kumar, Kalyan Mondal, Anjan Barman and Saquib Shamim

Publications

a) In journals

1. Priyanka Dobariya, Vinay Thakur, Amrutha A, Karan Marvaniya, Ashish Maurya, **Pradip Pachfule**, Prashant Kumar, Raghavan Ranganathan, Shilpi Kushwaha, Ketan Patel, *Large-Area Supramolecular Crystalline Thin Films of Polyoxometalates with Controlled 1-nm Pores Enabling Ultra-Selective Molecular Transport*, Journal of the American Chemical Society, 2026 (https://doi.org/10.1021/jacs.5c17644)
2. Bidhan Kumbhakar, Avanti Chakraborty, Uttam Pal, Gaurav Jhaa, Sukanta Mondal, Abhik

Banerjee, Tanusri Saha-Dasgupta, **Pradip Pachfule**, *A Dimolybdenum Paddlewheel Embedded Covalent Organic Framework for Photocatalytic Hydrogen Peroxide Generation*, Small, 21, 2501823, 2025

3. Bikash Mishra, Akhtar Alam, Avanti Chakraborty, Bidhan Kumbhakar, Samrat Ghosh, **Pradip Pachfule**, Arne Thomas, *Covalent Organic Frameworks for Photocatalysis*, Advanced Materials, 37, 2413118, 2025
4. Bikash Mishra, Shyamali Maji, Monojit Roy, Supriti Dutta, Archisman Sinha, Tarak Nath Das, Sukanta Mondal, Abhik Banerjee, Arne Thomas, **Pradip Pachfule**, Debashis Adhikari, *A Thiazole-Linked Dithiophenedione-Functionalized Covalent Organic Framework for Photocatalytic Oxidative Dehydrogenation Reactions*, Chemistry of Materials, 37, 8775-8786, 2025
5. Bikash Mishra, Supriti Dutta, Uttam Pal, Subhajit Rana, Sandeep Kumar Mishra, Tanusri Saha-Dasgupta, **Pradip Pachfule**, *Diketopyrrolopyrrole-based Donor–Acceptor Covalent Organic Frameworks for Iodine Capture*, Small, 21, 2411199, 2025
6. Bidhan Kumbhakar, Avanti Chakraborty, Uttam Pal, Gaurav Jhaa, Sukanta Mondal, Abhik Banerjee, Tanusri Saha-Dasgupta, **Pradip Pachfule**, *A Dimolybdenum Paddlewheel Embedded Covalent Organic Framework for Photocatalytic Hydrogen Peroxide Generation*, Small, 21, 2501823, 2025
7. Anurupa Maiti, **Pradip Pachfule**, Amit Biswas, Venkataramanan Mahalingam, Anup Bhunia, *Controlled Heterogeneous Electrocatalytic Oxidation of Carboxylates and Halides for the Synthesis of Novel Chemicals*, ChemCatChem, 2025
8. Akhtar Alam, Monojit Roy, Shyamali Maji, Avanti Chakraborty, Vikramjeet Singh, Amit Kumar, Sukanta Mondal, Abhik Banerjee, Kamalakannan Kailasam, Debashis Adhikari, **Pradip Pachfule**, *Xantphos–Cu-Decorated Covalent Organic Frameworks for C– H Arylation through Sensitized Electron Transfer*, Advanced Materials, 37, 2416100, 2025
9. Bikash Mishra, Supriti Dutta, Uttam Pal, Subhajit Rana, Sandeep Kumar Mishra, Tanusri Saha-Dasgupta, **Pradip Pachfule**, *Diketopyrrolopyrrole-based Donor– Acceptor Covalent Organic Frameworks for Iodine Capture*, Small, 21, 2411199, 2025
10. Bidhan Kumbhakar, Uttam Pal, Avanti Chakraborty, Pekham Chakrabortty, Tanusri Saha-Dasgupta and **Pradip Pachfule**, *Engineering donor-functionalized covalent organic frameworks to promote photocatalytic hydrogen peroxide generation*, Chemical Communications, 61, 15425-15428, 2025
11. Aparna Tiwari, Supriti Dutta, Bikash Mishra, Pekham Chakrabortty and **Pradip Pachfule**, *An anthraquinone-based covalent organic framework for sustainable photocatalytic oxidative degradation of polystyrene*, Chemical Communications, 62, 1581-1585, 2026
12. Avanti Chakraborty, Uttam Pal, Sonali Priyadarshini Swain, Sudipa Mondal, Akhtar Alam, Tanusri Saha-Dasgupta and **Pradip Pachfule**, *Engineering intermolecular charge transfer in covalent organic frameworks for photocatalytic hydrogen peroxide generation*, Journal of Materials Chemistry A, 2026, DOI: 10.1039/d5ta09118g
13. Supriti Dutta, Monojit Roy, Shyamali Maji, Bikash Mishra, Anirban Sen, Aparna Tiwari, Tarak Nath Das, Sukanta Mondal, Abhik Banerjee, Debashis Adhikari, **Pradip Pachfule**, *Cationic Covalent Organic Framework for Photocatalytic Defluorinative Amination of Fluoroarenes*, Angewandte Chemie, 65, e16235, 2026

Talks / Seminars Delivered in reputed conference / institutions

1. An oral presentation titled 'Harnessing the Sunlight for Photocatalytic Water Splitting' was given on 08th March 2025 at the '6th European Conference on Metal Organic Frameworks and Porous Polymers (EuroMOF2025)', which was held at Heraklion, Crete (Greece) from 21 to 24 September 2025. This conference focuses on cutting-edge research in MOFs, COFs, and porous polymers, spanning their design, synthesis, characterization, and emerging applications in energy, environment, catalysis, and advanced functional materials; 22/09/2025; Heraklion, Crete, Greece; 25 Minutes
2. An invited talk titled Harnessing the Sunlight for Photocatalytic Hydrogen Peroxide Generation'

was delivered on 14th January 2026 at 'The International Conference on Metal-Organic Framework and Porous Organic Polymers for Energy and Sustainability 2026 (MOFES-2026)' organized by JNCASR, Bangalore, scheduled from 12-15 January 2026 in Bangalore. The conference fostered in-depth discussions on the design, synthesis, and functionalization of porous materials. Emphasis was placed on fundamentals and applications in energy storage and conversion, gas storage and separation, carbon capture, water harvesting, catalysis, and renewable energy systems; 14/01/2026; JNCASR, Bangalore, India; 30 Minutes

3. An oral presentation titled 'Harnessing the Sunlight for Photocatalytic Water Splitting' was given on 06th March 2026 at the Symposium on 'Advanced Materials', supported by the SPARC (Scheme for Promotion of Academic and Research Collaboration), Government of India, held at IIT Kanpur, India on 06th and 07th March 2026. This conference showcased the contemporary breakthroughs across key research areas, including (but not limited to) 2D materials, nanographenes, organic semiconductors, polymers, photoactive materials, advanced materials for energy and catalysis, and biomaterials; 06/03/2026; IIT Kanpur, India; 30 Minutes

4. An invited talk titled 'Harnessing the Sunlight for Photocatalytic Water Splitting' was delivered on 17th March 2026 at the Fuel Chemistry Division, Bhabha Atomic Research Centre (BARC), Trombay, Mumbai-400085, India; 17/03/2026; Bhabha Atomic Research Centre (BARC), Mumbai, India; 45 Minutes

Administrative duties

1. Member of the "Library Committee" at S. N. Bose National Centre for Basic Sciences, Kolkata, which is responsible for advising on the management and development of a library. This committee plays a crucial role in shaping library policies, collection development, and ensuring the library effectively serves its users

2. Member of the committee responsible for the upgrading and beautification of the Central Courtyard in the Main Building at the S. N. Bose National Centre for Basic Sciences in Kolkata. The committee is responsible for finalising one model of the artwork as drawn and submitted by the artist, and for discussing the quality and quantity of the sculpture materials for the beautification of the Central Courtyard in the Main Building

3. Member of the "Hazardous Waste Disposal of the Centre" Committee responsible for the treatment and disposal of hazardous and other wastes generated at S. N. Bose National Centre for Basic Sciences, Kolkata

4. Member of the Committee constituted for continuation of CMS facility for Contractual Staff (Academic & Administrative), Temporary Status Employees and Scholars of the S. N. Bose National Centre for Basic Sciences, Kolkata

5. Member of the Committee constituted for continuation of CMS facility for Contractual Staff (Academic & Administrative), Temporary Status Employees and Scholars of the S. N. Bose National Centre for Basic Sciences, Kolkata

6. Worked as a Convener of Monitoring Committee for the AMC of Housekeeping of Main Building and Hostels. This committee was responsible for the Renewal and Fresh tendering of the Contract for the work - Day to Day Maintenance & Housekeeping of Krishnachura, Radhachura and Basundhara Hostel Buildings and Transit Quarter Complex, Creche, Director's Bungalow, Sub-stations and Laboratory Building-1 at the S. N. Bose National Centre for Basic Sciences, Kolkata

Patents Taken and Process Developed with Details

1. Photosynthesis of hydrogen peroxide from water using hydrazone-based covalent organic frameworks (COFs) by Pradip Pachfule, Tanusri Saha-Dasgupta, Avanti Chakraborty, Akhtar Alam, Uttam Manna, Archisman Sinha, and Chowdhury Ismat Nurani; Application No. 202531010086A; Applied

Awards, Recognitions, if any

1. IGSTC PECFAR Award 2025 (June 2025):
   Received the Paired Early Career Fellowship in Applied Research (PECFAR) for early-career Indian and German researchers to explore, connect and network for research collaboration in applied research sponsored by Indo-German Science & Technology Centre (IGSTC) and Department of Science and Technology (DST),

Government of India and the Federal Ministry of Education and Research (BMBF), Government of Germany. This fellowship is awarded in collaboration with Prof. Oliver Dumele (University of Cologne, Köln, Germany).

2. Rising Star by Small (August 2025):
   Awarded the Rising Star Award, given by Small (Wiley), which celebrates emerging talent and recognizes individuals who show exceptional promise early in their careers. It honors the creativity, dedication, and innovation of individual young scientist who are shaping the future in their fields.

3. DAAD Research Ambassador (November 2025):
   Selected as an honorary Research Ambassador by DAAD to promote study and research opportunities in Germany. The Research Ambassadors share their experiences, offer guidance to prospective students, and represent the German Academic Exchange Service (DAAD) in their home countries.

Membership of Learned Societies

1. Young Associate of Maharashtra Academy of Sciences:
   For the significant contributions to the field of Chemical Sciences, awarded a Young Associate from the Maharashtra Academy of Sciences, which is a premier scientific society established in 1976 with the specific aim of the promotion of science and technology. The selection of a 'Young Associate' is a rigorous process, for which the applicant needs to have a significant contribution and publication record in the respective research area.

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Olefin-linked Covalent Organic Frameworks (COFs) for Photocatalytic Water Splitting for Hydrogen Generation (FILE NO.SRG/2022/000217); DST-SERB; 2.5 Years (Until January 2025); PI

2. Low-Cost Earth- Abundant Functional Materials for Solar Fuel Production – LEAFS; Department of Science and Technology (DST), Ministry of Science & Technology, Government of India, and French National Research Agency (ANR), France; 3 Years (From December 2025); PI

Conference / Symposia / Schools organized

1. The symposium entitled "Sustainable Futures: Science, Technology, and the Environment" was arranged in collaboration with German Consulate General Kolkata, India; 20/11/2025; S. N. Bose National Centre for Basic Sciences, Kolkata, India; 1 Day

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Dr. Ketan Patel - Central Salt & Marine Chemicals Research Institute, Bhavnagar, India; Sl. No. 1; National

2. Prof. Arne Thomas, Department of Chemistry / Functional Materials, Technische Universität Berlin, Germany; Sl. No. 3, 4; International

3. Dr. Samrat Ghosh, CSIR-Central Leather Research Institute (CSIR-CLRI), Chennai, India; Sl. No. 3, 5; National

4. Prof. Abhik Banerjee, Research Institute for Sustainable Energy (RISE), TCG Centres for Research and Education in Science and Technology Sector V, Salt Lake, Kolkata, India; Sl. No. 4, 6, 13; National

5. Dr. Debashis Adhikari, Department of Chemical Science, Indian Institute of Science Education and Research, Mohali, India; Sl. No. 4, 8, 13; National

6. Prof. V. Mahalingam, Department Chemistry, Department Chemistry, Indian Institute of Science and Research Education (IISER), Kolkata, India; Sl. No. 7; National

Outreach program organized / participated

1. Delivered a one-hour keynote lecture entitled 'Overview of Global Higher Education and Research Opportunities' as part of the International E-Workshop on Foreign Scholarship Opportunities (IEWFSO 2026), organised by NES Science College in Nanded, Maharashtra, on 21 January 2026.

2. Delivered a one-hour lecture entitled 'The Porous World - With (Nearly) Nothing' as part of the Topical Research School (TRS) event, 'Recent Advances in Physical and Chemical Sciences',

organised by the Department of Physics at Cachar College, Silchar, India, on 11 March 2026.

Areas of Research

The research at the Extended Crystalline Organic Materials (ECOM) laboratory at the S. N. Bose National Centre for Basic Sciences focuses on the following major areas:

Covalent organic frameworks for photocatalysis: Covalent organic frameworks (COFs), porous and crystalline materials composed of organic moieties linked by covalent bonds, are used as photocatalysts. In this photochemical phenomenon, electrons in the COFs are excited by photon absorption, generating electron-hole pairs that facilitate redox reactions with reactant species. Using COFs as photocatalysts, we are currently exploring their applications in energy conversion and environmental remediation processes. We have successfully demonstrated the application of COFs for photocatalytic water splitting, hydrogen peroxide generation, organic transformations and polystyrene degradation, providing opportunities for sustainable energy production under environmentally benign conditions.

Covalent organic frameworks for energy storage: Covalent organic frameworks (COFs) are emerging as promising porous materials, offering a crystalline structure with tunable properties that are highly attractive for various energy storage applications. Recently, we have used COFs as electrode materials in supercapacitors - energy storage devices that charge and discharge rapidly. Beyond supercapacitors, COFs have been used as cathode materials for lithium-ion and lithium-sulfur batteries as well as bifunctional electrocatalysts for Zn-air batteries. We believe that given their interesting properties, efficiency, and durability, COFs could play a significant role in making future batteries more efficient and sustainable.

Covalent organic frameworks and transition metal chalcogenide for water splitting: Hydrogen (H2) is a

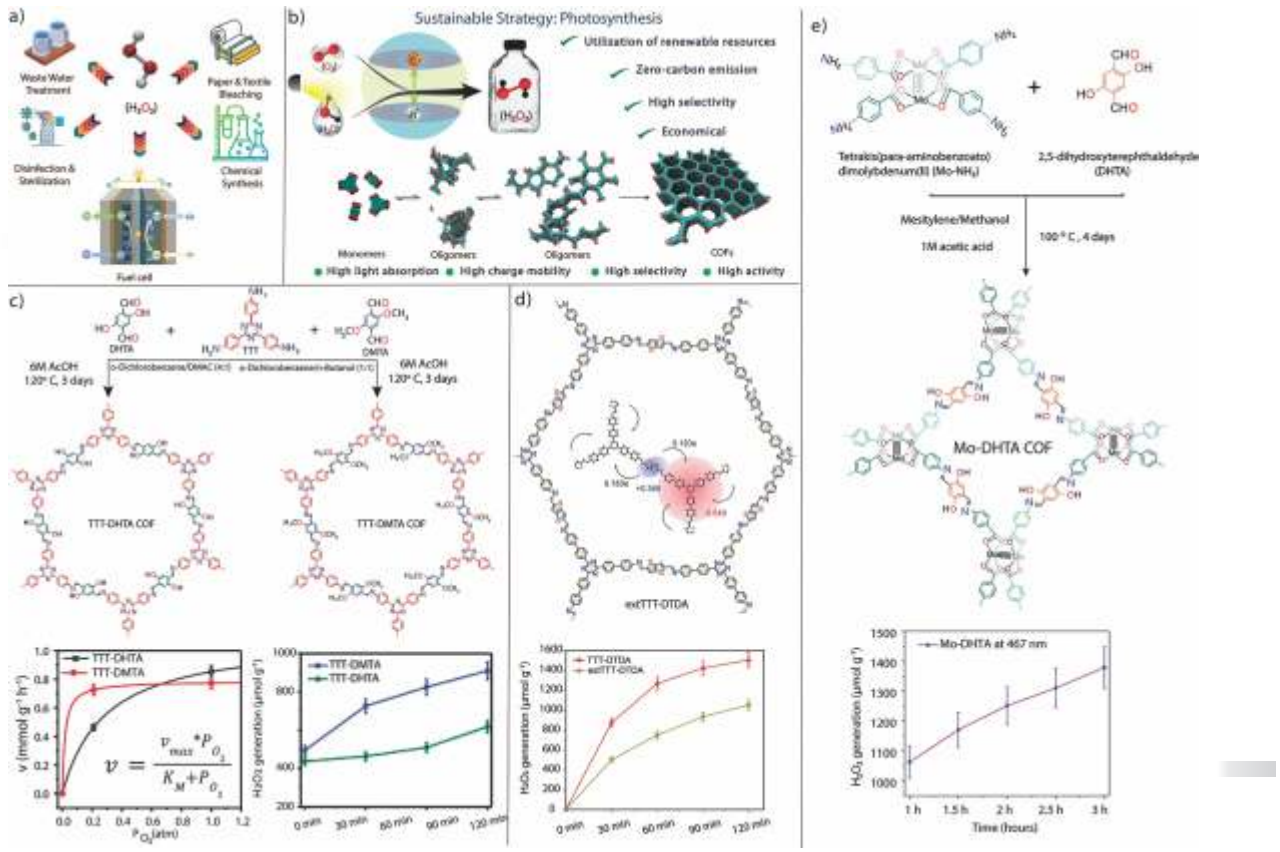


Figure 1. Recent works on photocatalytic H2O2 generation using COFs. (a) Various applications of H2O2. (b) Advantages of photocatalytic H2O2 generation using COFs. (c) Photocatalytic H2O2 generation using TTT-DHTA and TTT-DMTA COFs with kinetic modelling. (d) Intermolecular charge transfer in extTTT-DTDA COF for H2O2 generation. (e) Simulated structure of Mo-DHTA COF and H2O2 generation performance.

highly valuable chemical that is widely used in various industries as a clean fuel source, a feedstock for ammonia production and in numerous hydrogenation processes. To overcome the conventional energy-intensive steam methane reforming process that dominates hydrogen production, alternative materials and processes are needed to achieve sustainable hydrogen production and meet the growing demand for clean energy sources. We have recently discovered a class of robust, efficient covalent organic frameworks and transition-metal chalcogenides that can be synthesized on a large scale and used for electrocatalytic hydrogen production.

Organic Frameworks (COFs), crystalline porous polymers with tunable pore architectures, high surface areas, and modular structures, have emerged as promising candidates for electrochemical applications. Their metal-free nature, excellent stability, and ability to incorporate redox-active building blocks make them attractive platforms for developing cost-effective electrode materials and electrocatalysts. Building on our expertise in molecularly engineered COFs, our future research programme focuses on two interconnected areas: (I) COF-based electrodes for lithium- and sodium-ion batteries through side-chain engineering and (ii) donor-acceptor

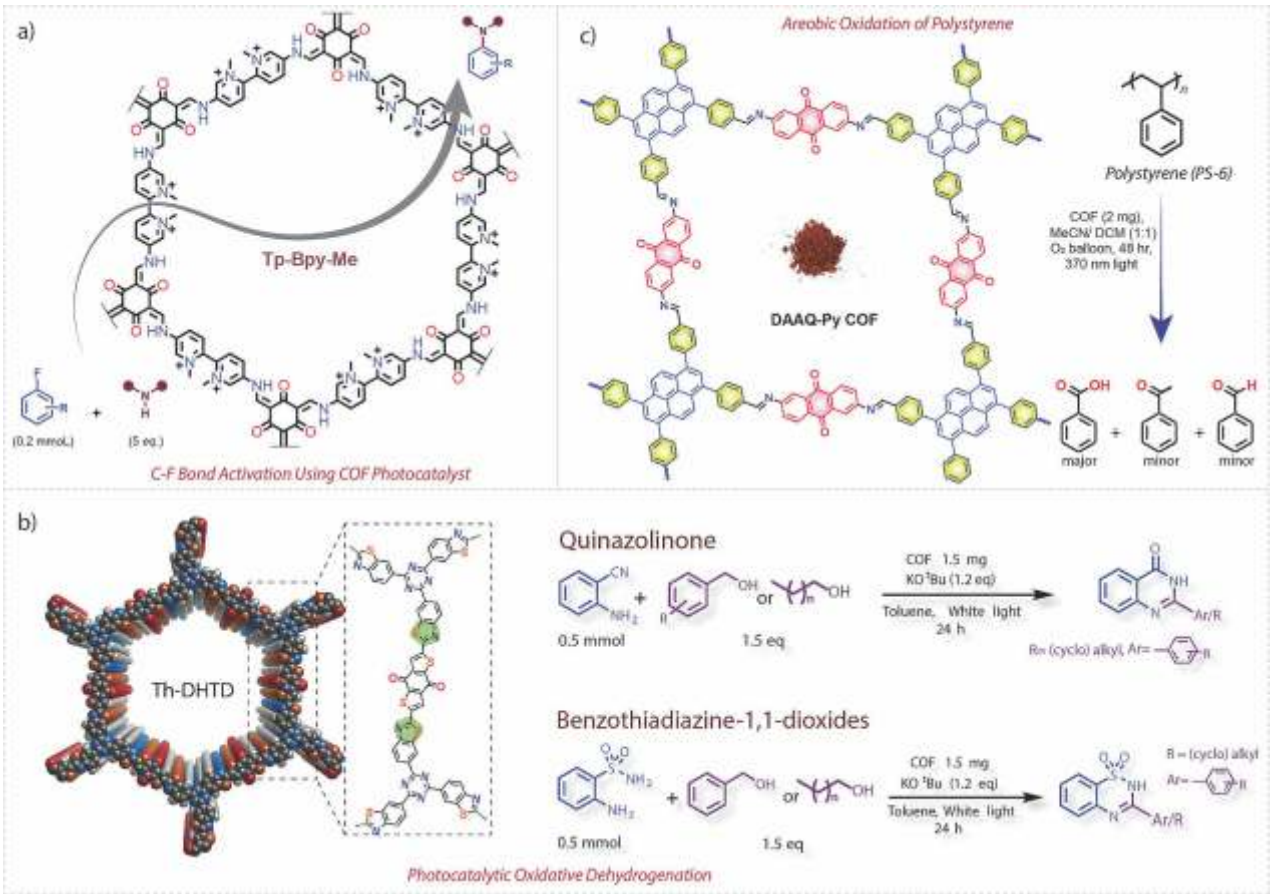


Figure 2. a) Synthesis of cationic Tp-Bpy-Me COF for the photocatalytic defluorinative amination of fluoroarenes. b) Synthesis of Th-DHTD COF via post-synthetic modification of Im-DHTD COF for the photocatalytic quinazolinone and benzothiadiazine-1,1-dioxides. c) Synthesis of DAAQ-Py COF for the aerobic polystyrene degradation.

Plan of Future Work Including Project

Covalent Organic Frameworks for Energy Storage and Generation

The transition toward sustainable energy technologies has intensified the search for advanced materials capable of efficient energy storage and conversion. Covalent and metal-incorporated COFs for the oxygen reduction reaction (ORR), a key process in fuel cells and metal-air batteries.

A. Side-Chain Engineered DKP-COFs for Advanced Batteries: A major challenge in organic battery electrodes is achieving both high energy density and rapid ion transport. To address this, we are developing pyrene-

linked diketopyrrolopyrrole (DKP)-based COFs containing unsubstituted, methylated, and ether-functionalized DKP units. This approach enables systematic tuning of pore environments and ion-framework interactions. Among these materials, the ether-functionalized Py-DKPOMe COF is expected to exhibit superior performance. Ether groups provide additional lithium- and sodium-ion coordination sites, facilitating ion diffusion and improving charge-storage kinetics. Preliminary studies indicate enhanced ion transport, excellent rate capability, and long-term cycling stability. Practical applicability will be evaluated in full-cell configurations using Li-rich LNMO cathodes, establishing structure-property relationships for next-generation organic battery materials.

B. Metal-Free Donor-Acceptor COFs for ORR: In parallel, we are developing metal-free donor-acceptor COFs as efficient ORR electrocatalysts. Our design combines a dithiophenedione (DHTD) acceptor with electron-rich donor units such as TAPA and TTT to produce highly conjugated frameworks. The donor-acceptor architecture promotes charge separation and optimizes the electronic environment of heteroatom active sites. Preliminary results suggest that TTT-DHTD delivers a half-wave potential of ~0.82 V versus RHE, approaching commercial Pt/C catalysts and exceeding many reported metal-free COF electrocatalysts. Density functional theory (DFT) calculations indicate enhanced adsorption of oxygenated intermediates and reduced reaction barriers, leading to accelerated ORR kinetics. Future work will focus on integrating these catalysts into rechargeable zinc-air batteries and evaluating their practical performance.

C. Metal-Incorporated Woven COFs for Enhanced ORR: To further improve ORR activity, we will incorporate catalytically active transition metals into woven COF architectures. These materials combine crystalline order, permanent porosity, and exceptional structural robustness, providing highly accessible active sites for electrocatalysis. The integration of earth-abundant metals into nitrogen-rich coordination environments is expected to enhance catalytic activity while maintaining efficient mass and charge transport. Comparative studies of metal-free and metal-incorporated woven COFs will reveal the roles of framework topology, heteroatom-mediated electronic modulation, and metal d-orbital interactions during ORR. These insights will guide the rational design of next-generation COF electrocatalysts for fuel cells and metal-air batteries.

Collectively, these research directions provide a coherent roadmap for exploiting COFs in both energy storage and energy conversion, enabling sustainable and scalable electrochemical technologies.

Any other Relevant Information including social impact of research

Research Output Highlights:

Being an experienced researcher in functional porous materials for energy storage and generation, published more than 98 papers that have been cited over 14,800 times, with an h-index of 56 and an i-10 index of 88 (Source: Google Scholar).

Besides high citations from papers in high-quality journals, ten (10) papers have been recognized as 'Highly Cited Papers' which received enough citations to place them in the top 1% category of the academic field of Chemistry in their respective publication year (Papers: Journal of the American Chemical Society: 2, Angewandte Chemie International Edition: 2, Nature Chemistry: 1, Advanced Materials: 1, Nature Communications: 1, Nature Reviews Materials: 1, Chemical Communications: 1, Chemical Society review: 1).

Out of 98 publications, 50% of papers are published in the top 10% journals in the field of materials sciences (E.g., Journal of the American Chemical Society, Angewandte Chemie International Edition, Nature Chemistry, Nature Communications, Chemistry of Materials, Advanced Materials, Advanced Functional Materials, etc.).



Rajib Kumar Mitra

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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Aritra Marik; Biomolecular hydration in presence of solutes; Under Progress
2. Shah Imtajul Haque; Membrane hydration; Under Progress
3. Asesh Bera; Small molecules in biology; Under Progress
4. Partha Das; Physicochemical Mechanisms of Phase Separation: Insights into Solvation Structure and Dynamics; Under Progress
5. Shrabasti Mukherjee; Membrane biology and drug delivery; Under Progress
6. Anushree Sen; Computational; Biology; Under Progress; Prof. Jaydeb Chakrabarti, SNBNCBS
7. Sourik Dutta; Nanoparticles for Optoelectronic applications; Under Progress; Dr. Ali Hossain Khan, SNBNCBS
8. Bikram Das; Applications of Nanocrystal; Under Progress; Dr. Ali Hossain Khan, SNBNCBS
9. Bidisha Sarkhel; Solvation of small molecules; Under Progress

b) Post-Docs

1. Indrani Bhattacharya; Bimolecular hydration
2. Anannya Bhattacharya; Biophysics and nano-biology
3. Sourav Nandi; Biophysics
4. Vibeizonuo Rupreo; Biophysical Chemistry

c) External Project Students / Summer Training

1. Janis Mathew; Studying The Effect of Ion Specificity on The Dielectric Relaxation of Water Using Terahertz Time Domain Spectroscopy; National Institute of Technology, Warangal

Teaching

1. Spring Semester; Fundamentals of Biophysics; PhD; 6 students; Shared with Dr. Shubhasis Haldar

Publications

a) In journals

1. Swapnil Barman, Pratap Kumar Pal, **Rajib Kumar Mitra**, *External Control Over Magnon-Magnon Coupling in a Two-Dimensional Array of Square-Shaped Nanomagnets*, Advanced Quantum Technologies, 8, 2500181, 2025
2. Vibeizonuo Rupreo, Ria Saha, Jhimli Bhattacharyya, **Rajib Kumar Mitra**, *Molecular mechanisms of Lobeline-mediated inhibition of lysozyme amyloidogenesis: A synergistic approach using biophysical and cheminformatics techniques*, Biophysical Chemistry, 326, 107502, 2025
3. Ayishwarya Dutta, Sumana Pyne, **Rajib Kumar Mitra**, Hemant K. Kashyap, *Insights into the Destabilizing Effect of Fluorinated Ethanol on Biomimetic Membranes*, Journal of Physical Chemistry B, 130, 1598-1608, 2026
4. Aritra Marick, Ria Saha, Soumya Mondal, Tarak

Karmakar and **Rajib Kumar Mitra**, *Revisiting Lanthanide Solvation: The "Gadolinium Break" That Does Exist*, The Journal of Physical Chemistry Letters, 17, 623-629, 2026

5. Shah Imtajul Haque, Ria Saha, Vibeizonuo Rupreo, **Rajib Kumar Mitra**, *Lysozyme Amyloid Modulates Membrane Structure and Hydration and Impacts Its Fusogenicity*, Langmuir, 41, 15918-15925, 2025
6. Indrani Bhattacharya, Alexander Hautke, Emma Rossi, Laurie Stevens, Aritra Marick, Asesh Bera, Tanushree Das, Alberta Ferrarini, Marialore Sulpizi, Simon Ebbinghaus, **Rajib Kumar Mitra**, *Non-monotonous Concentration Dependent Solvation of ATP Could Help to Rationalize Its Anomalous Impact on Various Biophysical Processes*, Journal of Physical Chemistry Letters, 16, 4305-4314, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. "Impact of Ion Solvation on Biomolecular Condensation" on Kolkata Biophysics Chapter; 14/05/2025; S.N. Bose National Centre for Basic Sciences, Kolkata; 30 minutes
2. "Role of Hydration in Biomolecular Condensation: Insight from THz Spectroscopy" at International Symposium on Advanced Materials and DeVices 2025, 19-20 December 2025, Organized by Department of Physics, IIT Kharagpur, India; 20/12/2025; Bose Institute, Kolkata; 30 minutes
3. "Role of Hydration in Biomolecular Condensation: Insight from THz Spectroscopy and the Potential Effect of High Intensity Radiation" at "User Interaction Meeting on Science with IR/THz Free Electron Lasers", January 29- 30, 2026, at the Raja Ramanna Centre For Advanced Technology, Indore, Madhya Pradesh; 30/01/2026; Raja Ramanna Centre For Advanced Technology, Indore, Madhya Pradesh; 30 minutes
4. "Membrane Hydration and Fusogenicity: Effect of Cholesterol" at Biophysics Today; 04/12/2025; S.N. Bose National Centre for Basic Sciences, Kolkata ; 30 minutes
5. "Application of THz Spectroscopy in (soft) Condensed Matter Systems" at Friday Colloquium, NPL; 09/05/2025; CSIR-National Physical Laboratory, New Delhi; 1 hour
6. "Role of Hydration in Biomolecular Condensation: Insight from THz Spectroscopy" at Ruhr University, Bochum; 08/09/2025; Ruhr University, Bochum, Germany; 1 hour

Administrative duties

1. Dean (Administration and Resource Generation)
2. Nodal Officer (TRC-SNBNCBS)
3. Chairman, SCOLP Committee
4. Chairman, Technical Cell
5. Chairman, External Standing Technical Committee
6. Head, Department of Chemical and Biological Sciences (additional charge)
7. Chairman, Grievance Redressal Committee
8. Convenor, Project and Patent Cell

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Biomolecular condensates: Exploring the associated hydration and energetics using THz spectroscopy; SERB-DST (ANRF); 2024-2027; PI

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Collaboration with Prof. Hemant Kashyap, IIT Delhi; Sl. No. 1; National
2. Collaboration with Prof. Tarak Karmakar, IIT Delhi; Sl. No. 2; National
3. Collaboration with a group of scientists at Ruhr University, Bochum, Germany; Sl. No. 4; International
4. Collaboration with Prof. J. Bhattacharyya, NIT, Nagaland; Sl. No. 6; National

Areas of Research

Lanthanides (Ln) offer rich and otherwise unusual chemistry, which includes their redox behavior, ligand coordination, diverse quantum phenomena, etc. Unlike the lighter elements, these f-block elements could exhibit nonlinear trends in various chemical and physical

properties across the series with a noticeable break often being observed in the central atom gadolinium (Gd). This popular notion of "Gd break" has been challenged and banished by researchers in the past, making this as an ever-debated issue in the chemical fraternity. In this Letter, we examine the solvation behavior of dilute solutions of chlorides of La^{3+}, Nd^{3+}, Gd^{3+}, Ho^{3+}, and Lu^{3+} using THz time domain and frequency domain spectroscopy coupled with MD simulation measurements. We find that unlike mono- and divalent cations LnIII solvation is nonmonotonic and shows a sudden break at Gd. Our result finds relevance considering the fact that with the surge of technological advancement heavy cations are being exposed to the environment, and to understand their potential effect on the flora and fauna, it is a prerequisite to understand their solvation behavior in greater detail.

The intriguingly surplus abundance of adenosine triphosphate (ATP) found in living cells has often been rationalized in terms of ATP acting as a "biological hydrotrope" or "biological aggregation inhibitor" to solubilize proteins under stressed conditions. Here, we scrutinize the universality of such a property of ATP depending on different environmental circumstances; we report instantaneous fibrillation of two globular proteins, namely, bovine serum albumin (BSA) and ovalbumin (Ova), at ambient temperature (25 °C) and at pH 2 in the presence of ATP. This behavior is in stark contrast to the fact that ATP is reported to suppress thermal unfolding of these same two proteins. Field emission scanning electron microscopy (FESEM), high-resolution transmission electron microscopy (HRTEM), and circular dichroism (CD) measurements confirm the aggregates as amyloid-like fibrils. Estimation of protein hydration using terahertz Fourier transform infrared spectroscopy (THz-FTIR) in the 1.5-16.7 THz (50-550 cm-1) frequency window confirms the key role of the triphosphate (TPP) moiety of ATP, as it binds directly to the solvent-exposed charged residues of the unfolded proteins, which seeds the aggregation process. Protein residue specificity is found to dictate the aggregation kinetics, as lysine-rich BSA shows faster kinetics compared to that of Ova, which contains a relatively smaller number of lysine residues; however, its abundance of arginine residues is not markedly different to account for the observed large change in the fibrillation rate. This result receives further support from the fact that in lysozyme, where the number of arginine residues are greater than lysine residues, a nonfibrillar crystalline-like aggregate is observed in the presence of ATP. Our study thus embeds a note of caution to reckon ATP as a universal biological hydrotrope, as this ability could get reversed, and ATP can as well act as a "biological aggregation mediator" depending upon its immediate environments.

Lysozyme, which is abundantly found in cellular environments, can form cytotoxic amyloid fibrils under stressed conditions. While amyloid formation leads to the loss of enzymatic function of lysozyme, its effects could extend beyond this, as the fibrils could interact with lipid membranes and impair their fusion propensity, which is harmful to membrane functionality, like particle degradation and triggering of immune responses. To address this, we investigate the interaction between lysozyme fibrils and two model liposomes: an ordered raft-like mixed membrane composed of DOPC-sphingomyelin-cholesterol and a less-ordered non-raft-like membrane DOPC. Dynamic light scattering, fluorescence spectroscopy, and scanning electron microscopy studies reveal that lysozyme amyloids do interact with the lipid membranes and alter their ordering; THz-Fourier Transform Infrared Spectroscopy (FTIR) measurements show that membrane hydration also gets perturbed. The liposomes, in the presence of the amyloid, show significantly reduced fusion propensity; interestingly, the decrease in fusion propensity is found to be less pronounced in the mixed raft-like membrane compared to non-raft-like membranes. The mixed raft-like membranes, owing to their ordered structure, modify the hydration in a manner that fusogenicity is retained to a greater extent than in the non-raft-like liposomes.

Numerous pathological conditions, collectively termed amyloidosis, are associated with the aggregation of misfolded proteins under stressed physiochemical conditions. Natural compounds capable of modulating protein aggregation or disassembling preformed fibrils hold promise as potential therapeutic candidates for treating aggregation-related diseases. In this study, we aim to examine the binding interaction and effectiveness of Lobeline (Lob), a piperidine alkaloid, in preventing the formation of acid-denatured Lysozyme (Lyz) amyloid using various spectroscopic, cheminformatics and imaging techniques. Steady-state and time-resolved fluores¬cence measurements confirm a direct interaction between Lyz and Lob with a binding constant of ~106 M-1 with a 1:1 binding stoichiometry. The association has

been found to be spontaneous and is driven by entropy involving non-electrostatic interactions. Molecular Docking shows that Lob stabilizes Lyz by hydrophobic and hydrophilic interactions. The anti-amyloid properties of Lob in Lyz amyloid fibrils are assessed through a range of in vitro techniques, including turbidity measurement, dynamic light scattering (DLS), Thioflavin T (ThT) fluo¬rescence, Circular Dichroism studies and Field Emission Scanning Electron Microscopy (FESEM) imaging. These studies demonstrate that Lob halts the fibrillation of acid-treated Lyz at the nucleation stage by providing alternative pathways for hydrogen bonding and other weak interactions with key amino acid residues necessary for the formation of oligomers and fibrils.

Plan of Future Work Including Project

We aim to experimentally in-vitro and ex-vivo realize and establish the concept that biomolecular (protein, membrane etc.) condensation process is associated with a definite modification in the structure and dynamics of the interfacial solvation. We will monitor the explicit change in protein/lipid hydration at the different aggregated state(s) during the condensation process using THz time domain (TTDS) and FIR-FTIR spectroscopic technique(s) combined with other complementary spectroscopy/microscopy techniques and its possible modulation by altering the solvent physical parameter(s) upon the addition of excipient(s). THz spectroscopy probes the low frequency collective vibration modes of water, and therefore is very sensitive to the global network dynamics of water around the different polar and nonpolar moieties of biomolecules. We expect that the different aggregated state(s) would render different solvation imprint(s), which can be traced and detected in real time using THz spectroscopy. We will extend our studies in presence of externally added excipient(s), which is expected to change the physical properties of water, and thus also the condensation dynamics; this study could lead to find a strategy to modulate the aggregate formation process. Finally, we will estimate the energetic parameters (entropy and enthalpy) associated with the condensation process using temperature dependent TTDS and FIR-FTIR measurements following a recently developed concept of THz calorimetry. Our study would result in a fundamental and molecular level apprehension on the otherwise less studied aspect of solvation change during biomolecular condensation. The output of this proposal would render positive impetus for further research on the condensation associated bio-physical phenomenon.



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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Narayan Maity; Experimental Studies of Metastable and Self-Organised Systems; Awarded
2. Amrita Mondal; Experimental Studies of Complex chemical systems; Awarded
3. Sudipta Mitra; Computer Simulations of Relaxation Dynamics in Condensed Phases ; Awarded
4. Rik N Mukherjee; Computer Simulations of Ionic Deep Eutectic and Other Systems; Under Progress
5. Abdul Aziz; Computer Simulations of Biomolecular Aggregation; Under Progress

b) Post-Docs

1. Shrestha Chowdhury; Theoretical & Computational Studies of Azeotrope: Basic Science Aspects Application Potential

c) External Project Students / Summer Training

1. Neha; Continous Time Random Walk in Deep Eutectics: Primary Concepts; Shiv Nadar University

Teaching

1. Autumn Semester; Physical Chemistry: Theory and Experiments; PhD; 4 students

Publications

a) In journals

1. Dipanwita Roy, Satadru Chakraborty, Saba Suladze, Minsu Kim, Narayan Chandra Maity, Kamal Mroue, **Ranjit Biswas**, Bernd Reif, DongKuk Lee, Prasenjit Bhaumik, Anirban Bhunia, *Generation of Membrane-Damaging hIAPP Oligomers via Direct Interaction with DOPC/DOPS Nanodiscs*, Langmuir, https://doi.org/10.1021/acs.langmuir.5c05718
2. Jayanta Mondal, Dhrubajyoti Maji, **Ranjit Biswas**, *Characterization of water in (glucose + urea + water) deep eutectic solvent through dielectric relaxation spectroscopy: Temperature dependent measurements and computer simulations*, Journal of Chemical Physics, 163, 184502, 2025
3. Sudipta Mitra, **Ranjit Biswas**, *Correlations between ionic conductivity and co-solvent modulated water structure and dynamics in aqueous Zn-ion battery electrolytes*, Journal of Chemical Physics, 163, 164502, 2025
4. Karishma Biswas, Sudipta Mitra, Dibakar Roy, Sanhita Roy, Dibakar Sarkar, DeokHyun Son, Rohit Das, Anuradha Roy, Dulal Senapati, Humaira Ilyas, A. Harikishore, **Ranjit Biswas**, Suman Chakrabarty, DongKuk Lee, Indranil Biswas, Sudipto Saha, Pallob Kundu, Anirban Bhunia, *Transgenic Tobacco Plants Expressing Synthetic Peptides: A Functional and Structural Analysis for Pathogen Resistance*, Plant Biology Journal, 2025, (DOI: https://doi.org/10.1111/pbi.70287)
5. SK. Samir Ahamed, Suman Chakrabarty & **Ranjit Biswas**, *Why $[BMIM]^+[PF_6]^-$ is hydrophobic and*

$[BMIM]^+[BF_4]^-$ hydrophilic in nature? A quantum chemical investigation, Journal of Chemical Sciences, 137, 92, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Delivered a Golden Jubilee Distinguished Lecture, entitled, "Condensed Phases at Unique Condition - Exciting Physical Chemistry Aspects"; 28/03/2026; School of Chemistry, University of Hyderabad; 60 minutes
2. Delivered an invited talk entitled, "National Science Day: The Scientist & His Journey"; 28/02/2026; Aliah University, New Town Campus, Kolkata; 60 minutes
3. Delivered an invited departmental lecture on entitled, "Continuous Time Random Walk in Ionic Acetamide Deep Eutectics"; 25/02/2026; IIT Delhi; 45 minutes
4. Delivered an invited Keynote lecture entitled, "Continuous Time Random Walk in Ionic Acetamide Deep Eutectics: Emergence of Dynamical Separation of Particles As Glass Transition is Approached"; 23/02/2026; Shiv Nadar University, NCR, Delhi in an International Conference on Photochemistry, Photophysics & Photodynamics (iP3-2026); 30 minutes
5. Invited talk at the IISER Kolkata entitled," Conductivity in Battery Electrolyte Systems: Roles for Solution Structure, Ultrafast Solvent Modes and Ion-Ion Motional Correlations"; 25/01/2026; International conference "Nanomaterials and Molecules: From Spectroscopy to Bioimaging (NaMoSBio) 2026"; 25 minutes
6. Delivered a popular lecture entitled, "Satyendra Nath Bose: Was he a Scientist Only?" in local vernacular; 02/01/2026; Online mode lecture organized by a social media platform "Biggan Chorchar Asor"; 75 minutes
7. Social Outreach talk in local vernacular entitled, "Let us make bond stronger, let us live together"; 21/12/2025; Writwik Sadan, Berhampore, Murshidabad; 60 minutes
8. Delivered an invited lecture on December 12, 2025, entitled, "Dynamical Anomaly in Aqueous Solutions of Small Amphiphilic Molecules: Independent Confirmation via Label-Free Measurements"; 12/12/2025; In a conference 'Advances and Innovations in Chemical Sciences (AICS-2025)' at Vedic Village, Kolkata; 25 minutes
9. Invited talk entitled, "Entropy or Enthalpy - Who Stabilizes the Liquid Phase of Deep Eutectic Systems?"; 12/10/2025; In a Physical Chemistry Symposium (SoPhyC-2025), IIT Patna; 25 minutes
10. Social Outreach talk in local vernacular entitled, "Social message in the children's book 'SAHAJ PATH' by Rabindranath Tagore"; 21/09/2025; Berhampore Collectorate Auditorium, Berhampore, Murshidabad; 60 minutes
11. Delivered a popular lecture in local vernacular entitled, "Chemistry in Ancient India: A Glimpse"; 29/08/2025; Kandi Raj College, Murshidabad in a one day symposium celebrating the Platinum Jubilee of the College; 60 minutes
12. Outreach lecture (popular lecture) in the local vernacular for the visiting school children of Naktala High School entitled, "Satyendra Nath Bose: Beyond Science"; 23/07/2025; S. N. Bose National Centre for Basic Sciences; 45 minutes
13. Delivered an invited lecture for college students entitled, "Physics & Chemistry of Physical Chemistry" in C. K. Majumdar Memorial Summer Workshop in Physics 2025; 19/07/2025; S. N. Bose National Centre for Basic Sciences; 60 minutes
14. Delivered an invited lecture entitled, "Water at Unique Thermodynamic Condition: Does It Acquire Anything Special?"; 17/07/2025; In the conference "Interdisciplinary Horizons of Physical Chemistry" (IHPC), at the Bose Institute, Unified Academic Campus, Salt Lake Sector V, Kolkata; 25 minutes

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. A Theoretical Approach to Predict Deep EutecticFormation: Locating the Lowest Melting Point; DST(MATRICS_SERB); 3 years; PI

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Langmuir, 42, 9045-9060, 2026; Sl. No. 1; National
2. Plant Biotechnology Journal, 24, 526-546, 2026; Sl. No. 4; National

Outreach program organized / participated

1. Delivered a popular lecture entitled, "Satyendra Nath Bose: Was he a Scientist only?" in local vernacular on January 02, 2026, in online mode organized by a social platform "Biggan Chorchar Asor"
2. Social Outreach talk in local vernacular entitled, "Let us make bond stronger, let us live together" on December 21, 2025 in the Writwik Sadan, Berhampore, Murshidabad
3. Social Outreach talk in local vernacular entitled, "Social message in the children's book 'SAHAJ PATH' by Rabindranath Tagore" on September 21, 2025 in the Berhampore Collectorate Auditorium, Berhampore, Murshidabad
4. Delivered a popular lecture in local vernacular entitled, "Chemistry in Ancient India: A Glimpse" on August 29, 2025, at the Kandi Raj College, Murshidabad in a one day symposium celebrating the Platinum Jubilee of the College
5. Outreach lecture (popular lecture) in the local vernacular for the visiting school children of Naktala High School on July 23, 2025 at the S. N. Bose National Centre for Basic Sciences entitled, "Satyendra Nath Bose: Beyond Science"

Areas of Research

We developed a theoretical formalism for predicting eutectic temperature for several experimentally known deep eutectic sol-vents (DESs) (ionic and nonionic) by separating the enthalpic and entropic contributions to the change in free energy of mixing. By incorporating both attractive and repulsive interactions into the calculation of enthalpic and entropic changes, this theory provides a thermodynamic explanation for the negative deviations from ideal behaviour in DESs. We examined five acet-amide-based DESs where the other components are, respectively, urea, lithium bromide, lithium nitrate, calcium nitrate, and strontium nitrate. Enthalpic contribution was obtained from the simulated trajectories, while the entropic component was calculated from the two-phase thermodynamics method. The predicted eutectic temperatures were better than those from the ideal solution model when compared against experiments. Interestingly, the nature of interparticle interaction (ionic and nonionic) was found to decide the dominance of either enthalpy or entropy, thereby setting up a tug-of-war between these two thermo-dynamic forces for stabilizing the liquid phase of these two-component systems at a temperature much lower than the meltingtemperatures of the neat components. These results were published in ChemPhysChem, 2026; 27:e202500913; https://doi.org/10.1002/cphc.202500913.

We studied the role of ultrafast medium dynamics in determining the conductivity of a representative gel polymer electrolyte system composed of propylene carbonate, lithium perchlorate (LiClO4), and polypropylene glycol (PPG), with a fixed PC : LiClO4 ratio of 10.7, and explored the possible reasons behind the breakdown of Onsager theory in successfully predicting the composition-dependent measured conductivities at different temperatures. For this purpose, we measured the solution dynamical response by employing frequency dependent dielectric relaxation (DR) experiments and a streak camera-based fluorescence dynamics setup. These measurements indicated fast solution dynamics facilitated ion transport, while the slow diffusive dynamics offered frictional resistance. These opposite roles for the fast and the slow dynamics led to viscosity decoupling of conductivity and suggested the presence of non-hydrodynamic modes for ion transport. These results were published in J. Chem. Phys. 164, 194503 (2026); doi: 10.1063/5.0324926.

Plan of Future Work Including Project

(i) Understanding Structure & Dynamics of Cryoprotectants via Dielectric Relaxation Measurements, Time-resolved Fluorescence, Measurements and Simulations

(ii) Exploring the Interaction & Dynamics of Azeotropes via Simulations & Experiments

(iii) Prediction of the Lowest Melting Points of Probable Deep Eutectic Mixtures via Theory and Simulations

(iv) Understanding the Enzyme Promiscuity by Probing the Kinetics via Simulations & Experiments



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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Naglaa Atif Alhadi Rahmaa; Spectroscopic studies on applied nano materials; Under Progress; Prof. Ranjit Biswas (Co-supervisor)

b) Post-Docs

1. Monojit Das; Preclinical studies on the detection of Corneal Fibrosis (CF) and its prognosis using optical parameters from a slit lamp for potential development of early diagnosis of CF at point of care

Publications

a) In journals

1. Naglaa Atif Alhadi, Monojit Das, Nivedita Pan, Susmita Mondol, Ranjan Das, Samir Kumar Pal, Photo-Responsive Nano-Enzyme Catalysis for Controlled ROS Generation, ChemCatChem, 17, e00280, 2025
2. Naglaa Atif Alhadi, Surajit Sadhukhan, Nivedita Pan, Gourab Ghosh, Lopamudra Roy, Jhimli Sengupta, Monojit Das, Jhuma Bhadra, Ranjan Das & **Samir Kumar Pal**, *A Nanosensor Detects Nerve Gas Simulants in Model Public Water Using a Nano-Formulation to Preserve Integrity of the Test Samples*, Journal of Fluorescence, 2025, DOI: https://doi.org/10.1007/s10895-025-04590-7
3. Monojit Das, Susmita Mondal, Ria Ghosh, Lopamudra Roy, Anjan Kumar Das, Siddhartha Sankar Bhattacharya, Debasish Pal, Debasish Bhattacharya, Prantar Chakrabarti, Asim Kumar Mallick, Jayanta Kumar Kundu, **Samir Kumar Pal**, *A Pleiotropic Nanomedicine Mitigates Splenic Hyperplasia, Ineffective Erythropoiesis, G6PDH Anomaly through Redox Buffering in Preclinical Mice Model*, ChemMedChem, 20, e202400698, 2025
4. Lopamudra Roy, Shweta Paul, Amrita Banerjee, Ria Ghosh, Susmita Mondal, Monojit Das, Nivedita Pan, Ishitri Das, Soumendra Singh, Debasish Bhattacharya, Asim Kumar Mallick and **Samir Kumar Pal**, *Challenges in "probing spectroscopic probes" for noninvasive simultaneous disease diagnosis*, Frontiers in Chemistry, 12, 2025, https://doi.org/10.3389/fchem.2024.1463273

Membership of Learned Societies

1. Indian Association for the Cultivation of Science, Life Member
2. Indian Physical Society
3. Member of Governing Council Indian National Academy of Engineering: INAE
4. Programme Advisory Committee (PAC): 2021-2024 in Electrical, Electronics and Computer Engineering of Science and Engineering Research Board (SERB)
5. Fellow of Indian National Academy of Engineering (FNAE)

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Development of a Non-Invasive Spectroscopic Device for The Assessment of Urinary Bladder Cancer (UBC) and Large-Scale Clinical Trial for Early Diagnosis; Department of Science & Technology and Biotechnology, Government of West Bengal funded (Sanction order no.: 1472 (Sanc.)/STBT-11012(19)/2/2025-ST SEC) R&D project; 3 years; Co-PI

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Professor Ranjan Das, Department of Chemistry, West Bengal State University, Kolkata, India; SL. No. 1, 2; National
2. Professor Niko Hildebrandt; International
3. Dr. Anjan Kumar Das, NRS Medical College, Kolkata, 700014, India; National

Areas of Research

Ultrafast Spectroscopy of Biomolecules and Nanomaterials; Bio-Nano Interface; Dye/Quantum Dot Sensitized Solar Cells and Photocatalysis; Biomedical Instrumentation

Plan of Future Work Including Project

1. Development of low-cost instruments for the nation.
2. Development of point-of-care diagnosis.
3. Development of biocompatible nanohybrids for treating different diseases.
4. Development of low-cost sensors for environmental applications.
5. Basic experimental photophysical studies on bio-mimetic systems.
6. Basic studies on energy harvesting materials.
7. Clinical Trial of Nanomedicine in Human Subject
8. Pre-clinical Studies of Nanomedicines in Animal Model



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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Deep Chaudhuri; Mechanobiology of Chaperones; Under Progress
2. Rianita Mondal; Mechanobiology of protein-drug interaction; Under Progress
3. Sudipta Adhya; Understanding folding landscape of protein L; Under Progress
4. Subhradeep Chakravarty; Biology of Senescent; Under Progress
5. Somasree Dey; Mechanobiology of protein L; Under Progress

b) Post-Docs

1. Amarnath Pal; Role of drugs in cancer
2. Milan Patra; Mechanism of senescence process
3. Subhas Chandra Bera; Development of magnetic tweezers
4. Nicky Didwania; Chaperone biology

c) External Project Students / Summer Training

1. Tiyasha Chakraborty; Study of Protein L

Teaching

1. Spring Semester; Fundamentals of Biophysics; PhD; 6 students; Shared with Prof Rajib Mitra

Publications

a) In journals

1. Shreyansh Priyadarshi, Camellia Mazumder, Bhavesh Neekhra, Sayan Biswas, Debojyoti Chowdhury, Debayan Gupta & **Shubhasis Haldar**, *OncoMark: a high-throughput neural multi-task learning framework for comprehensive cancer hallmark quantification*, Communications Biology, 8, 1434, 2025
2. Soham Chakraborty, Shivam Pandit, Krishnendu Sinha, Madhu Bhatt, Debojyoti Chowdhury, Suman Chakrabarty, **Shubhasis Haldar**, *Unraveling antibody-induced mechanical stability of antigen: Insights from single-molecule studies*, Protein Science, 34, e70201, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Invited lecture in Advanced Talk at FCS-XVI online Workshop, November 7-9, 2025; 07/11/2025; Online Workshop; 1 hour 30 minutes
2. Invited lecture in ACS Global Scientific Conference IIT Bombay, October 8-11 2025; 08/10/2025; IIT Bombay; 20 minutes
3. Invited lecture in Mechanobiology-Talk Ramakrishna Mission Seva Pratishthan (RKMSP) campus, October 7, 2025; 07/10/2025; Ramakrishna Mission Seva Pratishthan (RKMSP) campus; 40 minutes
4. Invited lecture in "Indian Biophysical Society" North-Eastern Hill University, March 12-15, 2026; 12/03/2026; North-Eastern Hill University; 15 minutes

5. Invited lecture in "NU-BioTalk 2026: Evolving Landscape of Translational Medicine - A Future Perspective" Sister Nivedita University, February 19-20, 2026; 19/02/2026; Sister Nivedita University; 30 minutes
6. Invited lecture in "Emerging Trends in Bioscience Research (ETBR 2026)" Aliah University, February 10-11, 2026; 10/05/2026; Aliah University; 30 minutes
7. Invited lecture in "Recent Advances in Physical Chemistry: Biophysical, Analytical, and Materials Perspective", IIT Kharagpur January 3-4, 2026; 03/01/2026; IIT Kharagpur; 30 minutes
8. Invited lecture in Magnetic and Optical Tweezers (MTOT2025), IIT Bombay December 15-17, 2025; 15/12/2025; IIT Bombay; 20 minutes
9. Invited lecture in FCS XVI Workshop-Cum-Conference, SINP, December 6-10, 2025; 06/12/2025; SINP; 20 minutes
10. Invited lecture in Microbiology day, Adamas University, October 30, 2025; 30/10/2025; Adamas University; 40 minutes

Administrative duties

1. Member Secretary of the IBSC committee

Patents Taken and Process Developed with Details

1. Patent applied for "Cancer Hallmark Activity Quantification System"; Application number 202511064233 dt 04th July; Applied

Awards, Recognitions, if any

1. Dr. Bhavana Janakbhai Dave Cancer Biology Oration Award, 2026 by The Gujarat Cancer & Research Institute, Ahmedabad

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. High-Throughput Covalent Magnetic Tweezers for Mechanobiological Dissection and Drug Screening at the Single-Molecule Level; ANRF; 3 years; PI

Conference / Symposia / Schools organized

1. Biophysics Today; 02/12/2025; SNBNCBS; 3 days
2. C.K. Majumdar Memorial Summer Workshop; 15/07/2025; SNBNCBS; 9 days
3. Kolkata Biophysics Chapter 2025; 14/05/2025; SNBNCBS; 1 day

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Prof. Suman Chakrabarty, SNBNCBS; Sl. No. 2; National
2. Dr. Debayan Gupta, Ashoka University; Sl. No. 1; National

Outreach program organized / participated

1. Participated in a outreach program at Dinabandhu Andrews College, March 24, 2026

Areas of Research

My research focuses on understanding complex biological processes using single-molecule biophysics, mechanobiology, and AI-driven computational approaches. A major focus of my laboratory is the development of advanced single-molecule technologies, particularly covalent magnetic tweezers (CMT), to investigate protein folding, chaperone-assisted folding, mechanotransduction, and force-dependent molecular interactions at nanometer resolution. I established the first covalent magnetic tweezers platform in India and later developed real-time microfluidic magnetic tweezers for simultaneous quantification of multiple molecular parameters in a single experiment.

Another important area of my research is cancer mechanobiology and systems biology. My group studies how mechanical forces regulate cancer progression, stemness, immune evasion, and cellular signaling pathways. We integrate biophysical experiments, molecular biology, imaging, and machine learning approaches to identify novel biomarkers and therapeutic targets. My laboratory is also actively developing AI-based computational frameworks for cancer diagnostics and precision medicine. We developed ACSCEND and

OncoMark, machine-learning-driven platforms for identifying cancer stem cells and decoding cancer-associated molecular behavior from transcriptomic datasets. In parallel, we continue to investigate molecular chaperones, antibody-mediated mechanical stabilization, and stress-response pathways associated with neurodegenerative diseases and cancer. Overall, my research combines chemistry, biophysics, molecular biology, and artificial intelligence to develop next-generation tools for understanding biological complexity and translational medicine.

Plan of Future Work Including Project

My future research plans are centered on developing next-generation single-molecule technologies and applying them to fundamental problems in mechanobiology, cancer biology, protein quality control, and cellular stress responses. One major direction of my laboratory is to understand how mechanical forces regulate cellular senescence and cancer progression. We are currently building a mechanobiology framework to investigate how force-dependent conformational changes in proteins influence senescence-associated signaling pathways, inflammatory responses, and tumor heterogeneity. The long-term goal is to establish the biochemical basis of mechanically regulated senescence and identify potential mechanosensitive therapeutic targets in cancer and aging-related diseases. Another important future direction is our emerging work on periplasmic protein quality control and bacterial mechanobiology. Building upon our earlier studies on chaperone-mediated folding under force, we are investigating how periplasmic chaperones and redox-active proteins regulate bacterial survival under mechanical and environmental stress. This includes studying force-regulated folding pathways, bacterial virulence-associated proteins, and stress-adaptation mechanisms at the single-molecule level. These studies may provide new insights into bacterial pathogenesis and potential antibacterial strategies targeting mechanosensitive pathways.

A major technological goal of my laboratory is the development of advanced temperature-controlled covalent magnetic tweezers platforms. While current magnetic tweezers systems allow force-dependent measurements, biological systems are simultaneously regulated by temperature, force, and chemical environment. We aim to integrate precise temperature control with single-molecule force spectroscopy to investigate temperature-dependent protein folding landscapes, phase transitions, aggregation pathways, and chaperone-assisted refolding dynamics under physiologically relevant conditions. This platform will provide unprecedented opportunities to study thermomechanical coupling in proteins and biomolecular complexes. In parallel, we plan to further integrate artificial intelligence and machine-learning approaches with single-molecule experiments and cancer biology. Our future goal is to combine large-scale experimental datasets with AI-driven predictive models to better understand cellular heterogeneity, mechanotransduction networks, and disease progression. We are particularly interested in developing computational frameworks that can connect molecular-scale mechanical behavior with cellular phenotypes in cancer and neurodegenerative diseases.

Overall, my long-term vision is to establish an interdisciplinary research program combining biophysics, mechanobiology, molecular biology, and artificial intelligence to develop innovative technologies and mechanistic understanding of complex biological systems. Through these efforts, I aim to contribute both to fundamental biological science and to translational applications in cancer biology, infectious diseases, and precision medicine.



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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Abhinandan Das; Rational design and mechanism of action of inhibitors for Acetylcholinesterase; Awarded
2. Dibyendu Maity; Machine learning in physics: prediction, identification and enhanced sampling; Under Progress
3. Sreyan Bhowmick; Computational investigation of allosteric regulation in proteins; Under Progress
4. Sutanu Mukhopadhyay; Computational approaches towards drug discovery; Under Progress
5. Sayari Bhattacharya; Computational Study of Misfolding and Aggregation in Proteins and Peptides; Under Progress
6. Shaheerah Shahid; Development of enhanced sampling methods and AI/ML for molecular simulations; Under Progress
7. Sauptik Sadhukhan; Machine learning inspired method development in soft-condensed matter; Under Progress

b) Post-Docs

1. Saheb Dutta; QM/MM and classical simulations of enzymes and protein-protein interactions

c) External Project Students / Summer Training

1. Shreya Mondal; Comparative Analysis of Protein Unfolding Induced by Different Denaturation Processes: A Molecular Dynamics Simulation Study; Bidhannagar College
2. Avinandan Maity; Allostery in Proteins: A Computational Overview; Adamas University

Teaching

1. Autumn Semester; CB 631: Advanced Numerical Methods & Simulation; PhD; 8 students

Publications

a) In journals

1. Krishnendu Sinha, Amit Kumawat, Hyunbum Jang, Ruth Nussinov, **Suman Chakrabarty**, *Phosphorylation induces altered protonation states and allosterically regulates Rac1–RhoGDI complex*, Protein Science, https://doi.org/10.1002/pro.70413
2. Sutanu Mukhopadhyay & **Suman Chakrabarty**, *PPIscout: Protein-protein interaction site hotspot mapping using mixed amino acid-water molecular dynamics simulation*, Journal of Chemical Sciences, 137, 106, 2025
3. Dibyendu Maity, Shaheerah Shahid and **Suman Chakrabarty**, *PathGennie: Rapid Generation of Rare Event Pathways via Direction-Guided Adaptive Sampling Using Ultrashort Monitored Trajectories*, Journal of Chemical Theory and Computation, 21, 11377-11389, 2025
4. Sutanu Mukhopadhyay, Krishnendu Sinha, **Suman Chakrabarty**, *Harnessing Allostery to Modulate Protein–Protein Interactions: From Function to Therapeutic Innovations*, Journal of Molecular Biology, 437, 169382, 2025

5. SK. Samir Ahamed, **Suman Chakrabarty** & Ranjit Biswas, *Why $[BMIM]^+[PF_6]^-$ is hydrophobic and $[BMIM]^+[BF_4]^-$ hydrophilic in nature? A quantum chemical investigation*, Journal of Chemical Sciences, 137, 92, 2025
6. Soham Chakraborty, Shivam Pandit, Krishnendu Sinha, Madhu Bhatt, Debojyoti Chowdhury, **Suman Chakrabarty**, Shubhasis Haldar, *Unraveling antibody-induced mechanical stability of antigen: Insights from single-molecule studies*, Protein Science, 34, e70201, 2025
7. Sayari Bhattacharya and **Suman Chakrabarty**, *Mapping conformational landscape in protein folding: Benchmarking dimensionality reduction and clustering techniques on the Trp-Cage mini-protein*, Biophysical Chemistry, 319, 107389, 2025
8. Karishma Biswas, Sudipta Mitra, Dibakar Roy, Sanhita Roy, Dibakar Sarkar, DeokHyun Son, Rohit Das, Anuradha Roy, Dulal Senapati, Humaira Ilyas, A. Harikishore, Ranjit Biswas, **Suman Chakrabarty**, DongKuk Lee, Indranil Biswas, Sudipto Saha, Pallob Kundu, Anirban Bhunia, *Transgenic Tobacco Plants Expressing Synthetic Peptides: A Functional and Structural Analysis for Pathogen Resistance*, Plant Biology Journal, 2025, (DOI: https://doi.org/10.1111/pbi.70287)
9. Sutanu Mukhopadhyay and **Suman Chakrabarty**, *Mixed-Solvent Molecular Dynamics Simulation Reveals a Druggable Allosteric Pocket in the PCSK9 C-Terminal Domain*, Journal of Physical Chemistry B, 129, 11737-11744, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Departmental Seminar at School of Chemistry, University of Hyderabad ; 24/04/2025; School of Chemistry, University of Hyderabad; 1 day
2. Departmental Seminar at Dept. of Chemistry, Visva-Bharati, Santiniketan; 29/04/2025; Dept. of Chemistry, Visva-Bharati University; 1 day
3. National Conference on Interdisciplinary Horizons of Physical Chemistry (IHPC); 17/07/2025; Bose Institute, Kolkata; 3 days
4. CRSI Bronze Medal Lecture at CSIR-NSC-35 conference; 03/07/2025; Indian Institute of Technology Gandhinagar; 3 days
5. Frontiers and Advances in Chemistry: Theory & Synthesis (FACTS2025); 01/08/2025; Ashoka University; 3 days
6. Statistical Mechanics in Chemistry and Biology 2025 (SMCB-2025); 17/12/2025; TIFR Hyderabad; 3 days
7. Physics for Sustainability: Health, Energy, and Environment (SPHERE); 16/10/2025; Indian Institute of Science (IISc), Bangalore; 3 days
8. Indo-French workshop "Navigating rugged landscapes: Machine learning approach to dynamics and enhanced sampling in disordered systems, and statistical physics approaches to machine learning"; 25/11/2025; JNCASR, Bengaluru; 4 days
9. 19th Theoretical Chemistry Symposium TCS-2025; 02/12/2025; IIT Bombay; 4 days
10. Emerging Trends in Disease Biology: Mechanisms to Medicine; 20/02/2026; IIT Kharagpur; 3 days
11. Recent Advances in Chemical Sciences 2026 (RACS26); 14/03/2026; Visva-Bharati University; 2 days
12. International Workshop on "Machine learning, enhanced sampling, and dynamical surrogate models for glassy and adaptable materials"; 30/03/2026; University of Chicago Center, Delhi; 3 days

Administrative duties

1. Part-time Chief Vigilance Officer (CVO), SNBNCBS
2. Member, Media Cell
3. Member, Committee for management of the Param Rudra Boson supercomputing facility under NSM hosted at SNBNCBS, Kolkata

Awards, Recognitions, if any

1. Bronze Medal from The Chemical Research Society of India (CRSI), 2025
2. Dr. APJ Abdul Kalam HPC & AI Award - 2025 under the category Researcher in R&D in HPC Applications in India

Membership of Learned Societies

1. Biophysical Society, USA
2. American Chemical Society (ACS), USA
3. Chemical Research Society of India (CRSI), India

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Development of weighted ensemble based enhanced sampling methods for quantitative estimation of rare event kinetics from molecular simulation; ANRF, India (ARG MATRICS); 5 years; PI

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Collaboration with Prof. Ruth Nussinov (NCI, USA); Sl. No. 1; International
2. Collaboration with Prof. A. Bhunia (Bose Institute, Kolkata); Sl. No. 8; National

Outreach program organized / participated

1. Delivered invited lecture at the Science Camp organised by the Jagadis Bose National Science Talent Search (JBNSTS)

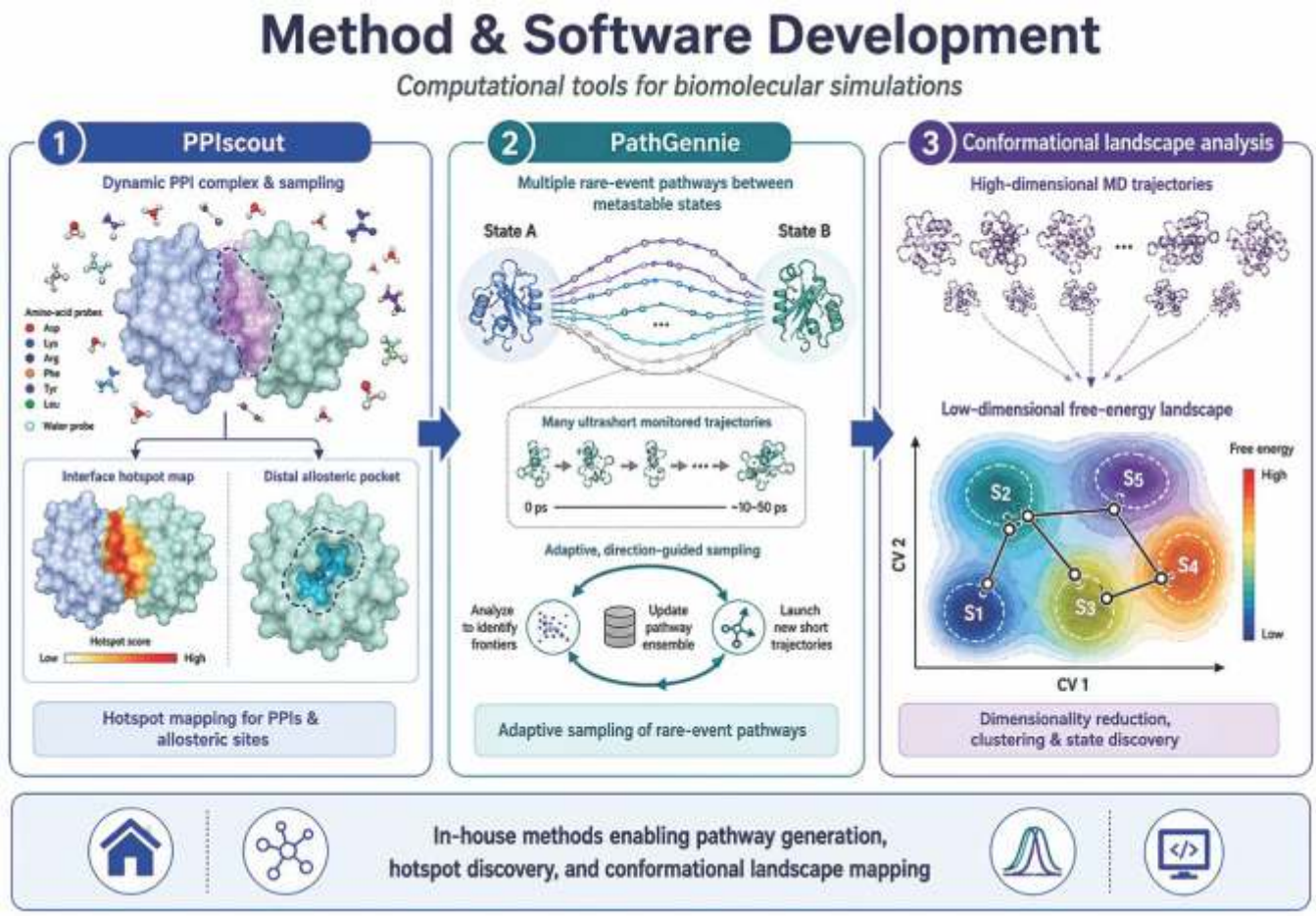
Areas of Research

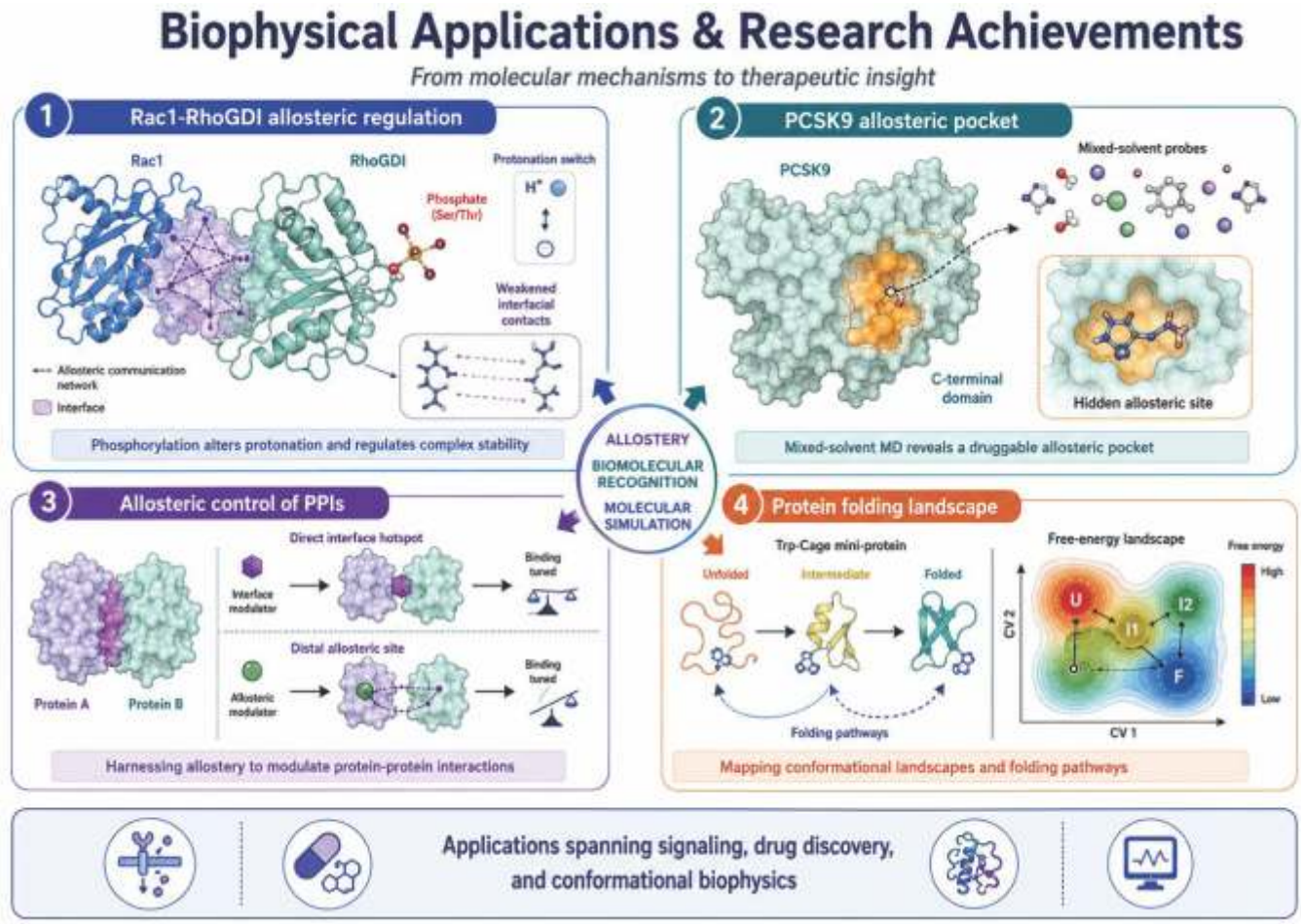
Computational Biophysical Chemistry

Statistical Mechanics and AI/ML Based Computational Modeling and Simulation of Large Scale Molecular Systems

Our research focused on the computational dissection and therapeutic exploitation of protein allostery and protein-protein interactions (PPIs), combining mechanistic molecular dynamics (MD) studies with the development of new, openly released computational tools.

A central thrust was method development for rare-event sampling and conformational analysis. We introduced "PathGennie", a direction-guided adaptive sampling framework that generates rare-event transition pathways, e.g. ligand (un)binding and protein (un)folding, using swarms of ultrashort, unbiased trajectories without external biasing forces. It produces physically meaningful pathways on picosecond timescales and yields excellent seeds for weighted-ensemble simulations, substantially accelerating rate-constant convergence. Complementing





this, we have systematically benchmarked dimensionality-reduction (PCA, TICA, VAE) and clustering (K-means, HDBSCAN, GMM) techniques on the Trp-Cage mini-protein, establishing practical guidance for characterising folding landscapes and showing that density-based clustering best recovers free-energy minima.

A second thrust targeted allosteric modulation of PPIs for drug discovery. Mixed-solvent MD uncovered a previously uncharacterised, druggable cryptic allosteric pocket in the C-terminal domain of PCSK9 - a key cholesterol-regulating target - opening a new route to inhibitors for hypercholesterolemia. We generalised this capability with "PPIscout", an in-house mixed amino acid-water MD method that maps binding hotspots and cryptic/allosteric sites at featureless PPI interfaces, validated on MDM2, Bcl-XL and PDZ targets. In a constant-pH MD simulation study, we have revealed how site-specific dual phosphorylation of RhoGDI shifts histidine protonation states to allosterically weaken the Rac1-RhoGDI complex and drive selective GTPase release - an international collaborative work with Prof. Ruth Nussinov (NCI, USA) that resolves a long-standing "phosphorylation code."

Significant achievements include: (i) release of two open-source computational tools, PathGennie and PPIscout, broadening our methodological footprint; (ii) discovery of a novel druggable allosteric site in PCSK9 with direct therapeutic relevance, (iii) mechanistic resolution of phosphorylation-driven allostery in Rho-GTPase regulation through a high-visibility international collaboration.

Plan of Future Work Including Project

A national collaborative project is in progress with Prof. Soumya De, IIT Kharagpur on understanding the mechanism of the enzyme Intein

An international collaborative project is in progress with Prof. Rupak Majumdar, MPI-SWS, Germany on developing AI/ML based computational methods to understand dynamics in complex molecular systems

Department of Condensed Matter and Materials Physics







Anjan Barman

Senior Professor
Condensed Matter and Materials Physics
abarman@bose.res.in

Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Suchetana Mukhopadhyay; Ultrafast spin dynamics in quantum materials/ ferromagnet heterostructures; Awarded; Prof. Chiranjib Mitra, IISER Kolkata, Co-Supervisor
2. Chandan Kumar; Spin Dynamics in Emerging Magnetic Materials; Under Progress
3. Bikram Baghira; Magnetization Dynamics and Spin Waves in Engineered Magnetic Structures; Under Progress
4. Suranjana Chakaborty; Spectroscopic Studies of Molecules; Under Progress
5. Sayan Mathur; Spin Wave Dynamics in Advanced Magnetic Textures; Under Progress
6. Sayanti Mondal; Ultrafast Spin Dynamics in Low Dimensional Magnetic Systems; Under Progress
7. Najrul Ansari; Ultrafast spin dynamics in Ferroic Materials; Under Progress
8. Sourav Mandal; Hybrid Magnonics in Nanoscale Magnetic Systems; Under Progress
9. Soumava Mondal; Ultrafast spin dynamics in and van der Waals magnets; Under Progress
10. Susmita Das; Ultrafast spin dynamics in advanced magnetic materials; Under Progress

b) Post-Docs

1. Rubina Ghosh; Spintronics at organic/ inorganic interface
2. Sibashish Chakraborty; Ultrafast Magneto-Plasmonics in Patterned heterostructures
3. Ekta Yadav; Ultrafast spin dynamics and spin transport at ferromagnet/ superconducting interface
4. Payal Bhattacharjee; Dynamics of Skyrmions and other Topological Spin Textures

c) External Project Students / Summer Training

1. Shib Shankar Utthasini; Magnetization Dynamics in Ferromagnet/ Nonmagnet Heterostructures; S. N. Bose National Centre for Basic Sciences (IPhD student)
2. Aparna Bhunia; Ultrafast Magnetization Dynamics in Magnetic Nanostructures; IIT (ISM) Dhanbad
3. Sreyasi Samanta; Magneto-Optical Kerr Effect Study in Advanced Magnetic Materials; NIT, Rourkela

Teaching

1. Spring Semester; PHY516: Magnetism & Superconductivity; Integrated PhD; 3 students; Shared with Prof. P. Singha Deo
2. Spring Semester; PHY616: Advanced Condensed Matter Physics I; PhD; 1 student; Shared with Prof. P. Singha Deo
3. Spring Semester; PHY592: Methods of Experimental Physics; Integrated PhD
4. Spring Semester; PHY502: Project Research III; Integrated PhD; 1 student
5. Autumn Semester; PHY304: Project Research II; Integrated PhD; 1 student

Publications

a) In journals

1. David Muradas-Belinchón, Suchetana Mukhopadhyay, Francesco Foggetti, Surya N.

Panda, Olof Karis, Peter M. Oppeneer, **Anjan Barman** and M. Venkata Kamalakar, *Electrical Control of Ultrafast Magnetic Speeds in Graphene Spin Field-Effect Junctions*, Physical Review Letters, 135, 097001, 2025

2. Sreya Pal, Md Nur Hasan, Himanshu Bangar, Nastaran Salehi, Sayan Mathur, Manuel Pereiro, Patrik Thunström, Pranaba Kishor Muduli, Debjani Karmakar and **Anjan Barman**, *Deciphering Interfacial Dzyaloshinskii–Moriya Interaction in Transition-Metal Dichalcogenide/Permalloy Heterostructures by Brillouin Light Scattering and First-Principles Calculations*, ACS Nano, 19, 23564-23574, 2025

3. P. Graczyk, B. Rana, A. Trzaskowska, B.K. Mahato, J.W. Kłos, M. Krawczyk, **Anjan Barman**, *Optical excitation and detection of high-frequency Sezawa modes in Si/SiO_2 system decorated with $Ni_{80}Fe_{20}$ nanodot arrays*, Ultrasonics, 148, 107522, 2025

4. Pratap Kumar Pal, Raisa Fabiha, Amrit Kumar Mondal, Supriyo Bandyopadhyay, **Anjan Barman**, *Harnessing GHz Frequency Spin-Orbit Torque for Spin-Wave Amplification in Nanomagnets*, Advanced Functional Materials, 36, e22422, 2026, DOI: https://doi.org/10.1002/adfm.202522422

5. Arundhati Adhikari, Piotr Graczyk, Avinash K. Chaurasiya, Sayanti Mondal, Jarosław W. Kłos and **Anjan Barman**, *Optical probing of magnons and phonons in $Ni_{80}Fe_{20}$nanodot arrays*, Nanoscale, 18, 4392-4398, 2026, DOI: 10.1039/d5nr04628a

6. Raisa Fabiha, Pratap Kumar Pal, Michael Suche, Amrit Kumar Mondal, Erdem Topsakal, **Anjan Barman**, Supriyo Bandyopadhyay, *Spin Hall Nano-Antenna*, Advanced Science, 13, e20505, 2026, https://doi.org/10.1002/ advs.202520505

7. Ajit Kumar Sahoo, Suchetana Mukhopadhyay, Bikram Baghira, Jeyaramane Arout Chelvane, Jyoti Ranjan Mohanty, **Anjan Barman**, *Spin Pumping in MagnetostrictiveGalfenol Interfaced with Ta*, Advanced Functional Materials, 35, 2424006, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Hybrid Interface for Magnonics: A Quantum Technology Platform, A. Barman, Advanced Functional Materials and Devices (AFMD 2026) (Keynote Lecture); 19/03/2026; SRM University, Chennai; 45 minutes

2. Ultrafast Spin Manipulation in Engineered Magnetic Materials: Paving the Way for Next-Generation Computing, A. Barman, IEEE Magnetics Society Seminar; 03/03/2026; College of Engineering, Virginia Commonwealth University, USA; 60 minutes

3. Ultrafast Spin Manipulation in Engineered Magnetic Materials: Paving the Way for Next-Generation Computing, A. Barman, Physics Department Seminar; 24/02/2026; Department of Physics, University of Delaware, Newark, USA; 60 minutes

4. All-Optical Study of Ultrafast Magnetization Dynamics in 2D Material/Ferromagnet Heterostructures, A. Barman, Disorder and Size Effects in Quantum Materials; 04/02/2026; S. N. Bose National Centre for Basic Sciences, Kolkata 700106; 30 minutes

5. Hybrid Interface for Magnonics: A Quantum Technology Platform, A. Barman, 3rd Symposium on Magnetism and Spintronics (SMS-3); 21/01/2026; IIT Hyderabad; 30 minutes

6. Ultrafast Spin Manipulation in Tailored Magnetic Materials: Paving the Way for Next Generation Computing, A. Barman (Distinguished Lecture); 14/01/2026; University of Engineering and Management; 60 minutes

7. Spin Texture Driven Magnetization Dynamics in Advanced Spintronic Materials, A. Barman, Symposium on Advanced Materials and Devices (SAMDEV 2025); 19/12/2025; Bose Institute; 30 minutes

8. Magnetic Texture Controlled Ultrafast Spin Dynamics in Engineered Magnetic Nanostructures, A. Barman, INSA Anniversary General Meeting and Celebration of Science Week, 2025; 04/12/2025; IIT Delhi; 20 minutes

9. Ultrafast Magnetization Dynamics in 2D Material/Ferromagnet Heterostructures, A, Barman, 12th DAE BRNS Theme Meeting on Ultrafast Science (UFS 2025) (Plenary Lecture); 13/11/2025; IIT Hyderabad; 40 minutes

10. Ultrafast Spin and Magnetization Dynamics in 2D Material/Ferromagnet Heterostructures, A. Barman, Recent Development in Natural Science (Keynote Lecture); 04/11/2025; Jadavpur University; 60 minutes

11. Ultrafast Spin and Magnetization Dynamics in 2D Material/Ferromagnet Heterostructures, A. Barman, FDP on Quantum Materials and Devices (QMD); 25/09/2025; IIT Delhi; 60 minutes
12. Secrets and Strategies in Capturing Research Grants: A Practitioners Views and Perspectives, A. Barman; 02/08/2025; North Bengal University; 30 minutes
13. Magnetization Dynamics: from Theory to Experiment, A. Barman, LNMIIT Physics Colloquium; 26/07/2025; LNMIIT Jaipur; 60 minutes
14. Fundamentals and Frontier Applications of Laser Science, A. Barman, C. K. Majumder Memorial Workshop 2025; 20/07/2025; S. N. Bose National Centre for Basic Sciences, Kolkata 700106; 60 minutes
15. Ultrafast Spin Manipulation in Tailored Magnetic Materials: Paving the Way for Next Generation Computing, A. Barman, Physics Colloquium; 15/07/2025; Shiv Nadar Institute of Eminence; 60 minutes

Administrative duties

1. Dean Faculty
2. Member of CAC
3. Member of ARPAC
4. Chairman of Works Committee
5. Chairman of Annual Procurement Committee
6. Chairman of Space Committee

Awards, Recognitions, if any

1. Elected Fellow of the Indian National Science Academy (INSA) in 2026
2. Featured in top 2% most cited scientists' list released by Stanford-Elsevier in 2025
3. Associate Editor of npj Spintronics (Springer-Nature)
4. Editorial Board Member of Nanotechnology (IOPscience)

Membership of Learned Societies

1. Member of the American Physical Society
2. Member (Fellow) of Institute of Physics (UK)
3. Life Member of Materials Research Society of India (MRSI)

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Development of strongly spin-orbit coupled topological quantum hetero-structures for spintronic application; Nano-Mission, DST; 2021-26; PI
2. Two-dimensional Ferromagnetic and Organic Molecule Spinterfaces as Molecular Spin Qubits for Quantum Technologies and Energy Harvesting Applications; I-HUB Quantum Technology Foundation, IISER Pune; 2023-26; PI

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Prof. Supriyo Bandyopadhyay, Virginia Commonwealth University, USA; Sl. No. 4, 6; International
2. Prof. Venkata Kamalakar Mutta and Prof. Peter Oppeneer, Uppsala University, Sweden; Sl. No. 1; International
3. Dr. M. Pereiro and P. Thunström, Uppsala University, Sweden; Sl. No. 2; International
4. Prof. P. K. Muduli, IIT Delhi and Dr. D. Karmakar, BARC Mumbai; Sl. No. 2; National
5. Prof. Jaroslaw W Klos and Maciej Krawczyk, AMU, Poznan, Poland; Sl. No. 3, 5; International
6. Dr. Jeyaramane Arout Chelvane, DMRL, Hyderabad and Prof. Jyoti Ranjan Mohanty, IIT Hyderabad; Sl. No. 7; National

Outreach program organized / participated

1. Delivered a Lecture Series entitled "Fundamentals of Laser Sciences and Line shapes & Line Broadening" to Undergraduate Students at Shiv Nadar University between 31st January and 3rd February 2026 (Total 4 hour)

Areas of Research

Ultrafast spin dynamics and emergent spin phenomena, including spintronics, magnonics, and spin-orbitronics in magnetic thin films, nanostructures, and heterostructures; quantum and topological materials; ferroelectric materials; and organic materials

During the reporting period, our research made significant advances in ultrafast magnetism, spintronics, magnonics, and spin-orbitronics through a series of high-impact

publications in Physical Review Letters, ACS Nano, Advanced Functional Materials, and Advanced Science. The work spans fundamental discoveries in spin dynamics and their translation into next-generation spintronic and magnonic devices.

A landmark study demonstrated the first electrical control of ultrafast magnetic speeds in graphene spin field-effect junctions. By electrostatically tuning the Fermi level of graphene, the team achieved gate-controlled modulation of superdiffusive spin currents across graphene/Co interfaces, reducing the femtosecond laser-induced demagnetization time from 203 fs to 93 fs-more than doubling the magnetization quenching rate. This work establishes a new mechanism for electrically controlling ultrafast spin transport without modifying the device structure, opening exciting opportunities for sub-picosecond spintronic memory, logic, and quantum technologies.

In another major contribution, our group systematically investigated interfacial Dzyaloshinskii-Moriya interaction (DMI) in transition-metal dichalcogenide (TMD)/permalloy heterostructures using Brillouin light scattering and first-principles calculations. By correlating the symmetric (Heisenberg exchange) and antisymmetric (DMI) exchange interactions with the intrinsic spin-orbit coupling of monolayer MoS^2, $MoSe^2$, WS^2, and WSe^2, the study provided a comprehensive microscopic understanding of chiral magnetic interactions in two-dimensional materials. These findings offer valuable guidelines for designing skyrmion-based and spin-orbitronic devices.

Our group also introduced a novel approach for spin-wave amplification using GHz-frequency alternating-current spin-orbit torque. Resonant excitation of selected spin-wave modes in magnonic crystals resulted in more than an order-of-magnitude enhancement of spin-wave amplitude together with significant linewidth narrowing, enabling tunable spectral filtering. This work demonstrates an energy-efficient strategy for low-loss magnonic information processing and microwave signal manipulation.

Another important achievement involved the investigation of spin pumping in magnetostrictive Galfenol/Ta heterostructures. Through time-resolved magneto-optical Kerr effect measurements and theoretical modeling, the study revealed exceptionally efficient spin current generation, reporting one of the highest effective spin-mixing conductance values for Galfenol-based systems. The work also elucidated the role of tilted magnetic anisotropy and strain-induced magnetic modes, highlighting Galfenol as a promising material platform for spintronic and straintronic applications.

Extending spintronics into the area of analog communication, we proposed and demonstrated the concept of a Spin Hall Nano-Antenna, a compact device that converts spin-wave excitations generated via alternating spin-orbit torque into electromagnetic radiation. Operating as both a transmitting and receiving

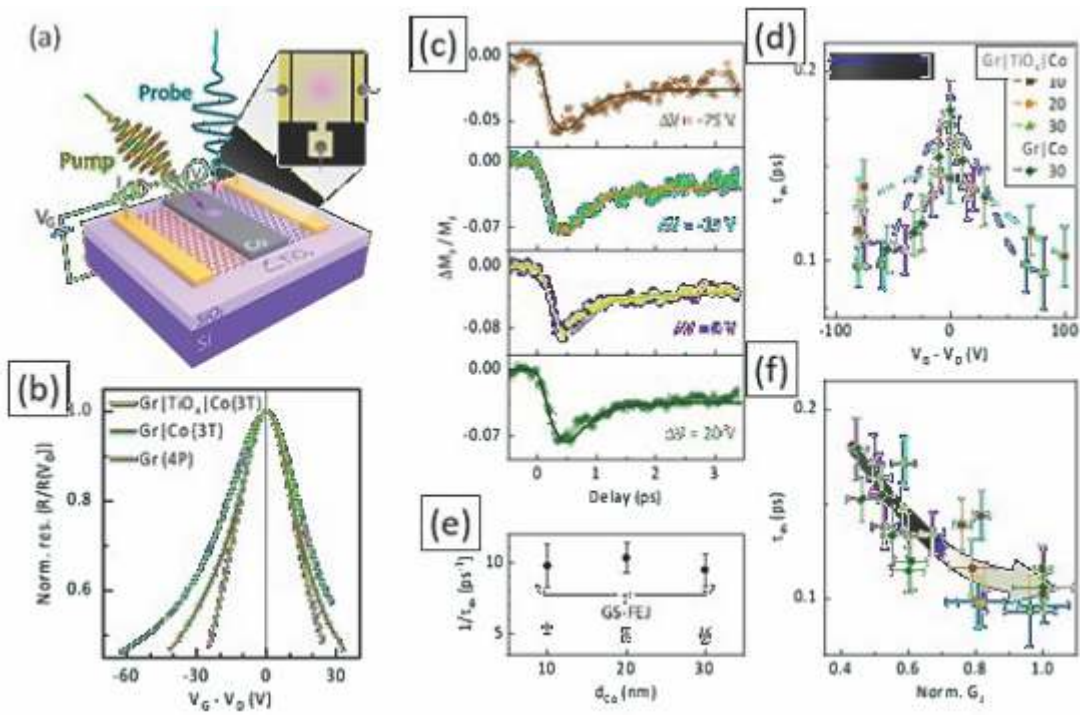


Figure1: Device scheme and static characterization and gate-tunable spin dynamics in graphene-spin field effect junctions.

antenna, this ultrasmall spintronic antenna exhibits significantly enhanced radiation efficiency compared with conventional antennas of similar dimensions, offering a new paradigm for wireless on-chip communication and integrated microwave technologies.

Collectively, these achievements establish our research group at the forefront of ultrafast spin dynamics, spin-orbitronics, and magnonics, with broad implications for future quantum, memory, communication, and energy-efficient computing technologies.

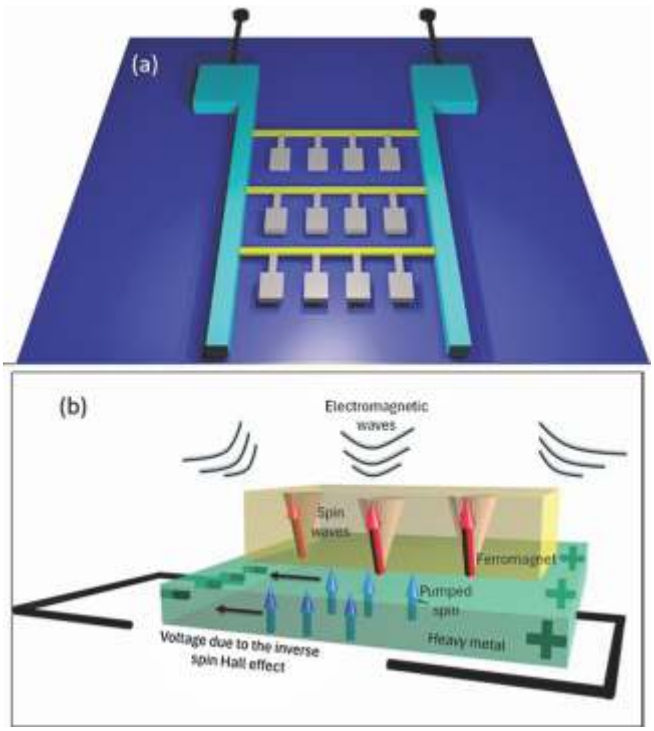


Figure2: Harnessing GHz Frequency Spin-Orbit Torque for Spin-Wave Amplification in Nanomagnets and Demonstration of a Spin-Hall Nano Antenna.

Plan of Future Work Including Project

A major direction will be the exploration of two-dimensional material/ferromagnet heterostructures, including transition metal dichalcogenides and graphene integrated with magnetic thin films. These systems provide strong interfacial spin-orbit coupling, proximity-induced magnetism, and efficient charge-to-spin conversion, offering unique opportunities for electrical tuning of spin-wave dispersion, damping, nonreciprocity, and chiral magnon transport. Combining advanced Brillouin light scattering spectroscopy, ultrafast optical techniques, and micromagnetic simulations, the project aims to establish fundamental mechanisms governing voltage-controlled spin dynamics in these hybrid systems.

Another major thrust will be the exploration of three-dimensional artificial spin ice (3D-ASI) as a programmable magnonic medium. Recent studies have demonstrated experimentally that magnetic charge states produce distinct spin-wave spectral fingerprints, enabling non-invasive readout of emergent magnetic configurations. These findings open new opportunities for designing reconfigurable three-dimensional magnonic devices, neuromorphic computing architectures, and low-power information processing systems. Future work will investigate dynamic control of magnetic charges, topological defects, and spin-wave propagation in complex 3D magnetic networks, while extending these concepts to other frustrated magnetic nanoarchitectures and programmable metamaterials.

Another important direction will involve the development of hybrid magnonic and spintronic devices, integrating magnetic nanostructures with microwave, optical and quantum platforms. Particular emphasis will be placed on coherent spin-wave manipulation, nonlinear magnonics, magnon-phonon coupling, and magnonic logic for beyond-CMOS computing technologies. The programme will also investigate quantum magnonics and coherent information transfer in hybrid quantum systems.

Research will continue on topological spin textures, including skyrmions, vortices, domain walls and artificial spin ice, with the aim of understanding their static and dynamic behaviour under electrical, optical and thermal stimuli. These studies are expected to provide new mechanisms for robust information transport and storage with minimal energy consumption.

Future research will focus on achieving electrical control of spin-wave dynamics in multiferroic and hybrid low-dimensional materials for energy-efficient magnonic technologies. A primary objective will be to investigate spin-wave excitation and propagation in $BiFeO^3$ (BFO), a room-temperature antiferromagnetic ferroelectric, where electric-field-induced switching of ferroelectric polarization can be exploited to manipulate antiferromagnetic order and spin-wave characteristics without external magnetic fields. Understanding the coupling between ferroelectric and magnetic order parameters will enable voltage-controlled magnonic devices with ultralow power consumption.

The programme will further strengthen international collaborations with leading research groups in Europe, Asia and North America to develop advanced experimental techniques for nanoscale magnetic imaging, Brillouin light scattering spectroscopy, time-resolved magneto-optical measurements, and ultrafast magnetization dynamics. Integration of large-scale micromagnetic simulations, data-driven modelling and artificial intelligence will accelerate materials discovery and optimization of magnonic devices.



Atindra Nath Pal

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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Dayal Das; Transport in 2D hybrid devices; Under Progress
2. Debasish Ghosh; Fabrication and transport in 2D superconductor hybrid; Under Progress
3. Dhritisundar Paramanik; Electronic transport and shot noise in single atomic/molecular junction; Under Progress
4. Mohana Roy; Transport in 2D semiconductor devices; Under Progress
5. Premananda Chatterjee; Low dimensional magnets and their heterostructure; Under Progress
6. Riju Pal; Electronic transport and ESR spectroscopy in van der Waal magnets; Awarded
7. Subhankar De; Effect of external stimuli on Single molecular junction; Under Progress

b) Post-Docs

1. Bikash Gajar; Transport in topological semimetal

c) External Project Students / Summer Training

1. Anumita Saha; DLTS spectroscopy on graphene/SiO_2; IISER Berhampore
2. Shibshankar Utthasini; Fabrication of 2D heterostructure; SNBNCBS

Teaching

1. Spring Semester; PHY 528: Mesoscopic Physics; Integrated PhD; 7 students; Shared with Dr. Barun Ghosh
2. Spring Semester; PHY 592: Methods of Experimental Physics; Integrated PhD; 10 students; Coordinator of the Course; Shared with Five other faculties
3. Spring Semester; PHY 628: Mesoscopic Physics; PhD; 7 students; Shared with Dr. Barun Ghosh

Publications

a) In journals

1. Rafiqul Alam, Debasis Dutta, Modhumita Sariket, Nitesh Kumar, Amit Agarwal, **Atindra Nath Pal**, *Nonlinear and Planar Hall Effects as Probes of Band Geometry in 1T-TaS_2 Driven by CDW Transition*, Advanced Functional Materials, 35, 2418643, 2025
2. Biswajit Pabi, Štěpán Marek, Tal Klein, Arunabha Thakur, Richard Korytár, **Atindra Nath Pal**, *Unconventional Electromechanical Response in Ferrocene-Assisted Gold Atomic Chain*, Nano Letters, 25, 13511-13518, 2025
3. Shatabda Bhattacharya, Shubhadip Moulick, Chinmoy Das, Shiladitya Karmakar, Hirokazu Tada, Tanusri Saha-Dasgupta, Tatsuhiko Ohto, Shinji Kitao, Makoto Seto, Pradip Chakraborty and **Atindra Nath Pal**, *Engineering Fe(II) spin-crossover/2D reduced graphene oxide heterostructures for tunable cooperativity, magnetic coupling, and conductance switching*, Nanotechnology, 36, 455702, 2025

4. Arnab Bera, Riju Pal, Buddhadeb Pal, Samir Rom, Suchanda Mondal, Deepti Rana, Aastha Vasdev, Sandeep Howlader, Manish Jana, Tanmay Maiti, Rafikul Ali Saha, Biswajit Das, Tanusri Saha-Dasgupta, Prabhat Mandal, **Atindra Nath Pal** and Mintu Mondal, *Observation of superconductivity and weak ferromagnetism in the quasi-one-dimensional chain compound* $(TaSe_4)_3I$ *at ambient pressure*, Physical Review B, 112, L180502, 2025
5. Binoy Das, Moumita Patra, Julekha Khatun, **Atindra Nath Pal**, Bipan Tudu, Nityananda Das, *Design and Study of Voltage-Dependent Capacitor Using BJT and Its Application as A Reactance Modulator*, International Journal of Electrical and Electronics Engineering, 12, 5, 2025

b) Other Publications

i) Conference proceedings / Reports / Monographs

1. APS Global Physics Summit 2025: Vineet Pandey, Prasenjit Ghosh, Riju Pal, Kenji Watanabe and Takashi Taniguchi, Atindra Nath Pal, Vidya Kochat,, "Broken Symmetry Quantum Hall States, Layer Hybridization and Screening Effects in Twisted Bilayer Graphene at Intermediate Angles." Presented at the APS Global Physics Summit 2025, March 17, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Invited colloquium at the Physics Department, IISER Pune; 25/08/2025; IISER Pune: Dept. of Physics; 1day
2. Invited talk and Visit to University of Wurzburg, Germany for DST-DFG-IRTG Workshop; 08/02/2026; Wurzburg, Germany; 3 days
3. Invited Talk at MRSI-ICEM 2025: NISER Bhubaneswar; December 17-20, 2025; 17/12/2025; NISER Bhubaneswar; 4 days
4. Invited talk at One day Workshop on Quantum Materials; 20/01/2026; SNBNCBS, Kolkata; 1day
5. Invited talk at SAMDEV 2025: BOSE Institute; 20/12/2025; Bose Institute, Kolkata; 2 days
6. Invited talk at the "International Conference on Nonlinear Optics and Nanophotonics: Fundamental to Technological Applications"; 09/07/2025; IISER Bhopal; 3 days
7. Invited talk at the Conference on 2D materials (2DMAT), SNBNCBS; 16/03/2026; SNBNCBS, Kolkata; 2 days
8. Invited talk at the conference on Contemporary Physics from 29 March 2026 to 31 March 2026; 29/03/2026; IIT Kharagpur; 3 days

Administrative duties

1. Incharge of Ellipsometry system, AFM, Helium plant, mechanical workshop, Oxford system, 3K measurement system and Joint incharge of clean room
2. Member of Faculty Search Committee
3. Member of Project & Patent Cell, Member of purchase sub-committee and several other committees time to time

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. DST/NM/TUE/QM-10/2019; DST-Nanomission; March 2023- March, 2028 (5 years); PI

Conference / Symposia / Schools organized

1. Co-organizer in the conference: Spin in Molecular Systems (SIMS) - 2025, November 29 - December 01, 2025, Jointly organized by IIT Kharagpur and SNBNCBS; 29/11/2025; IIT Kharagpur Research Park, Kolkata; 3 days

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Amit Agarwal, IIT Kanpur; Sl. No. 2; National
2. Arunabha Thakur, Jadavpur University; Sl. No. 1; National
3. Dr. Watanabe, Kenji and Dr. Taniguchi, Takashi; National Institute for Materials Science, Japan; Sl. No. 5; International
4. Hirokazu Tada, Tatsuhiko Ohto, Shinji Kitao, Makoto Seto, Japan; SL. No. 4; International
5. Mintu Mondal, IACS, Kolkata; Sl. No. 3; National
6. Nitesh Kumar, SNBNCBS; Sl. No. 2; National

7. Prabhat Mandal, SNBNCBS; Sl. No. 3; National
8. Pradip Chakraborty, IIT Kharagpur; Sl. No. 3; National
9. Stepán Marekb, Richard Korytár, Charles University, Prague; Sl. No. 1; International
10. Tanusri Saha Dasgupta, SNBNCBS; Sl. No. 3, 4; National
11. Vidya Kochat, IIT Kharagpur; SL. No. 5; National

Outreach program organized / participated

1. Delivered a popular level talk on the electron transport through a single atom to the college students of Ramkrishna Mission Vidyamandira, Belur Math on 7th February. I interacted with the students and faculty members

Areas of Research

Experimental Condensed Matter Physics: Low temperature transport, 2D materials, emergent phases in quantum materials, single atomic/ molecular transport

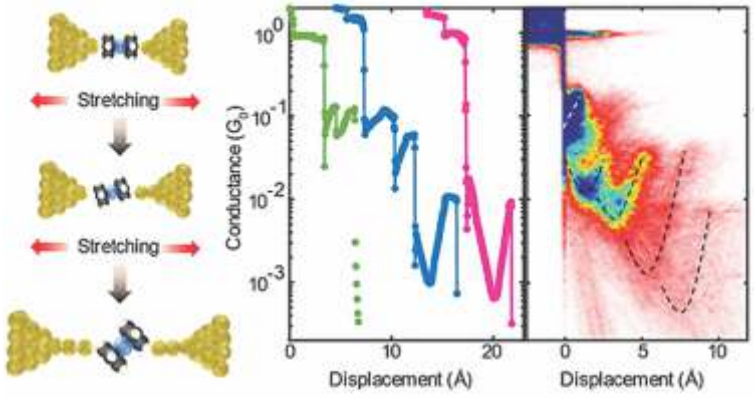
A. Atomic and Molecular Scale Transport: Our group continues to investigate quantum transport through atomic and molecular junctions. Building on earlier studies of ferrocene-assisted junctions, we demonstrated unusual electromechanical response in molecule-assisted gold atomic chains, where molecular rotation inside the chain gives rise to non-monotonic conductance evolution under strain (Nano Lett. 2025, 25, 36, 13511-13518). We are further exploring the role of molecular geometry and external stimuli on charge transport, while optimizing low-temperature and shot-noise measurement capabilities. Two PhD students are currently working in this area.

B. Electronic Transport and Defect Spectroscopy in 2D Hybrid Systems: Significant progress has been made in understanding transport and defect dynamics in two-dimensional materials and their hybrids. We previously demonstrated nearly barrier-free graphene contacts to ReS^2, resulting in high mobility and enhanced optoelectronic performance, and investigated charge noise in ambipolar tellurene transistor. During the current period, we established random telegraph noise spectroscopy as a sensitive probe of individual defects in graphene-contacted ReS^2-hBN heterostructures, leading to single-defect spectroscopy (arXiv:2511.17125). We have also initiated studies on 2D/organic hybrids and alloy TMDC systems for excitonic and optoelectronic applications.

C. Emergent Phases in van der Waals Magnets and Hybrid Systems: We continued our investigations on the Fe-Ge-Te family of quasi-two-dimensional magnets. Following our earlier discovery of spin reorientation and unusual magnetic anisotropy in $Fe4GeTe^2$, temperature-dependent Raman spectroscopy combined with theoretical calculations revealed strong spin-phonon coupling and phonon renormalization across the spin reorientation transition (under review). In parallel, we explored Fe(II) spin-crossover/reduced graphene oxide heterostructures and demonstrated tunable magnetic coupling and conductance switching (Nanotechnology 36 (45), 455702, 2025).

D. Correlation and Topology in Low-Dimensional Quantum Materials: Our research on charge-density-wave systems revealed Berry-curvature-driven planar and nonlinear Hall effects in the commensurate phase of 1T-TaS^2. We are currently investigating the low-temperature phase of 1T-TaS^2 using transport, noise spectroscopy and Raman measurements. Similar studies have been initiated on 1T-$TiSe^2$ and 6R-TaS^2. Furthermore, we reported the coexistence of superconductivity and weak ferromagnetism in the quasi-one-dimensional chain

Formation and evolution of 1D metallic chain using break junction



Unconventional electromechanical response in Ferrocene assisted Gold atomic chain.

B. Pabi et . al., **Nano Lett. 36,** 13511 (2025)

Figure 1: Break junction

compound $(TaSe4)^3I$ (Physical Review B 112 (18), L180502, 2025), and observed skyrmionic transport and first-order phase transitions in twisted bilayer graphene quantum Hall ferromagnets (Physical Review B 113 (16), L161110, 2026).

Nonlinear and Planar Hall Effects as Probes of Band Geometry in 1T-TaS_2 Driven by CDW Transition

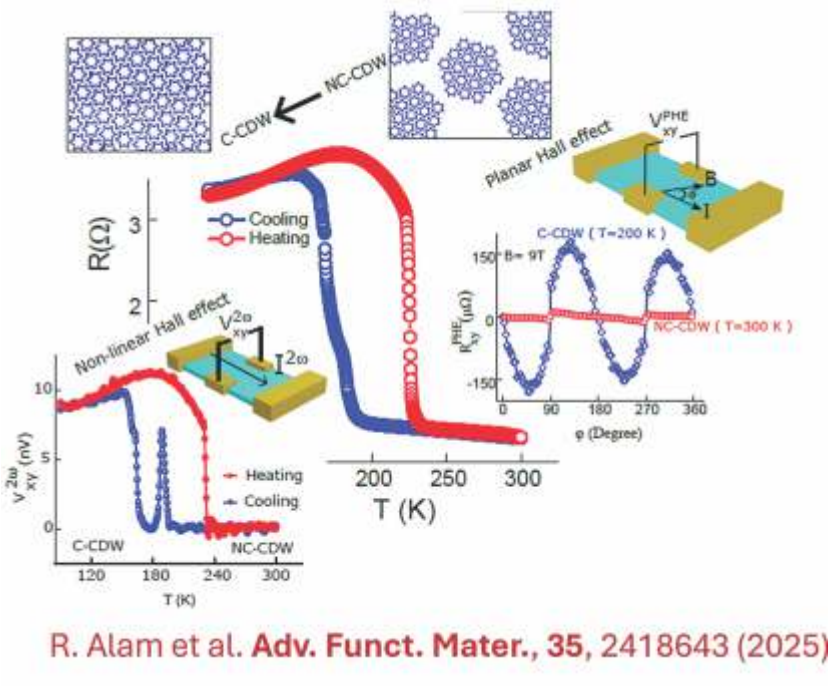


Figure 2: Figure on Nonlinear Hall effect

Plan of Future Work Including Project

Finally, I plan to establish a strong program in superconducting spintronics with vdW heterostructures. Metallic vdW magnets such as F4GT will be interfaced with Ising superconductors like $NbSe^2$ to probe spin-triplet proximity pairing and domain-wall-induced superconductivity enhancement. FI/S/FI trilayers using insulating or semiconducting magnets (CrX^3, CrSBr) will be fabricated to realize exchange-field-controlled magnetoresistance, with glove-box dry transfer ensuring pristine interfaces. These efforts aim to demonstrate gate-tunable, low-dissipation superconducting spintronic devices. Taken together, these four thrusts form a coherent program linking molecular junctions, defect-engineered 2D devices, emergent quantum phases, and superconducting spintronics. By systematically investigating charge, spin, and lattice interactions across multiple low-dimensional platforms, my research will provide both fundamental insights and functional outcomes, advancing high-mobility transistors, hybrid optoelectronics, spin logic, and superconducting spintronic elements aligned with national and international priorities in quantum technologies.

My future research will focus on four interlinked directions at the atomic, molecular, and 2D material scale. First, in atomic and molecular-scale transport, I will study charge and spin conduction through metal-molecule interfaces, with emphasis on helical and chiral molecules to probe chiral-induced spin selectivity (CISS). One-dimensional atomic and molecule-assisted chains will be explored to understand their stability, conductance evolution under strain, and hybridization effects. These efforts, complemented by shot-noise and low-temperature transport studies, will uncover microscopic principles of conduction relevant for nanoscale spintronic and quantum devices.

Second, in the area of two-dimensional devices, I will develop high-quality 2D materials using controlled CVD growth, glove-box transfer, and advanced lithography. Defect spectroscopy (DLTS, noise) combined with electronic transport will allow direct correlation between defects and device performance. Contact engineering will be pursued to realize high-quality p-type and ambipolar FETs, while hybrid architectures such as graphene/TMD, 2D/organic, and vdW heterostructures will be investigated for proximity effects, including spin-charge coupling, interlayer excitons, and gate-tunable transport. These studies aim to enable scalable optoelectronic, flexible, and spintronic device platforms.

Third, my group will explore emergent phases in quantum materials, focusing on van der Waals magnets (e.g., FGT) for anisotropic magnetoresistance, spin-orbit torques, and spin injection in 2D devices. Charge-density-wave and correlated systems such as $1T\text{-}TaS^2$ and RTe^3 will be studied for correlation-driven topological transitions and the interplay of lattice, spin, and charge degrees of freedom through transport and spectroscopy. Proximity-driven effects in hybrid vdW assemblies will be leveraged to access novel quantum phases and device functionalities.



Avijit Chowdhury

Associate Professor
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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Swapnil Roy; Optoelectronic Memristors for Artificial Visual Perception; Under Progress
2. Saikat Mitra; Growth And Physical Properties Study Of Perovskite Halides; Thesis Submitted; Dr. Barnali Ghosh (Saha), SNBNCBS, Supervisor
3. Swapnamay Paramanik; Metal Nanoparticle Decorated 2DHeterojunction Photocatalysts for Environmental Remediation and Energy Applications; Under Progress
4. Rajesh Jana; Exploring 2D Materials for Advanced Optoelectronic Synaptic Devices; Under Progress
5. Mukul Biswas; Triboelectric Nanogenerators for Sustainable Energy Harvesting and Selfpowered Device Applications; Under Progress
6. Sachin Paul; Study of Electrical Transport in TwoDimensional Halide Perovskites Memristive Artificial Synapses; Under Progress

b) Post-Docs

1. Dipanwita Mitra; Designing sustainable interfacial desalination systems for water remediation and resource recovery
2. Suma Das; Rational Design of Noble-Metal-Free 2D Semiconductor Photocatalysts for Artificial Photosynthesis: Green Hydrogen Evolution and CO2 Conversion

c) External Project Students / Summer Training

1. Animesh Pradhan; Boron Nitride and Polyaniline Composite Based Triboelectric Nanogenerator for Efficient Energy Harvesting; Jadavpur University
2. Rahul Mondal (TRC Project); Self-powered flexible TENG to estimate the pressure distribution inside a prosthetic socket; SNBNCBS, Kolkata

Teaching

1. Spring Semester; ELECTRONICS & INSTRUMENTATION (PHY 408); Integrated PhD; 14 students; Shared with Prof. Kalyan Mandal
2. Autumn Semester; BASIC LABORATORY I (PHY 491); Integrated PhD; 14 students; Shared with Dr. T Setti

Publications

a) In journals

1. Rahul Mondal, Mukul Biswas, Koyendrila Debnath, Snehasish Das, Uday Narayan Maiti, Sanat Kumar Adhikari, Barun Ghosh and **Avijit Chowdhury**, *Spatially confined surface terminated Mxenenanosheets as a multifunctional platform for triboelectric sensing and logic gates*, Journal of Materials Chemistry C, 14, 3206–3218, 2026
2. Ritamay Bhunia, Rajesh Jana, Anyesh Saraswati, Kinsuk Giri, Nitesh Kumar & **Avijit Chowdhury**, *$MoTe_2$-based synaptic-bridge memristor for brain-inspired computing: neuromorphic performance evaluation using MLP-CNN frameworks*, npj 2d materials and applications, 10, 45, 2026
3. Farhana Yasmin, Rajesh Deb, Yamineekanta Mishra, Asim Roy, **Avijit Chowdhury**, Saumya R.

Mohapatra, *Tuning the nucleation barrier energy of nonvolatile polymeric memristor by reducing its active layer thickness for threshold switching*, Applied Physics Letters, 127, 25, 2025

4. Saikat Mitra, Parushottam Majhi, Ganga S Kumar, Subarna Datta, Barun Ghosh, Arnab Bera, **Avijit Chowdhury**, Dipten Bhattacharya, Barnali Ghosh, *Multiple Ferroelectric Resonance in 2D Organic-Inorganic Halide Perovskite*, ACS Applied Electronic Materials, 7, 5485-5494, 2025
5. Saikat Mitra, Sayan Routh, Barnali Ghosh, **Avijit Chowdhury**, *Influence of Cation on X-Ray Detection Performance in Mixed-Halide 2D Ruddlesden-Popper Perovskite*, Physica Status Solidi A, 222, 2500439, 2025
6. Zarina Azmi, Deepak Deepak, Aruna Kadadevar, **Avijit Chowdhury**, Manjula G. Nair, Susanta Sinha Roy, Arpita Das, Saumya R. Mohapatra, *Unveiling the synergy of MXene supported ZIF-8 hybrid catalyst for enhanced oxygen evolution reaction*, Surface and Coatings Technology, 512, 132401, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Two Day Joint Meeting with Bose Institute; Title of the topic: 2D Materials for Devices, Sensing, and Energy Applications; 14/10/2025; Bose Institute, Kolkata; 15 minutes
2. Delivered a talk a as a part of scientific outreach activities; Title of the talk: Harvesting Low-Frequency Mechanical Energy Into Electricity; 22/12/2025; Sir Rajendra Nath Mukherjee Government Polytechnic, Basirhat; 60 minutes
3. Delivered a talk on 'Turning Low-Frequency Mechanical Energy into Clean Power using Triboelectricity'; 11/03/2026; Cachar College, Silchar; 60 minutes
4. One-day discussion meeting on 'Quantum Materials and Devices'; Title of the talk: Coexistence of Volatile and Nonvolatile Resistive Switching in 2D Halide Perovskite Memristor; 20/01/2026; S.N. Bose National Centre for Basic Sciences, Kolkata; 30 minutes
5. CGCRI-SNBNCBS Joint Workshop; Title of the topic: Exfoliated 2D materials for energy harvesting applications; 30/04/2025; S.N. Bose National Centre for Basic Sciences, Kolkata; 15 minutes

Administrative duties

1. Member of Theoretical Physics Seminar Circuit, SNBNCBS
2. Faculty In-charge, CKM Laboratory
3. Faculty In-charge, ALD, PLD, RTA

Membership of Learned Societies

1. Life member of MRSI
2. Life Member of Indian Association for the Cultivation of Science

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Development and testing of broadband optoelectronic synaptic devices employing ferroelectric/ photoelectric 2D material hybrid system; DST-SERB; 3 Years (March, 2023- March 2026); PI

Conference / Symposia / Schools organized

1. Organized a Topical Research School (TRS) as a Convener on "Recent Advances in Physical and Chemical Sciences" jointly with Cachar College, Silchar, under the Theoretical Physics Seminar Circuit (TPSC); 11/03/2026; Cachar College, Silchar, Assam; 11-13 March, 2026 (03 days)

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Dr.Saumya R. Mohapatra, Department of Physics, NIT SIlchar; Sl No. 3; National
2. Prof. Ashish Garg, Department of Sustainable Energy Engineering, Indian Institute of Technology Kanpur; National
3. Prof.Uday Narayan Maiti, Indian Institute of Technology Guwahati; Sl No. 1; National

Outreach program organized / participated

1. Educational Visit by the students from Naktala High School on 23/07/2025: Experiment demonstration and delivered a talk on 'Energy harvesting using triboelectric nanogenerators', Duration: 1hour

Areas of Research

Memristors for artificial synapses: Our current research focuses on the design of solution-processablememristors and memtransistors using two-dimensional materials, metal oxides, organic semiconductors, and hybrid nanocomposites. Particular emphasis is given on understanding charge transport, filament dynamics, interfacial engineering, and defect-mediated switching

mechanisms to achieve reliable resistive switching, multilevel conductance states, and analog synaptic behavior. The developed devices are further explored for emulating learning and memory functions, such as spike-timing-dependent plasticity, long-term potentiation, and associative learning.

Triboelectric and piezoelectric nanogenerators for energy harvesting and self-powered sensing: A major research thrust involves the construction of triboelectric and piezoelectric nanogenerators to harvest ambient mechanical energy and convert it into electrical power. The work emphasizes advanced nanostructured materials, including MXenes, transition-metal dichalcogenides, ferroelectric polymers, ionic-liquid-based composites, and other functional nanomaterials to enhance charge generation, retention, and energy conversion efficiency. The primary research objective is to improve output voltage, current, power density, and operational stability through interfacial engineering, dielectric modulation, and the formation of a microcapacitive network. Beyond energy harvesting, these nanogenerators are employed as self-powered sensors, human-machine interfaces, and wearable electronics. The generated electrical signals are also utilized for digital logic operations, tactile recognition, and real-time interactive systems.

Catalysts for water splitting: Research in solar photocatalysis aims to address environmental remediation and sustainable energy generation. The primary focus is on designing visible-light-active semiconductor photocatalysts and heterostructured nanocomposites based on graphitic carbon nitride (g-C_3N_4), ferrite oxides, metal sulfides, and related semiconductor materials. Strategic heterointerface engineering, band-gap modulation, defect engineering, and Z-scheme heterojunction construction are employed to improve light absorption, charge separation, and surface reaction kinetics. These materials are investigated for photocatalytic degradation of organic pollutants, photo-Fenton reactions, and solar-driven hydrogen (H_2) evolution through water splitting.

During the period under review, my research activities focused on developing advanced functional materials and devices for memristors and memtransistors, energy harvesting nanogenerators, and photocatalytic hydrogen evolution. Significant efforts were devoted to the synthesis, characterization, and device engineering of two-dimensional materials, metal oxides, organic semiconductors, and hybrid nanocomposites. I actively engaged in supervising PhD and post-doctoral students, including summer trainees, providing guidance on experimental design, materials characterization, data analysis, and scientific writing. In addition to research and supervision, I contributed to various academic activities, including manuscript reviewing, project proposal preparation, participation in scientific meetings, science outreach and collaboration with other research groups. I was also involved in regular teaching duties during this period and remained engaged in upgrading the teaching laboratories by adding new experiments. I was also involved in developmental activities, smooth functioning of some equipment under the technical cell, and administrative tasks entrusted to me from time to time.

Work 1: This work presents MoS_2nanosheets integrated within a PVDF-TrFE/EMIM-TFSI (PMSI) matrix to enhance charge retention by inducing a highly crystalline ß-phase (~85%). The EMIM-TFSI ionic liquid (IL) triggers electroactive ß-phase nucleation in pristine PVDF-TrFE (~61%). XPS binding energy shifts reveal strong electrostatic interactions between MoS2 and PVDF-TrFE. Blue-shifted FTIR spectra suggest H-bonding between PVDF-TrFE (-CH_2 groups) and TFSI- (-SO_2, oxygen atoms), facilitating effective ionic-electronic coupling. A vertical contact-separation Triboelectric nanogenerators (TENGs)

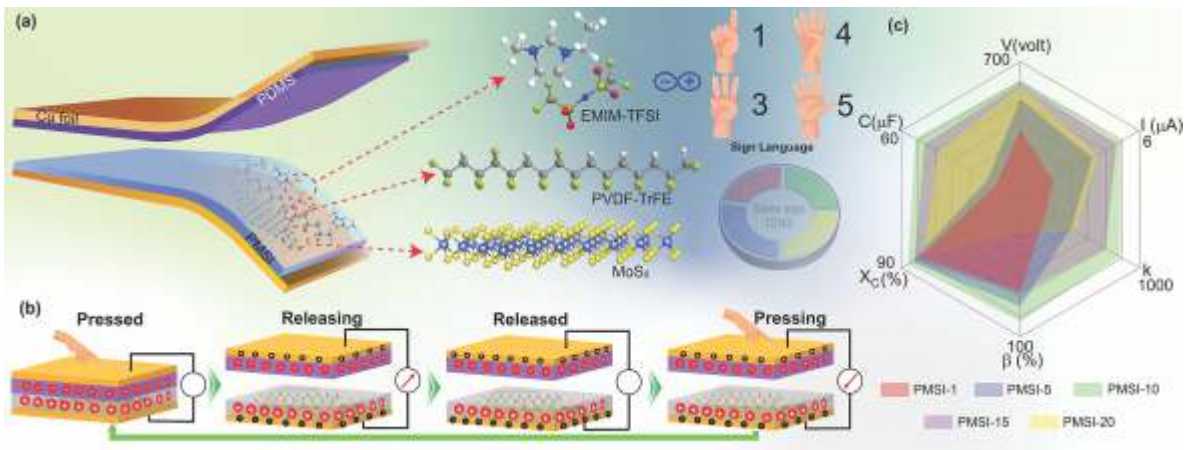


Figure 1: Structure and performance of the TENG device: (a) schematic illustration of the TENG device structure, (b) working mechanism, and (c) output performances of the TENG.

with optimized PMSI@PDMS frictional layers delivers a VOC of ~600 V, an ISC of ~5.1 μA, and a power density of ~4.8 W/m^2 . The TENG sustains stable output over 50,000 cycles, powers 120 LEDs, charges a capacitor to 8.3 V in 6 s, and operates as a self-powered interface for real-time digit recognition (0-9) and interactive gaming controllers (Simon Says) (Figure 1).

Work 2: This work highlights the solution-processed, two-terminal memristive devices using exfoliated 2D layered fillers. Highly crystalline 2H-MoTe2 single crystals were embedded within a polyvinyl alcohol (PVA) matrix to form a ~100 nm active switching layer. An optimized 3:1 (MoTe2:PVA) ratio demonstrates a uniform percolative conductive network that successfully mitigates non-uniform filament nucleation. Driven by redox-mediated silver filament dynamics, the device demonstrates stable bipolar resistive switching with minimal voltage variation over 125 consecutive cycles, robust data retention (>104 s), and endurance across 103 pulses. Beyond robust non-volatile memory behavior, the artificial synapse effectively emulates essential biological functions, including paired-pulse facilitation (PPF), spike-timing-dependent plasticity (STDP), spike-number-dependent plasticity (SNDP), long-term potentiation (LTP), and long-term depression (LTD), along side higher-order cognitive behaviors, such as Pavlovian associative learning and real-time Morse code recognition. Finally, the neuromorphic potential of the device was validated by integrating its experimental conductance states into Multilayer Perceptron (MLP) and Convolutional Neural Network (CNN) architectures, which successfully executed off-chip image classification on the CIFAR-10 dataset (Figure 2).

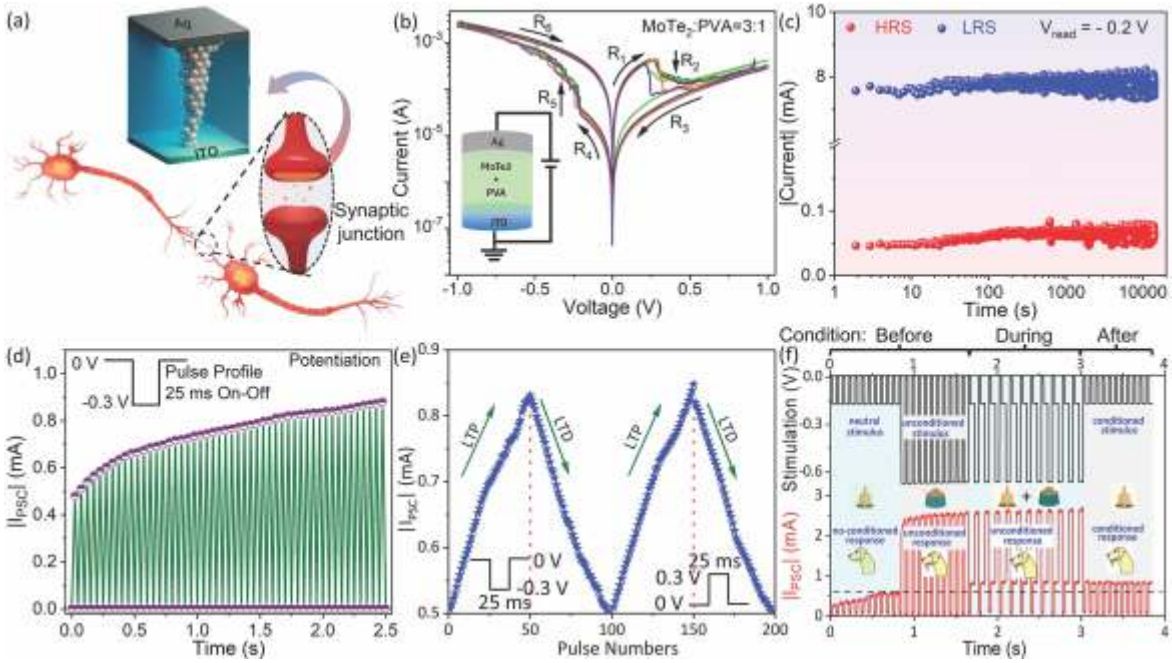


Figure 2: (a) Schematic representation of biological synapse and artificial synapse, (b) current vs voltage characteristics in MoTe2-based memristor, (c) retention study of the device at LRS and HRS at a read voltage -0.2V, (d) potentiation study for 50 pulses, (e) representation of mimicking long- term potentiation (LTP) and long-term depression (LTD) by the memristor, and (f) experimental demonstration of associative learning (Pavlov's dog experiment).

Plan of Future Work Including Project

Our future research will focus on developing high-performance 2D halide perovskites and optimising their structural and optoelectronic properties for advanced device integration. A key objective of this work will be to design an integrated, self-powered neuromorphic platform by coupling triboelectric nanogenerators (TENG) with resistive random-access memory (RRAM) devices, thereby enabling simultaneous energy harvesting and intelligent tactile sensing. Complementing this, the research will explore the synergistic integration of direct-current (DC) TENGs and piezoelectric pressure sensors to build highly sensitive, multi-modal self-powered active sensors. This multi-pronged approach aims to bridge the gap between advanced materials synthesis and next-generation smart systems for artificial skin and soft robotics.

Any other Relevant Information including social impact of research

1. Served as a peer reviewer and reviewed manuscripts across major scientific publishing, including ACS, RSC, Wiley, and Elsevier.



Barnali Ghosh (Saha)

WIDUSHI-A Scientist
Condensed Matter and Materials Physics
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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Saikat Mitra; Growth And Physical Properties Study Of Perovskite Halides; Thesis submitted; Dr. Avijit Chowdhury (Co-supervisor)

Publications

a) In journals

1. D. Banerjee, Snehamoyee Hazra, Subarna Datta, Jipin Peter, Raju K. Biswas, **Barnali Ghosh**, *The effect of Nd-doping on polymorphic behavior and dielectric properties of HfO_2: An experimental study and DFT calculation*, Journal of Alloys and Compounds, 1029, 180724, 2025
2. Subarna Datta, **Barnali Ghosh**, and Soumyadipta Pal, *Investigation of Size-Dependent Electrical Transport in Single Nanowire $La_{1-x}A_xMnO_3$ (x = 0.3 & 0.5 for A = Ca and x = 0.5 for A = Sr) Using Nanolithography-Based Device Fabrication*, IEEE Transactions on Nanotechnology, 24, 593-601, 2025
3. Parushottam Majhi, Anirban Goswami, Subarna Datta, Ravindra Singh Bisht, **Barnali Ghosh** and A K Raychaudhuri, *Phase coexistence and evolution of insulator-metal transition in $Nd_{1-x}La_xNiO_3$(0#£ x £#1) in presence of correlation and disorder*, Journal of Physics: Condensed Matter, 37, 325601, 2025
4. Saikat Mitra, Parushottam Majhi, Ganga S Kumar, Subarna Datta, Barun Ghosh, Arnab Bera, Avijit Chowdhury, Dipten Bhattacharya, **Barnali Ghosh**, *Multiple Ferroelectric Resonance in 2D Organic-Inorganic Halide Perovskite*, ACS Applied Electronic Materials, 7, 5485-5494, 2025
5. Saikat Mitra, Sayan Routh, **Barnali Ghosh**, Avijit Chowdhury, *Influence of Cation on X-Ray Detection Performance in Mixed-Halide 2D Ruddlesden-Popper Perovskite*, Physica Status Solidi A, 222, 2500439, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. International Conference on "Frontiers in Advanced Materials, Nanotechnology, Computing, Artificial Intelligence Based Devices" for Environment and Sustainable Development (FAMN-CAID-2026); Hybrid Mode, March 13-15, 2026; Motilal Nehru College, University of Delhi; 3 days
2. Invitation to be session chair at International Conference on Advanced Physics: Innovations for a Sustainable Future (IEMPHYS-26); 10 January, 2026; IEM Management House, Kolkata; 1 day

Membership of Learned Societies

1. Life member Indian Physics Association
2. Life member Indian Association for the Cultivation of Science
3. American Chemical Society (ACS)
4. Editor for the IIP (Iterative International Publishers)

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. WIDUSHI-A, DST/WIDUSHI-A/PM/2023/16(G) under WISE-KIRAN Division; DST, GOI; 5 years; PI

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. VECC, Kolkata; Sl. No. 1; National
2. IEM, Kolkata; Sl. No. 2; National
3. UGC-DAE-CSR, Kolkata; Sl. No. 3; National
4. CGCRI, Kolkata; Sl. No. 4; National

Areas of Research

- Synthesis of 2D organic-inorganic halide perovskite thin films on single crystalline substrates
- Synthesis of Single crystals of 2D halide perovskites
- Study of Photo-response property in 2D Perovskite Halide
- Study of impedance spectroscopy on 2D halide perovskites
- Growth and physical property study of perovskite lead halide
- Crystallographic structural evolution study in 2D lead halide perovskites using Synchrotron X-ray diffraction
- Study on Photo detector based device of perovskite halide films

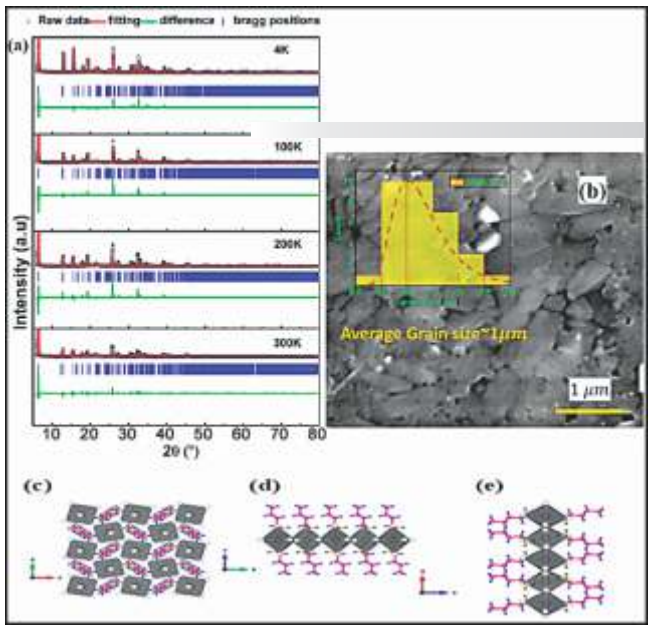


Figure 1: ***(a)*** *X-ray diffraction (XRD) patterns along with corresponding Rietveld refinement profiles of BAPB recorded at different temperature.*

1) Multiple Ferroelectric Resonance in 2D Organic – Inorganic Halide Perovskite

Dielectric properties of organic – inorganic 2D lead halide perovskite BA_2PbBr_4 (BA = butyl-ammonium, $C4H_9NH_3$) (BAPB)have been investigated as a function of temperature across 9 to 300K and the frequency range from 100kHz to 10MHz. The low-frequency region (100kHz to 1MHz) shows nearly constant loss while the high-frequency region (1 – 10 MHz) exhibits multiple ferroelectric resonance features. The resonance features could originate from electromechanical vibration of ferroelectric domain walls of various sizes with resonance frequency ~ 107rad/s and damping constant ~ 107 s – 1. The ferroelectricity of the compound is confirmed by the measurement of remanent polarization (~ 0.012 C/cm2 @10 V) at room temperature using the Positive-Up-Negative-Down protocol within the Sawyer – Tower circuit. Additional piezoelectric force microscopy has been done to confirm its ferroelectricity. As structural refinement reveals BAPB crystallizes in the non-polar pbca space group, the appearance of ferroelectricity in this material seems to be unusual, termed as improper ferroelectrics.

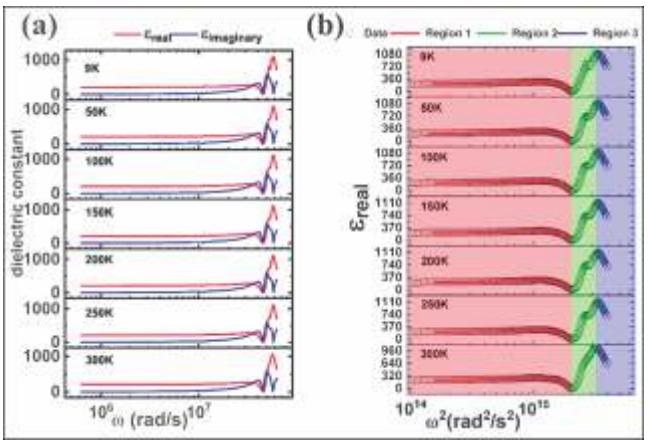


Figure 2: ***(a)*** *real and imaginary part of dielectric constant variation with frequency* w_1 ***(b)*** *resonance equation fit of real part of dielectric constant vs* w_2.

2) Direct & efficient detection of x-ray radiation using thermally evaporated 2D hybrid lead halide perovskite

This work demonstrates fast response and direct detection of x-ray radiation by thermally evaporated 2D hybrid halide perovskite (BA_2PbBr_4) (n-BA = Butylammonium = $C4H_9NH_3$) based film. A highly efficient pin-hole free/compact film (thickness ~ 1 m), via a controlled evaporation process, has been grown to fabricate solid-state x-ray radiation detector film (typical dimension ~ $1 \times 1 cm^2$) of 2D hybrid halide perovskite BA_2PbBr_4 (BAPB) material. Direct detection of x-rays is possible using this detector by simple electrical readout method,

where a change in resistance occurs while exposed to x-ray radiation at ambient temperature. The detector current increases when an x-ray impinges on it and exhibits the highest sensitivity ~ 1000 mC/ Gy/cm^2. The detector film shows fast response, exhibiting quick response-recovery time ~ ms towards x-ray. The detector film exhibits reasonably high dark resistivity ~ 10 W 10 cm and μgood mobility-lifetime (mt) product 3.308 x10^{-6} cm^2 /sec. The 2D hybrid halide perovskite (BA2PbBr4) based detector can sustain an effective high electric field ~5000Vcm^{-1}corresponding to 40V operational bias. It shows very good radiation resistant towards x-ray and retains its crystal structure, as confirmed from structural data under sustained x-ray exposure. It shows long-term stability or shelf life (~4months) and response is highly repeatable with less than 5% fluctuation, which is an important key performance metric for any radiation detector. This detector has good application potential in several areas like, medical imaging, security checking, etc.

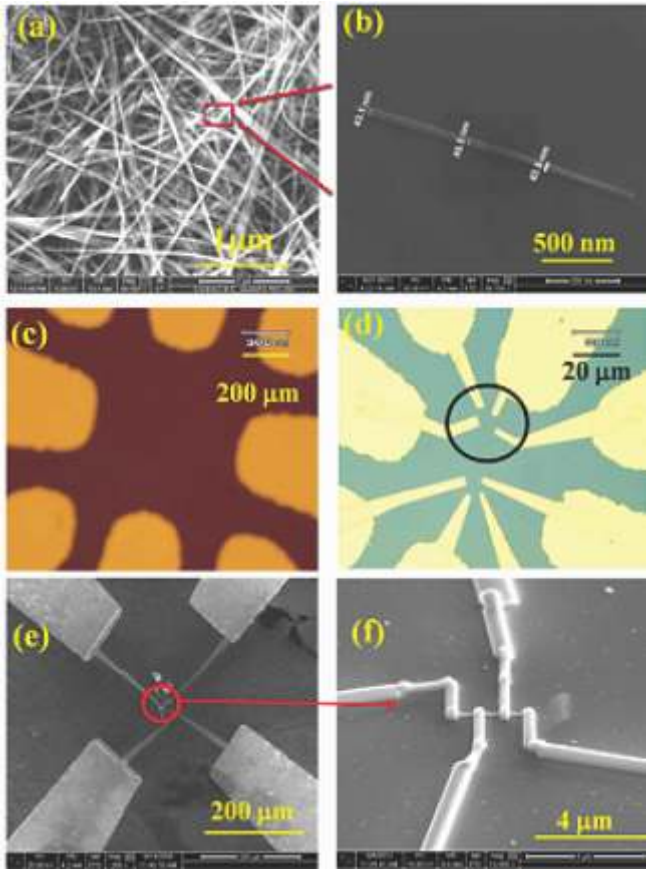


Figure 3: Making the single NW devices by photo, e-beam and ion lithography. (a) SEM image of ensemble of NWs. (b) SEM image of single NW (LSMO50) drop casted on SiO2/Si substrate. (d) Inter-connections using e-beam lithography to bring the electrodes closure. (e, f) SEM image of single NW connected to four probe using e beam and ion beam lithography and enlarged view of single nanowire device

3) Investigation of Size-Dependent Electrical Transport in perovskite oxide Single Nanowire Using Nanolithography-Based Device Fabrication

This work investigates the integration of single nanowire $La_{1-x}A_xMnO_3$ (x =0.3& 0.5 for A=Ca; x=0.5 for A =Sr) nano-devices via advanced nanolithography techniques for transport measurements. The comparative study of resistivity in bulk and nanowire forms highlights a significant size-dependent enhancement in transport behavior. Notably, the resistivity data for La1 – xAxMnO3 nanowires could not be fully explained by conventional models like Mott Variable Range Hopping (VRH) model, Efros- Shklovskii (ES) localization model, adiabatic small polaron hopping (ASPH) model etc. A hybrid model incorporating fluctuation-induced tunneling and disorder-induced localization more accurately captures the resistivity variation across temperature ranges. This refined approach successfully models transport behavior, particularly in the insulating regime, validating its applicability over previous models. The study establishes a robust methodology combining precise lithographic fabrication and improved theoretical modeling, paving the way for accurate transport characterization in complex oxide nanowires.

Plan of Future Work Including Project

- Synthesis of 2D organic-inorganic halide perovskite thin films on single crystalline substrates
- Synthesis of Single crystals of 2D halide perovskites
- Study of Photo-response property in 2D Perovskite Halide
- To understand the physical/ chemical process that leads to growth of 2D perovskite Halide thin films on different single crystalline substrates by intelligent combination of wet chemistry as well as thermal evaporation and thermal annealing and evolve a process of tuning band gap and excitonic binding energy by cation / anion engineering
- Engineering and stabilizing the lower dimensional (2D) perovskite halide material in ambient operating conditions and thus developing devices for multifunctional application potentials, like optical detector, and radiation detectors
- To work on possibility of patenting and translational research leading to development of prototypes and likely technology commercialization



Barun Ghosh

Assistant Professor
Condensed Matter and Materials Physics
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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Kapil Gope; Electronic structure of quantum materials; Under Progress
2. Sudip Ghorai; Lattice dynamics and qunatum geometry in materials; Under Progress

b) Post-Docs

1. Koyendrila Debnath; Density functional theory based materials modelling
2. Koushik Pradhan (Bridge Fellow); Density functional theory based computation
3. Shubham Purwar (Bridge Fellow); Magnetic topological materials

c) External Project Students / Summer Training

1. Kaustav Mukhopadhyay (Summer Project); Exploration of electronic structure and topology using computation; IIT Kanpur
2. Thansingh Jankawat (AdHOC JRF); Material specific modeling of novel responses in quantum materials; SNBNCBS, funded by ANRF funded Prime Minister Early Career Research Grant

Teaching

1. Autumn Semester; Project Research II (3rd Semester Project) (PHY 509); Integrated PhD; 2 students
2. Autumn Semester; Quantum Mechanics I (PHY 405); Integrated PhD; 15 students; Shared
3. Spring Semester; Mesoscopic Physics (PHY 528); Integrated PhD; 7 students; Shared
4. Spring Semester; Mesoscopic Physics (PHY 628); PhD; 7 students; Shared
5. Spring Semester; Project Research III (4th semester project) (PHY 502); Integrated PhD; 1 student
6. Spring Semester; Summer Research Project (PHY 494); Integrated PhD; 2 students

Publications

a) In journals

1. Sougata Mardanya, **Barun Ghosh**, Mengke Liu, Christopher Broyles, Junyeong Ahn, Kai Sun, Jennifer E. Hoffman, Sheng Ran, Arun Bansil, Su-Yang Xu, Sugata Chowdhury, *Layer-Dependent Antiferromagnetic Chern and Axion Insulating States in UOTe,* Advanced Science, e10247, https://doi.org/ 10.1002/advs.202510247Digital Object Identifier (DOI)
2. Rahul Mondal, Mukul Biswas, Koyendrila Debnath, Snehasish Das, Uday Narayan Maiti, Sanat Kumar Adhikari, **Barun Ghosh** and Avijit Chowdhury, *Spatially confined surface-terminated MXene nanosheets as a multifunctional platform for triboelectric sensing and logic gates*, Journal of Materials Chemistry C, 14, 3206-3218, 2026
3. Nabil Atlam, Swati Chaudhary, Arpit Raj, Matthew Matzelle, **Barun Ghosh**, Gregory A. Fiete and Arun Bansil, *Giant shift current in electrically tunable superlattice bilayer graphene*, Physical Review B, 112, 245409, 2025
4. Anup Pradhan Sakhya, Brenden R. Ortiz, Nabil Atlam, Matthew Matzelle, **Barun Ghosh**, Milo

Sprague, Mazharul Islam Mondal, Iftakhar Bin Elius, Nathan Valadez, Arun K. Kumay, David G. Mandrus, Jonathan D. Denlinger, Arun Bansil and Madhab Neupane, *Diverse electronic topography in a distorted kagome metal $LaTi_3Bi_4$*, Physical Review Materials, 9, L111201, 2025

5. Mazharul Islam Mondal, Anup Pradhan Sakhya, Milo Sprague, Brenden R. Ortiz, Matthew Matzelle, Arun K. Kumay, Avike Seal, **Barun Ghosh**, Arun Bansil et al., *Observation of multiple flat bands and Van Hove singularities in the distorted kagome metal $NdTi_3Bi_4$*, Physical Review B, 112, L121104, 2025

6. Saikat Mitra, Parushottam Majhi, Ganga S Kumar, Subarna Datta, **Barun Ghosh**, Arnab Bera, Avijit Chowdhury, Dipten Bhattacharya, Barnali Ghosh, *Multiple Ferroelectric Resonance in 2D Organic-Inorganic Halide Perovskite*, ACS Applied Electronic Materials, 7, 5485-5494, 2025

7. Jian-Xiang Qiu, **Barun Ghosh** et al., *Observation of the axion quasiparticle in 2D $MnBi_2Te_4$*, Nature, 641, 62-69, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Delivered an invited talk on "Quantum Geometry & Dynamical Axion in antiferromagnetic topological insulator MnBi2Te4" in AAPLI-PSIK conference at IISER Pune; 21/05/2025; IISER Pune; 25 minutes talk
2. Presented a 15mins talk titled "Material specific modeling of novel responses in quantum materials" at the S N Bose center and Bose Institute joint workshop; 13/10/2025; Bose Institute, Kolkata; 15 minutes talk
3. Presented an Invited talk at the "Conference on Complex Systems and Condensed Matter Physics" at DPS, IISER Kolkata; 02/03/2026; IISER Kolkata; 45 minutes talk
4. Presented an invited talk for 2dMAT 2026 conference at SNBNCBS on "Quantum Geometry & Dynamical Axion in antiferromagnetic topological insulator MnBi2Te4"; 16/03/2026; SNBNCBS; 30 minutes talk
5. Presented an invited talk on "4th International Conference on Materials Genome" at SRM University, AP; 21/02/2026; SRM University, AP; 25 minutes talk
6. Presented in the "Discussion Meeting on Quantum Materials and Devices" conference; 20/01/2026; SNBNCBS; 25 minutes talk

Administrative duties

1. Member of Computer Service Cell Working group
2. Member of the Placement & Alumni Cell
3. Attended the Rashtriya Karmayogi program on January 29th, 2026
4. Served as a judge for the poster presentation in Bose fest
5. Helped in designing the new faculty webpage

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Material-specific modelling of novel responses in quantum materials; ANRF; 3years; PI

Conference / Symposia / Schools organized

1. Hosted Dr. Amit Kumar Jash from Weizmann Institute of Science for an early career talk; 13/02/2026; Fermion; 1 hour
2. Served as a representative faculty member for organizing "IMPACT 2026 - The Alumni Meet" and moderated a session titled "Post PhD to Professor: Exploring Academia"; 29/01/2026; Silver Jubilee Hall; 1 day

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Dr. Avijit Chowdhury, SNBNCBS; Sl. No. 2; National
2. Dr. Sugata Chowdhury, Howard University, USA; Sl. No. 1; International
3. Prof. Madhab Neupane, University of Central Florida, USA ; Sl. No. 4, 5; International
4. Prof. Suyang Xu, Harvard University, USA; Sl. No. 7; International

Outreach program organized / participated

1. Delivered an 1hour 15 minutes enrichment lecture on Topology in C. K. Majumdar Memorial Summer Workshop in Physics 2025. Date: July 19, 2025, from 9:30 p.m. to 10:45 p.m.

2. Delivered a 1hour 30 minutes lecture in Victoria Institution (College) on Quantum Materials. Date: 13 December 2025, 12:00pm-1:30pm
3. Delivered a 20 minutes talk in Hindi in IASST, Guwahati on Quantum Materials in the "Third All India Scientific and Technical Official Language Seminar 2025"

Areas of Research

During this period, my research focused primarily on the theoretical and computational investigation of quantum materials, including topological and magnetic materials, kagome systems, two-dimensional heterostructures, and nonlinear optical phenomena. The work involved density-functional-theory calculations, electronic-structure modelling, topology, quantum geometry, magnetism, and the prediction and interpretation of experimentally measurable responses. Seven research papers were published in peer-reviewed journals during the year, with an average impact factor of 11.9. These publications received broad visibility, and my work accumulated 704 citations during the calendar year.

A major highlight was the observation of the dynamical axion quasiparticle in two-dimensional MnBi2Te4, published in Nature. I modelled the electronic structure, Berry curvature, and magnetoelectric response of the material and demonstrated how an out-of-phase antiferromagnetic magnon coherently modulates the Berry curvature and the axion angle. This theoretical framework was central to interpreting the experimentally observed 44 GHz oscillation as a dynamical axion quasiparticle.

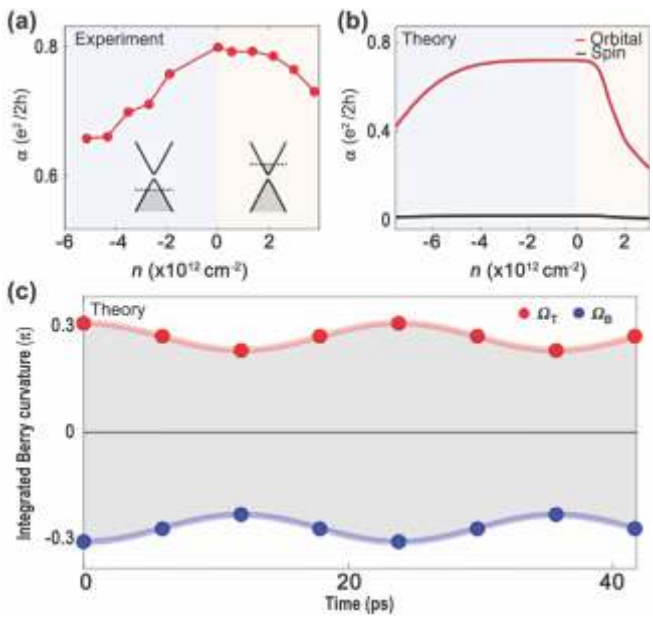


Fig. 1. (a-b) static magneto electric as a function of carrier density n for six-layer MnBi2Te4. For theory, the orbital and spin contributions are computed separately (the insets illustrate the doping of the Dirac bands). © the coherent precession of antiferromagnetic order potentially leads to an ultrafast control of Berry curvature. Taken from Nature 641, 62-69 (2025).

I also contributed to several experimental ARPES studies of kagome metals by performing density-functional-theory calculations and theoretically modelling the measured ARPES spectra. For the distorted kagome compounds NdTi3Bi4 and LaTi3Bi4, the calculations identified the orbital origin of the experimentally observed flat bands, Dirac-like dispersions, and multiple van Hove singularities. The modelling further clarified the effects of structural distortion, reduced rotational symmetry, and photon-polarization-dependent orbital selectivity on the measured electronic structures.

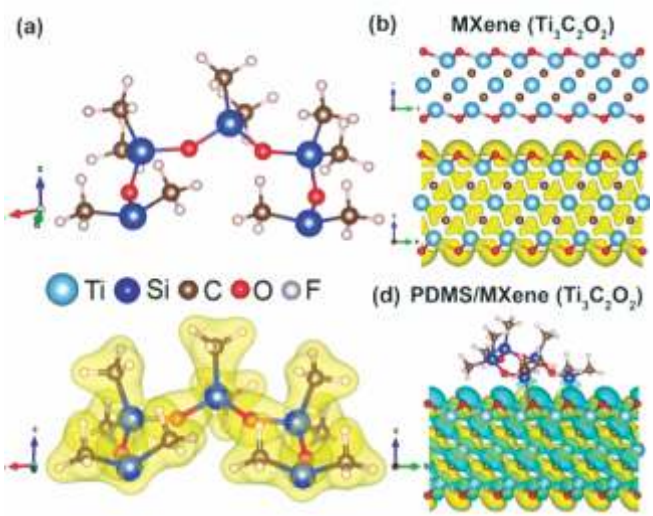


Fig. 2. (a) Molecular structure of polydimethylsiloxane (PDMS), (b) crystal structure of the 6 6 1 supercell and total charge density (bottom panel) of Ti3C2O2, and © charge density difference maps showing charge accumulation (yellow) and charge depletion (cyan) for PDMS-Ti3C2O2. Figure taken from Journal of Materials Chemistry C (2026), DOI: 10.1039/D5TC03448E.

In another experiment-theory collaborative study with Dr. Avijit Chowdhury from the department, we performed first-principles modelling of the interaction between surface-terminated Ti3C2X2 (X = O, F) MXene and PDMS. The calculations established the microscopic charge-transfer mechanism, electrostatic-potential redistribution, and modification of the electronic states at the MXene-PDMS interface. Another theory-experiment collaborative work with Prof. Barnali Ghosh on halide perovskite got published in ACS Applied Electronic Materials.

In a theory-driven first-principles collaborative study, we predicted layer-dependent antiferromagnetic topological phases in UOTe, including a compensated Chern-insulating bilayer and an axion-insulator-like trilayer, together with electrically and strain-controlled topological transitions. In another theory-led collaborative study on superlattice bilayer graphene, we modelled nonlinear optical responses and predicted a giant, electrically tunable shift current. This work was published in Physical Review B and it was selected as an Editors' Suggestion.

Plan of Future Work Including Project

During the coming year, we plan to continue and expand our theoretical and computational research on quantum materials, with particular emphasis on the prediction and microscopic understanding of novel electronic, magnetic, optical, and vibrational responses. The work will combine first-principles calculations, model-Hamiltonian approaches, Wannier-based electronic-structure methods, response-function calculations, and the development of numerical tools for material-specific modelling.

One major direction will be the computation of quantum weight using different but complementary formulations. We are currently comparing approaches based on the static structure factor, optical-conductivity sum rules, and direct calculations of the quantum metric. The objective is to establish their consistency, identify the role of dimensionality and electronic interactions, and understand how quantum weight evolves in layered, topological, and geometrically non-trivial systems.

We will also continue our work on chiral phonons, with emphasis on their microscopic origin, layer and surface dependence, angular momentum, and possible experimental signatures. Another ongoing project concerns the modelling of quantum geometry and nonlinear responses in superlattice and moiré-inspired systems, where band folding, hybridisation, and reduced symmetry can strongly enhance geometrical contributions to measurable observables. In parallel, we are developing phonon-based modelling strategies in collaboration with high energy physicists relevant to dark-matter detection.

Several experiment-theory collaborative projects are also in progress. These include the theoretical modelling of spiral magnetic order and its electronic consequences in EuAuAs, where we are studying the interplay between non-collinear magnetism, symmetry, band splitting, and possible transport responses. We are also investigating the magnetoresistance of Bi4I4 through electronic-structure and transport calculations, with the aim of interpreting experimental measurements and identifying the dominant microscopic mechanisms. Additional collaborative projects on topological, magnetic, and low-dimensional materials are expected to develop during the year.

Any other Relevant Information including social impact of research

1. Served as Referee of the journal PRB, PRL, Nature Physics, Advanced Physics Research



Bhaskar Mukherjee

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Guidance of Students/Post-Docs/Scientists

Teaching

1. Semester III; Advanced Quantum Mechanics & Applications PHY 505; 10 students; Shared with Prof. Manoranjan Kumar

Publications

a) In journals

1. **Bhaskar Mukherjee**, Christopher J. Turner, Marcin Szyniszewski and Arijeet Pal, *Symmetric Tensor Scars with Tunable Entanglement from Volume to Area Law*, Physical Review Letters, 136, 090401, 2026

Talks / Seminars Delivered in reputed conference / institutions

1. Symmetric Tensor Scars with tunable entanglement from volume to area law; 29/08/2025; RRI, Bengaluru; 1 hour
2. Symmetric Tensor Scars with tunable entanglement from volume to area law; 28/08/2025; IISc, Bengaluru; 1 hour
3. Symmetric Tensor Scars with tunable entanglement from volume to area law; 26/08/2025; ICTS, Bengaluru; 1.5 hour
4. Symmetric Tensor Scars with tunable entanglement from volume to area law; 14/08/2025; IIT Bombay; 1 hour
5. Symmetric Tensor Scars with tunable entanglement from volume to area law; 13/08/2025; TIFR, Mumbai; 1.5 hour
6. Symmetric Tensor Scars with tunable entanglement from volume to area law; 16/04/2025; Budapest Integrability Events (online); 1 hour
7. Two pedagogical lectures on "A brief overview of quantum many-body scars" and a seminar "Symmetric Tensor Scars with tunable entanglement from volume to area law"; 07/04/2025-10/04/2025; IIT Kanpur; 4 hour

Administrative duties

1. I have organized journal club meeting in the CMMP division at SNBNCBS, Kolkata on regular basis.
2. I have been in the interview panel of IphD entrance test at SNBNCBS, Kolkata (2025).
3. I have hosted academic visitors for Early Career Talks.

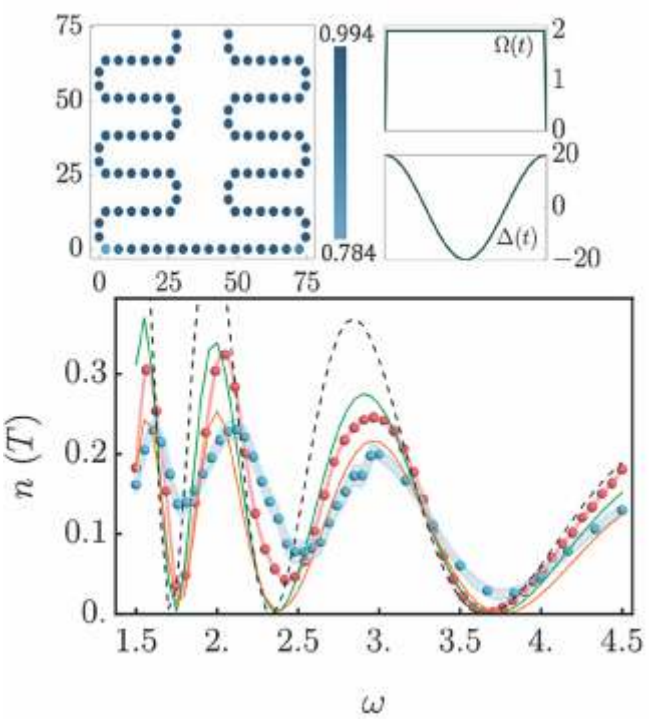
Conference / Symposia / Schools organized

1. "Physics of Non-equilibrium Systems" https://newweb.bose.res.in/Conferences/CQNS-2025/; 22/05/2025-23/05/2025; SNBNCBS, Kolkata; 2 days

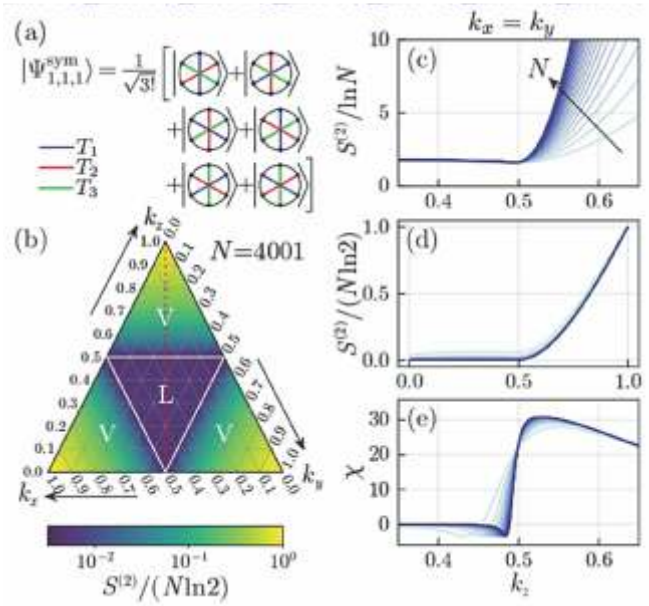
Areas of Research

Theoretical condensed matter physics, Quantum non-equilibrium dynamics, ETH violation, many-body entanglement etc.

Temporal quantum interference in many-body programmable atom arrays (Madhumita Sarkar, Ben Zindorf, **Bhaskar Mukherjee**, Sougato Bose, Roopayan Ghosh, arXiv:2511.09633): Quantum superposition famously manifests as spatial interference, epitomized by the double-slit experiment. Its less explored temporal analogue, St\"{u}ckelberg interference, arises in driven systems where phases accumulated along distinct time-domain pathways recombine. Extending this phenomenon to large interacting systems introduces a new complexity as delicate phase relationships are disrupted by many-body interactions. Here we experimentally achieve controllable vacuum-state freezing in programmable Rydberg arrays of up to 100 atoms, with visibility exceeding 70% and excitation suppression to 1% despite periodic driving that would typically induce heating.



Symmetric Tensor Scars with Tunable Entanglement from volume to area law (**Bhaskar Mukherjee**, C J Turner, Marcin Szyniszewski, Arijeet Pal, Phys. Rev. Lett 136, 090401 (2026)): Teleportation of quantum information over long distances requires robust entanglement on the macroscopic scale. Using a symmetric superposition of the antipodal triplet states, we construct polynomially many exact zero-energy eigenstates for a class of non-integrable spin-1/2 Hamiltonians with two-body interactions. These states exhibit non-thermal correlations, hence, are genuine quantum many-body scars. By tuning the distribution of triplets we induce extensive, logarithmic, or area-law entanglement, and can observe a second-order entanglement phase transition.



Plan of Future Work Including Project

I will continue to work on quantum non-equilibrium dynamics & many-body physics particularly on new ways to violate ETH in clean non-integrable systems.



Kalyan Mandal

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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Susanta Ghosh; Topological quantum materials; Awarded; shared with Thirupathaiah Setti
2. Soham Saha; Photoelectrochemical water-splitting; Thesis submitted
3. Ishita Jana; Multiferroic materials; Under progress
4. Sridhar Mohanty; Magnetocaloric effect; Under progress
5. Saurav Sarkar; Ferrite nanomaterials; Under progress

Teaching

1. 2nd semester; PHY 408 Electronics and instrumentation; Integrated Ph.D.; 14 students; shared with Avijit Chaudhuri
2. 2nd semester; PHY 492 Basic Laboratory II; Integrated Ph.D.; 14 students; shared with Thirupathaiah Setti
3. 4th semester; PHY 592 Methods of Experimental Physics; Integrated Ph.D.; 10 students; With other five teachers

Publications

a) In journals

1. Sourav Sarkar, Anupam Gorai, **Kalyan Mandal**, *A Ferromagnetic Resonance Study of $MgFe_2O_4$ Nanoparticles as Efficient Microwave Absorber for Different Frequency Bands*, ACS Applied Nano Materials, 9, 756-766, 2026
2. Arka Chaudhuri, Anupam Gorai and **Kalyan Mandal**, *Fabrication of NiS nanoparticles by Microwave technique and its effectiveness in electromagnetic interference shielding*, Physica Scripta, 100, 115917, 2025
3. Mily Kundu, Sourav Sarkar, **Kalyan Mandal**, *Investigation of magnetocaloric properties and critical phenomenon of the intermetallic compound DyCoAl across magnetic transition*, Journal of Magnetism and Magnetic Materials, 629, 173290, 2025
4. Shubhadip Moulick, Dipanjan Maity, Gaurab Samanta, **Kalyan Mandal** and Atindra Nath Pal, *Charge noise in low Schottky barrier multilayer tellurium field-effect transistors*, Nanoscale, 17, 2259-2268, 2025

b) Other Publications

i) Conference proceedings / Reports / Monographs

1. S. Sarkar, P.Saha and K. Mandal, "Geometry mediated interconvertibility between spin glass and superparamagnetism relaxation in ZnFe2O4 nanostructures", Proceedings of the 5th International Conference on Condensed Matter & Applied Physics (ICC 2025) jointly organized by the Condensed Matter Research Society and Bikaner Technical University, Bikaner, India

Membership of Learned Societies

1. Materials Research Society of India
2. Magnetic Society of India
3. Indian Society for Non-destructive Testing

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Dr. Arka Chaudhuri, Gour Mahavidyalaya, Malda, West Bengal, India; Sl. No. 2; National

Areas of Research

Magnetism and magnetic materials, Nanomaterials, Energy materials

I. Ferroelectric manipulation of space-charge layer in $Ga_{0.6}Fe_{1.4}O_3$ photoanode for enhanced photoelectrochemical water splitting: This work investigates the potential of multiferroic $Ga_{0.6}Fe_{1.4}O_3$ thin films as photoanodes for water oxidation, highlighting the crucial role of their ferroelectric properties. The as-prepared unpoled $Ga_{0.6}Fe_{1.4}O_3$ exhibited a photocurrent density of 11.8 A·cm-2, consistent with previously reported values. This specific sample is also well-known for its significant multiferroic characteristics. Basic characterization techniques, including XRD, SEM, TEM, and XPS, confirmed the formation of $Ga_{0.6}Fe_{1.4}O_3$ in the desired phase, despite the presence of defects attributed to the growth mechanism. Notably, the photoelectrochemical (PEC) response was influenced by electric field poling, showing a marked enhancement after negative, or downward poling. This behavior proved to be reversible, as the photocurrent decreased with positive poling. PFM and hysteresis data provided evidence for polarization domain switching. Mott-Schottky studies indicated that these polarization shifts modulate the depletion region at the semiconductor-electrolyte junction, changing the flat-band potential by 80 mV between up and down, depending on the direction of poling, thereby enhancing or reducing charge transfer and separation. Additionally, UV-Vis spectroscopy revealed a band gap of 2.59 eV, demonstrating the material's ability to harvest a substantial portion of the solar spectrum. This mechanism paves the way for electric field-controlled PEC water splitting under solar light.

II. Enhanced Exchange bias in Mn-rich $Ni_{36}Mn_{44+x}Ti_{20-x}$ Heusler alloys: We observed a significant exchange bias (EB) of 5.2 KOe in the bulk polycrystalline $Ni_{36}Mn_{44+x}Ti_{20-x}$ ($x = 0, 2, 4$) alloy where ferromagnetic (FM) and antiferromagnetic (AFM) phases coexists in the martensitic state. Coercivity and exchange bias field are found to be very temperature-dependent, which is highly related to the presence of unidirectional anisotropy in the FM/AFM region in our system. The Mn-Ti content ratio also affects the EB field. The possible coexistence of antiferromagnetic and ferromagnetic phase exchange interactions in the studied system was further substantiated by the investigatation of the magnetic memory effect and isothermal magnetic relaxation processes, where the absence of spin glass state was substantiated. After field cooling in a 2T magnetic field, the $x = 2$ sample exhibits the greatest value of 5.2 KOe at 2K, which is about 1.5 times the highest value ever reported in any Heusler alloy system. The intrinsic character of the observed EB behavior is confirmed by the analysis of a well-established training effect. This finding will pave the path for the development of EB materials in all-d metal Heusler alloy system.

Plan of Future Work Including Project

Single negative permittivity metamaterial is a scientifically rich avenue due to its tremendous application in several arena of materials research including novel superlens, antenna and filter design, band-gap materials, invisibility cloaks. Previously, epsilon negative (ENG) behaviour was achieved in multi-phase composites with the addition of conducting metal fillers. We have a plan to explore ENG in a single phase material with different morphology. ENG behaviour can be observed in nano-hollow spheres (NHS) because of the inversion of dominant polarization within the hollow cavity of NHS.

Any other Relevant Information including social impact of research

1. "Best Oral Presentation" award to the Ph.D. student Saurav Sarkar in the 5th International Conference on Condensed Matter & Applied Physics (ICC 2025) jointly organized by the Condensed Matter Research Society and Bikaner Technical University, Bikaner, India
2. Ph.D. student Saurav Sarkar was selected with funding for participating in the IEEE Magnetic Society Summer School-2025 organized by the University of California, San Diego, USA



Manoranjan Kumar

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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Sayan Ghosh; Exploring the Quantum & Thermal Fluctuations in Frustrated Strongly Correlated Low Dimensional Systems; Under Progress
2. Sourabh Saha; Study of exotic phases in multi-band correlated systems; Under Progress
3. Anutosh Biswas; Quantum Spin Liquid in Low Dimensional System and Quantum computation; Under Progress
4. Ayan Jana; Studying the electronic properties of materials using Density Functional Theory (DFT); Under Progress
5. Md. Sanowaz Molla; Application of Quantum Computing in magnetic systems; Under Progress

b) Post-Docs

1. Dibyajyoti Saikia; Topological properties in Condensed Matter Physics

c) External Project Students / Summer Training

1. Anirbit Mulo; Thermodynamics of 2D Classical XXZ model Hamiltonian; IIT Dhanbad
2. Shreya Barman; Quantum Circuits Meet Many-Body Physics: VQE vs ED for the Heisenberg Model; NIT Rourkela

Teaching

1. Autumn Semester; Advanced Quantum Mechanics and Applications; Integrated PhD; 10 students; Shared
2. Spring Semester; Quantum computing and algorithms with IBM India; PhD; 10 students; Shared

Publications

a) In journals

1. Anyesh Saraswati, Jyotirmoy Sau, Vera Misheneva, Rui Lou, Sudipta Chatterjee, Sandip Kumar Kuila, Bibhas Ghanta, Anup Kumar Bera, Partha Pratim Jana, Alexander Fedorov, Setti Thirupathaiah, **Manoranjan Kumar** and Nitesh Kumar, *Accessing quasiflat f bands to harvest large Berry curvature in NdGaSi*, Physical Review Materials, 10, L031202, 2026
2. Sourabh Saha, Jeroen van den Brink, **Manoranjan Kumar** and Satoshi Nishimoto, *Polarization-Driven Charge Frustration and Emergent Phases in the One-Dimensional Extended Hubbard Model*, Physical Review Letters, 135, 206504, 2025
3. Manodip Routh, Anutosh Biswas and **Manoranjan Kumar**, *Emergent quasiparticles of the spin – 1 trimer chain*, Physical Review B, 112, 094436, 2025
4. Manodip Routh, Sayan Ghosh and **Manoranjan Kumar**, *Exploring quantum phases in frustrated spin-1/2 chain and ladders: a detailed review*, Journal of Physics: Condensed Matter, 37, 403001, 2025
5. Sambunath Das, Dayasindhu Dey, **Manoranjan Kumar**, S. Ramasesha, *Quadrupolar phases and*

plateau states in skewed ladders, Journal of Magnetism and Magnetic Materials, 629, 173262, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Invited speaker in a conference 'Conference on 2D Material 2026, SNBNCBS'; 16-17 March 2026; SNBNCBS; 2 days
2. Invited speaker in a conference 'National Conference on electronic Structures 2025, IISER Bhopal'; November 2025; IISER Bhopal; 3 days
3. Invited speaker in a conference 'Physics of Strongly Correlated Electron Systems 2025, IIT BHU'; 12-14 September 2025; IIT BHU; 3 days

Administrative duties

1. Integrate PhD coordinator (Dean of IPhD program): This includes all the responsibility of the IPhD program (all the course works come under this programme)
2. Chairman of Param Rudra supercomputing facility at S N Bose Centre Kolkata: This facility has more than 200 users and responsibility includes the maintenance and taking care of all policy matters
3. Head of the Department: 'Condensed matter and Material Physics': largest department of the Institute (since 2024)
4. Chairman of computer cell advisory committee: Duty includes advisor in all the of decision making for the institutes' computer related issues and long-term plan
5. JEST coordinator of S. N. Bose National Centre for Basic Sciences (Responsibility of conducting examinations and involved in policy making since 2017)

Awards, Recognitions, if any

1. Editorial Board member of Journal of Physics: Condensed Matter

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Exploration of non-trivial spin textures in centro-symmetric metallic magnets and their attributes in electric transport; ANRF; 3 years; Co-PI
2. Application of quantum computing in quantum many body systems; IBM; 1 year; PI

Conference / Symposia / Schools organized

1. One of the conveners of International conference on 'Quantum Materials: Fundamentals to Functionalities' (QM:F2f) 2026; 26/03/2026; IIT Goa; 3 days
2. One of the co-organizers in International Conference on 'Quantum Materials and Emerging Concepts' (QMEC) 2025; 22-24 December 2025; IISER Bhopal; 3 days
3. One of the conveners of International conference SIMs at IIT KGP Kolkata campus (2025); 29 November – 1 December 2025; IIT KGP Kolkata campus; 3 days

Scientific collaborations with other national / international institutions

1. Prof. Arvind Kumar Yogi, UGC-DAE Consortium, Indore; Phys. Rev. B 113, 184416, 2026; National
2. Prof. Nitesh Kumar, SNBNCBS, Kolkata; Phys. Rev. B 113, 144409; Phys. Rev. Materials 10, L031202; National
3. Prof. Setti Thirupathaiah, SNBNCBS, Kolkata; Phys. Rev. Materials 10, L031202; National
4. Prof. Satoshi Nishimoto, IFW Dresden, Germany; Phys. Rev. Letters 135, 206504; International
5. Prof. Jeroen van den Brink, IFW Dresden, Germany; Phys. Rev. Letters 135, 206504; International
6. Prof. S Ramasesha, IISc, Bangalore; Journal of Magnetism and Magnetic Materials 629 (2025) 173262; National

Areas of Research

Development of advanced numerical methods for quantum many-body problems (DMRG, exact diagonalization, QMC)

Quantum many-body effects and frustration-driven emergent exotic phases: chiral, multipolar, bond-order, magnon condensation

Low-temperature physics and thermodynamics of correlated systems

Modeling of electronic properties of materials; transport in topological materials

Quantum computing algorithms for many-body physics

1. Strongly Correlated Electron Systems- Investigating the behavior of electrons in low-dimensional systems where interactions dominate over kinetic energy.
2. Quantum Magnetism- Exploring various magnetic ground states and excitations in spin chains, ladders, and frustrated lattices.
3. Frustrated Spin Systems- Studying systems where competing interactions prevent conventional magnetic order, leading to exotic quantum phases.
4. Quantum Phase Transitions- Understanding transitions between different quantum phases at zero temperature driven by quantum fluctuations.
5. Topological Phases and Edge States- Characterizing phases of matter that are defined by global topological properties rather than local order parameters.
6. Spin-Orbit Coupling in Low Dimensions- Analyzing the effects of spin-orbit interaction on the electronic and magnetic properties of 1D and 2D systems.
7. Numerical Techniques in Quantum Many-Body Physics- Applying advanced methods like DMRG (Density Matrix Renormalization Group), exact diagonalization, and tensor network techniques to simulate quantum systems.
8. Entanglement and Quantum Information in Condensed Matter- Using entanglement entropy and related measures to study quantum criticality and correlations in many-body systems.
9. Quantum computation- Solving the many body system using the quantum computation.

Plan of Future Work Including Project

We investigate a trimer ladder system exhibiting a nearly flat middle band and explore the effects of single-hole doping away from half filling, focusing on the formation of spin-polaron excitations. The interplay of flat-band physics and strong correlations is expected to yield unconventional quasiparticle behavior. In parallel, we study optical excitations in exotic phases of a one-dimensional extended Hubbard model with charge-dipole interactions, where rich correlated states emerge. Together, these studies aim to provide a unified understanding of quasiparticle dynamics and optical responses in strongly correlated low-dimensional systems using numerical (ED/DMRG) and analytical approaches.

Quantum Algorithms- Extending the Quantum Computing Basis Adaptive Algorithm to the new Systems along with developing the new algorithm.

Unified Pseudospin-½ Model for $TmVO_4$ & Elastocaloric Cooling- I will extend our pseudospin-½ framework to model the interplay of ferroquadrupolar (electronic) and nuclear orders in $TmVO_4$ under B^2g shear strain, transverse magnetic fields, and hyperfine coupling. By tracking entropy changes across quadrupolar ($T \sim 4$ K) and nuclear ($T \sim 0.3$ K) transitions, I aim to characterize a two-step elastocaloric effect, identifying $TmVO_4$ as a potential low-temperature solid-state refrigerant.

Kitaev-Heisenberg Model with Dzyaloshinskii-Moriya Interaction (DMI)- In realistic 2D materials, Kitaev and Heisenberg interactions coexist with DMI. I will study the Kitaev-Heisenberg model augmented with DMI on two-leg ladders and honeycomb lattices. By analyzing how DMI modifies the ground-state phase diagram, I aim to assess its effect on stabilizing or destabilizing the Kitaev spin liquid (KSL) and identify new emergent phases arising from the interplay of bond-directional anisotropy and chiral interactions.

In the future, we will focus on investigating magnetism and various topological behaviors in materials. Recently, altermagnetism has gained significant attention due to its potential applications in spintronics. We also intend to deeply investigate this phenomenon to understand its theoretical foundations, as well as its practical utility. Specifically, we aim to explore how to tune its properties from a theoretical perspective to facilitate the design of new instruments.



Nitesh Kumar

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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Gourab Hazra; Magnetic textures in centrosymmetric magnets; Under Progress
2. Banik Rai; Anomalous transport of quasi-two dimensional ferromagnets; Under Progress
3. Anyesh Saraswati; Single crystal growth and transport of noncentrosymmetric antiferromagnetic Weyl semimetals; Under Progress
4. Modhumita Sariket; Electrical transport of quantum materials under high pressure; Under Progress
5. Kakan Deb; Magnetism and transport properties of kagome and distorted kagome compounds; Under Progress

b) Post-Docs

1. Sourav Kanthal; Single crystal growth, neutron diffraction study of skyrmionic compounds with centrosymmetry
2. Sakila Khatun; Electrochemical hydrogen generation from high mobility and high stability quantum materials

c) External Project Students / Summer Training

1. Rudra Saha; Synthesis and characterization of altermagnetic candidate $Cr_{1-x}Ti_xSb$; Indian Association for the Cultivation of Science

Teaching

1. Autumn Semester; PHY 503, PHY 603 (Condensed Matter Physics); Integrated PhD; 25 students; shared with Dr. Saquib Shamim
2. Spring Semester; PHY 592; Integrated PhD; 10 students; shared with 5 other co-instructors

Publications

a) In journals

1. Lipika, Shobha Singh, Anyesh Saraswati, Vikas Chahar, Yan Sun, Pascal Manuel, Devashibhai Adroja, Walter Schnelle, **Nitesh Kumar**, Jhuma Sannigrahi and Kaustuv Manna, *Complex spin dynamics induced metamagnetic phase transitions in Dirac semimetal EuAuBi*, Physical Review B, 113, 104406, 2026
2. Anyesh Saraswati, Jyotirmoy Sau, Vera Misheneva, Rui Lou, Sudipta Chatterjee, Sandip Kumar Kuila, Bibhas Ghanta, Anup Kumar Bera, Partha Pratim Jana, Alexander Fedorov, Setti Thirupathaiah, Manoranjan Kumar and **Nitesh Kumar**, *Accessing quasiflat f bands to harvest large Berry curvature in NdGaSi*, Physical Review Materials, 10, L031202, 2026
3. Rafiqul Alam, Debasis Dutta, Modhumita Sariket, **Nitesh Kumar**, Amit Agarwal, Atindra Nath Pal, *Nonlinear and Planar Hall Effects as Probes of Band Geometry in 1T-TaS_2 Driven by CDW Transition*, Advanced Functional Materials, 35, 2418643, 2025
4. Rahul Pan, Anyesh Saraswati, Amit Mondal, Pujalin Biswal, Debakanta Samal, **Nitesh Kumar** and Partha Pratim Jana, *Unusual magnetic and transport properties of heavily disordered Mn–Zn–M (M = Ga and Sn) alloys with a -Mn-type chiral structure*, Dalton Transactions, 54, 14469-14479, 2025

5. Banik Rai, Krishnendu Patra, Satyabrata Bera, Sk Kalimuddin, Kakan Deb, Mintu Mondal, Priya Mahadevan, **Nitesh Kumar**, *Direction-Dependent Conduction Polarity in Altermagnetic CrSb*, Advanced Science, 12, 2502226, 2025
6. Banik Rai and **Nitesh Kumar**, *Cusplike feature in the Hall resistivity of a uniaxial ferromagnet in nonorthogonal Hall geometry*, Physical Review B, 112, 035110, 2025
7. S. M. Hossain, B. Rai, P. R. Baral, O. Zaharko, **Nitesh Kumar**, A. K. Bera and M. Majumder, *Evidence for magnetoelastic coupling and chiral magnetic ground state in quasi-van der Waals trigonal* $Cr_{1.22}Te_2$, Physical Review B, 112, 024439, 2025
8. Anyesh Saraswati, Sudipta Chatterjee, **Nitesh Kumar**, *Single Crystal Growth and Magnetotransport Properties of 4f Electron Antiferromagnet SmGaSi*, Physica Status Solidi Rapid Research Letters, 20, e202500350, 2026
9. Ritamay Bhunia, Rajesh Jana, Anyesh Saraswati, Kinsuk Giri, **Nitesh Kumar** & Avijit Chowdhury, *$MoTe_2$-based synaptic-bridge memristor for brain-inspired computing: neuromorphic performance evaluation using MLP-CNN frameworks*, npj 2d materials and applications, https://doi.org/10.1038/ s41699-026-00682-5

Talks / Seminars Delivered in reputed conference / institutions

1. Physics of Strongly Correlated Electron Systems (PSCES) 2025, IIT BHU; Title: Role of quasi-flat f bands in the electrical transport of NdGaSi; 12/09/2025; IIT BHU
2. International Conference on Chemistry and Physics of Solids (ChemPhySol-2025); Title: Participation of quasi-localized f-electrons in the electrical transport in NdGaSi; 28/11/2025; IISER Berhampur
3. Hindi Workshop, Guwahati; Title: Discovery of direction dependent conduction polarity in an altermagnetic candidate CrSb; 13/11/2025; IASST Guwahati
4. Discussion Meeting on Quantum Materials and Devices; Title: Signature of localized f-bands mediated transport in NdGaSi; 20/01/2026; SNBNCBS
5. Conference on 2D Materials (2dMAT 2026); Title: On the magnetism and magnetotransport properties of ferromagnetic kagome compound $MgMn_6Sn_6$; 16/03/2026; SNBNCBS

Administrative duties

1. Conferences, Workshops and Extension Programme: To review the details of the proposal submitted to organize conferences, workshops and schools
2. Disposal of hazardous chemicals: Efficient disposal of hazardous and non-hazardous wastes generated in the Centre
3. Hindi Cell: To organize Hindi-workshops and other events to increase the use of Hindi language in the administrative and academic spheres
4. Creche Management Committee: To maintain and the oversee the smooth running of Creche facility

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Novel quantum states in quasi-one dimensional materials; Max Planck Society, Germany; 2022-2027; PI
2. Exploration of non-trivial spin textures in centrosymmetric metallic magnets and their attributes in electrical transport; ANRF; 2025-2028; PI

Conference / Symposia / Schools organized

1. Conference: Disorder and Size Effect in Quantum Materials; 04/02/2026; SNBNCBS; 2 days (4-5th February 2026)
2. International Conference on Quantum Materials: Fundamentals to Functionalities (QM: F2f 2026); 26/03/2026; Bambolim Beach Resort, Goa; 3 days (26-28th March 2026)

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Dr. Partha Pratim Jana, IIT Kharagpur; Sl. No. 2, 9; National

2. Dr. Mintu Mondal, IACS, Kolkata; Sl. No. 3; National
3. Dr. Mayukh Majumder, Shiv Nadar University, Delhi NCR; Sl. No. 5; National
4. Dr. Oksana Zaharko, Paul Scherrer Institute, Switzerland; Sl. No. 5; International
5. Dr. Kaustuv Manna, IIT Delhi; Sl. No. 8; National
6. Dr. Anup Kumar Bera, BAARC; Sl. No. 9; National
7. Dr. Alexander Fedorov, IFW Dresden; Sl. No. 9; International

Outreach program organized / participated

1. Gave an outreach seminar at "Recent Advances in Physical and Chemical Sciences" organized in Silchar, Assam for college students during 11-13th March 2026. The title of the seminar was "Making Crystals in Lab"

Areas of Research

Electrocatalytic hydrogen generation by quantum materials as catalysts: Many topological semimetals magnetic or nonmagnetic have excellent carrier mobility at room temperature. If their chemical potential is ideally placed with respect to the H+ reduction potential, they can be good candidates for water splitting. We test many quantum materials for their activity for electrocatalytic hydrogen generation. We have found excellent performance by a ferromagnetic intercalated van de Waals compound Cr_5Te_8 which is very stable even after prolonged testing.

Rare earth based topological semimetallic systems: We are trying to understand the effect of the disorder in the non-rare-earth crystallographic sites on the topological properties, magnetism, position of flat bands. The whole this is also being view through the lens of crystal electric field (CEF). A representative material is NdGaSi.

Single crystal growth of altermagnetic systems with magnetic point groups that allow anomalous Hall effect (AHE) as well as those which do not allow AHE. We are considering prystine compounds as well as doped system where the doping can help in orienting Neel vector direction to allow AHE. The representative altermagnetic system which we are studying is CrSb.

Tuning itinerant ferromagnets with hydrostatic pressure as well as chemical composition to attain quantum critical point. Many itinerant ferromagnets upon tuning shows decrease in ferromagnetic transition temperature but does not decrease till 0K to attain quantum criticality by avoiding such criticality to give new phases such as antiferromagnetism and in some cases even superconductivity. Our quest is to attain quantum criticality or emergent phases by tuning pressure and chemical composition of carefully selected metallic ferromagnets. A representative compound of our interest is $LaCrGe_3$.

Magnetic and nonmagnetic kagome metals for flat band and electron correlation: Kagome lattice is a line-graph lattice and therefore can give rise to flat band and several interesting phenomena such as charge density order and unconventional superconductivity. Our aim is to identify materials and modify the chemical potential chemical by substitution to attain move the flat band to the Fermi energy. A representative kagome compound we are investigating is $MgMn_6Sn_6$.

In our research group, we have been investigating the interplay between magnetism, Berry curvature, spin-orbit coupling, and topological transport in correlated quantum materials. Our studies focused on rare-earth and transition-metal intermetallic compounds where magnetic ordering and electronic topology generate unconventional transport phenomena such as anomalous Hall effects, topological Hall effects, and weak antilocalization.

The study on $SmMn_2Ge_2$ (Fig. 1) examines the origin of a cusplike anomaly observed in Hall resistivity under nonorthogonal Hall geometry. Such features are often interpreted as signatures of the topological Hall effect caused by noncoplanar spin textures. However, the authors show that the anomaly originates from the anomalous Hall effect associated with the orthogonal component of magnetization when the magnetic field is tilted away from the easy axis. By combining Hall measurements, torque magnetometry, and magnetization studies, they demonstrate that the Hall response scales directly with the out-of-plane magnetization component. The work emphasizes the importance of carefully distinguishing true topological transport effects from geometrical and anisotropic magnetic contributions.

In trigonal $Cr^{1.22}Te^2$, a quasi-two-dimensional van der Waals ferromagnet, detailed structural and magnetic investigations reveal strong magnetoelastic coupling and a chiral magnetic ground state. Magnetization, Raman spectroscopy, and neutron diffraction measurements

show successive magnetic transitions and strong magnetic anisotropy. The neutron diffraction results uncover a noncoplanar umbrellalike spin configuration with finite spin chirality arising from canted Cr moments. This spin chirality generates real-space Berry curvature and explains the observed topological Hall effect. The geometrically frustrated triangular and kagome-like arrangement of Cr atoms further stabilizes complex magnetic textures, making $Cr^{1}.^{22}Te^{2}$ an important platform for studying skyrmions and topological spin phenomena.

Work on SmGaSi explores quantum interference effects in a rare-earth antiferromagnet. The compound crystallizes in a centrosymmetric tetragonal structure and undergoes antiferromagnetic ordering near 11 K followed by a spin-reorientation transition at lower temperature. Magnetotransport measurements reveal an unusual cusp-like magnetoresistance attributed to weak antilocalization caused by strong spin-orbit coupling. Analysis using the Hikami-Larkin-Nagaoka model indicates coherent quantum transport with a phase coherence length of approximately 22 nm at low temperature.

Finally, NdGaSi (Fig. 2) demonstrates that quasiflat 4f bands positioned near the Fermi level can generate exceptionally large Berry curvature and anomalous Hall conductivity. The evidence of the flat band at the Fermi energy comes from the enhanced Sommerfeld coefficient and spectral intensity in angle resolved photoemission

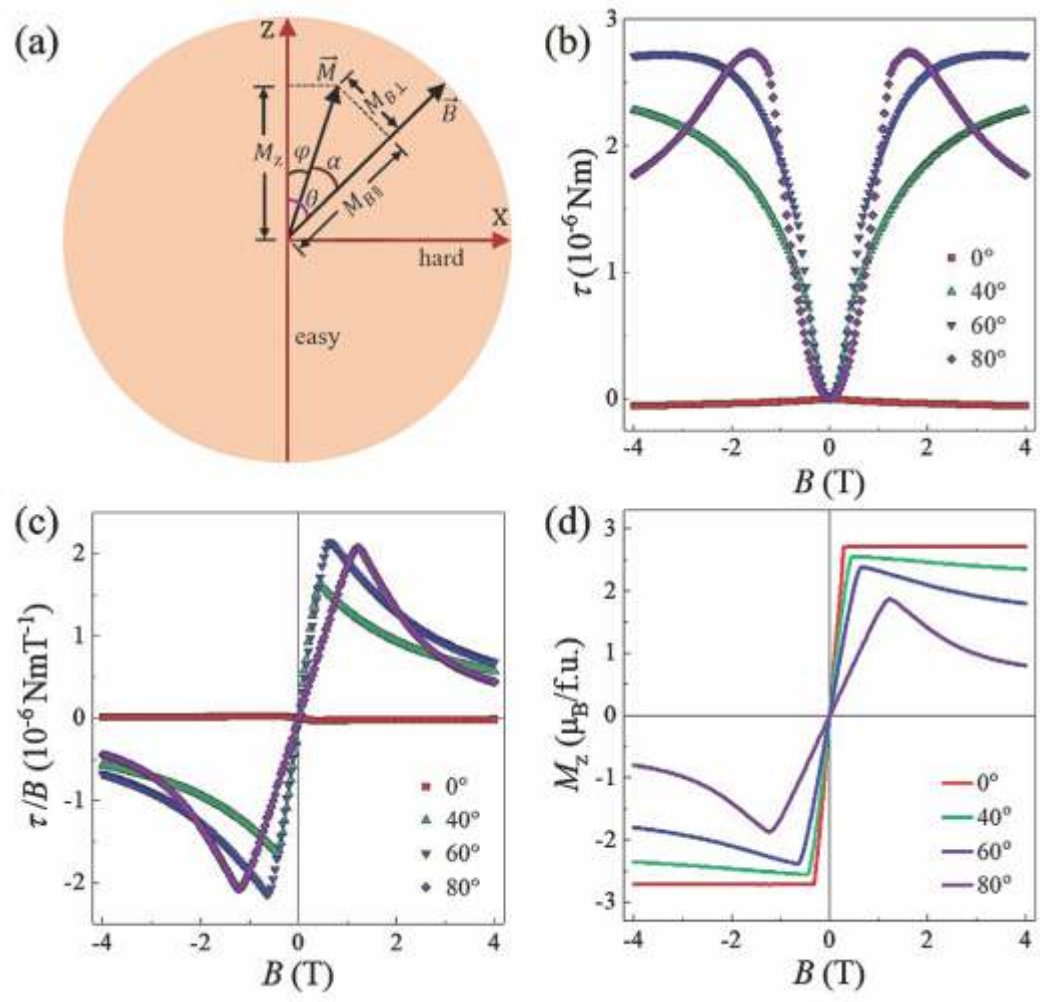


Fig. 1. (a) A schematic showing the various components of magnetization vector for the tilt q of the magnetic field relative to the z axis. The easy and hard axes of magnetization are also shown. (b) Torque (t) acting on the sample as a function of magnetic field for various values of q, (c) Variation of the quantity t/B as a function of magnetic field for various values of q. (d) Variation of the z component of the magnetization (Mz) as a function of the magnetic field for various values of q.

spectroscopy near the crossing points of dispersing and flat bands.

Together, these studies advance the understanding of correlated topological materials and emergent quantum transport phenomena.

We are extending our project on kagome systems to distorted kagome systems which have potential to exhibit spin-ice states. These can be characterized by various magnetization plateaus and can give rise to non-linear Hall effect. We will also look for flat bands in Laves phases

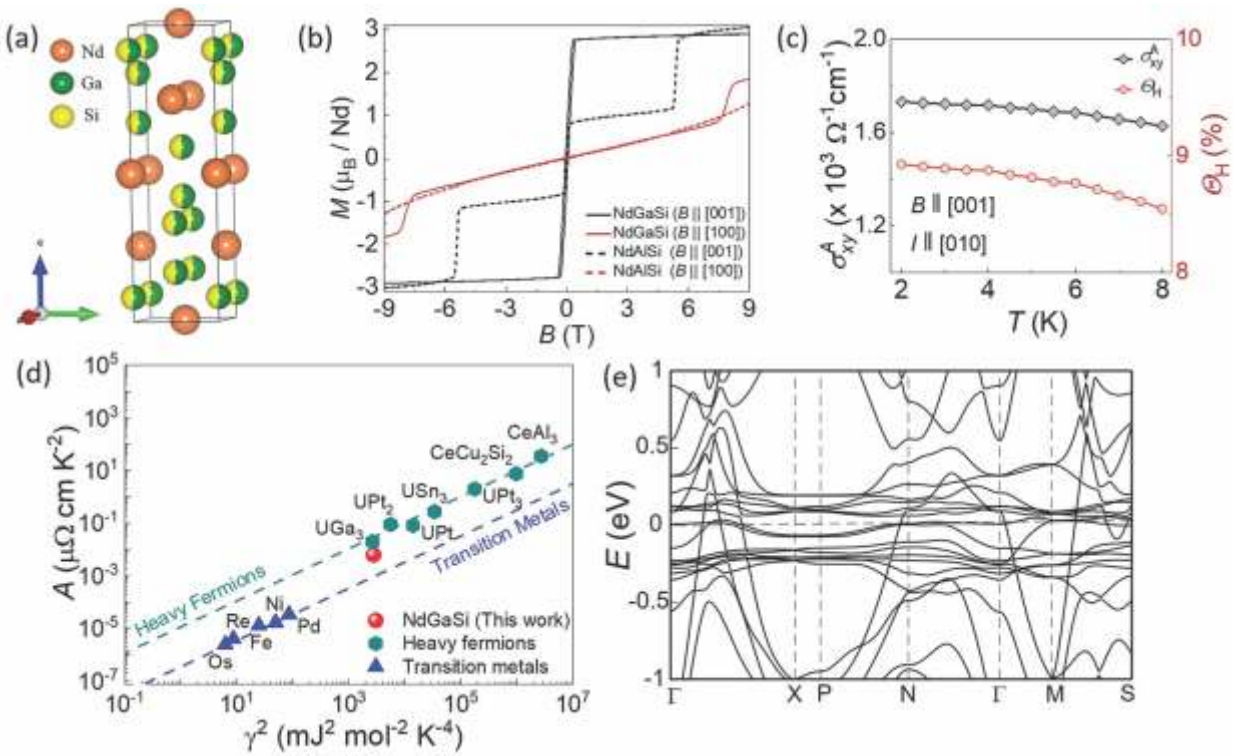


Fig. 2. Tetragonal crystal structure of NdGaSi with site mixing of Ga and Si atoms, (b) magnetization with magnetic field of NdGaSi as well as NdAlSi, demonstrating enhanced anisotropy in NdGaSi, © Large intrinsic anomalous Hall conductivity and anomalous Hall angle for NdGaSi, (d) Kadowaki-Woods ratios for various heavily and moderately correlated system including NdGaSi, (e) band structure of NdGaSi showing the presence of flat band at the Fermi energy.

Plan of Future Work Including Project

Non-trivial spin textures in centrosymmetric magnetic systems: Nontrivial spin textures such as skyrmions are often found in magnetic compounds with non-centrosymmetry because of Dzyaloshinskii-Moriya interaction. However, in centrosymmetric systems with RKKY interaction or magnetic frustration, multi-Q magnetic modulations can be found especially in Gd or Eu based systems. Upon application of magnetic field these multi-Q states can evolve into nano-sized skyrmions which are useful for high density data storage. We will identify many such systems and grow single crystals to perform magnetic and transport measurements. We will also characterize the multi-Q state by resonant elastic x-ray scattering.

which can be considered as interpenetrated kagome lattices in three dimensions.

We will be focussing on many more altermagnetic candidates which can give rise to AHE by choosing proper magnetic point group and collinear atiferromagnetic systems. In addition we will also look for p-wave magnetic systems which require spin canting.

In rare-earth based topological semimetals we will revisit the isotropic/anisotropic magnetic properties in terms of crystal electric field with the emphasis on the effect of disorder to distort the local symmetry around the rare-earth ions.



Priya Mahadevan

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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Prasun Boyal; Role of Structure in Magnetic and Topological Transitions; Awarded
2. Krishnendu Patra; Examining unusual ground states in transition metal compounds; Awarded
3. Shinjini Paul; Electronic, structural and magnetic properties of few layer transition metal compounds; Under Progress
4. Sanuja Kumar Khuntia; Examining the functionality of hybrid perovskites through ab-initio calculations; Under Progress
5. Jani Shivam Mukeshbhai; Electronic, structure and optical properties of Nanoplatelets of Inorganic Hybrid Perovskites; Under Progress
6. Madhurita Das; Study of the phase diagram of twisted bilayers, multilayers of layered materials; Under Progress
7. Maitreyee Barman; Electronic and Optical Properties of Low-dimensional Transition Metal Dichalcogenide Structures; Under Progress
8. Anita Ratha; Engineering magnetic ground states in quasi two-dimensional systems; Under Progress
9. Koustav Maiti; Modeling Optical Properties in Low-Dimensional Materials: Effects of Many-Body Interactions and Electron-Phonon Coupling; Under Progress
10. Anurag Paul; Modeling the structural and electronic properties of transition metal dichalcogenides; Under Progress

b) Post-Docs

1. Ranjani Bhattacharya; Transport
2. Arka Prava Sarkar; Hybrid perovskites
3. Anil Kumar Singh; Twsitronics
4. Prasun Boyal; Twistronics

c) External Project Students / Summer Training

1. Vijaykiran Nirwade; Perovskites for photodetectrionTw; Department of Physics and Electronics, NES Science College, Nanded

Publications

a) In journals

1. Shresth Gupta, Sema Sarisozen, Sanuja Kumar Khuntia, Felix Lang, **Priya Mahadevan**, Sayan Bhattacharyya, *X-Ray Detection with High Dynamic Sensitivity and Ultra-Low Detection Limits by Low-Dimensional Hybrid Bismuth-Iodides*, Advanced Functional Materials, 36, e14126, 2026
2. Pratap Pal, Krishnendu Patra, Subhajit Nandy, Sudipta Mahana, Jayjit Kumar Dey, Souvik Chatterjee, C. L. Prajapat, Tapas Paramanik, Dinesh Topwal, Amitabh Das, **Priya Mahadevan** and Debraj Choudhury, *Stability of the collinear up-up-down-down magnetic ordering in* Ca_3CoMnO_6, Physical Review B, 112, 214448, 2025
3. Poulomi Mukherjee, Ranjan Das, Debasmita Pariari, Koushik Das, **Priya Mahadevan** and D. D. Sarma, *Energy-Transfer Pathways That Sensitize* Mn^{2+} *Emissions Using* $Mn@CsPbCl_3$

Nanocrystals as a Generic Platform, ACS Energy Letters, 10, 6381-6389, 2025

4. Sreyan Raha, Prasun Boyal, Suvadip Masanta, Chumki Nayak, Abhijit Roy, Prabir Pal, **Priya Mahadevan**, Achintya Singha, *Mn-Intercalation-Induced Burstein–Moss Shift and Broadband Emission in* $MoSe_2$, Nano Letters, 25, 14333-14340, 2025
5. Basabendra Roy, Satyaki Kundu, Gaurav Dubey, **Priya Mahadevan**, Bipul Pal, Anamitra Mukherjee, Dhanvir Singh Rana, Bhavtosh Bansal, *Picosecond evolution of an induced metallic state under infinitesimal optical doping in* $NdNiO_3$, Journal of Applied Physics, 138, 065103, 2025
6. Banik Rai, Krishnendu Patra, Satyabrata Bera, Sk Kalimuddin, Kakan Deb, Mintu Mondal, **Priya Mahadevan**, Nitesh Kumar, *Direction-Dependent Conduction Polarity in Altermagnetic CrSb*, Advanced Science, 12, 2502226, 2025
7. Debayan Mondal, **Priya Mahadevan**, *Why Do We Have Dual Emission in Two-Dimensional Hybrid Perovskites?*, Journal of Physical Chemistry C, 2026, https://doi.org/ 10.1021/acs.jpcc.6c00118

Talks / Seminars Delivered in reputed conference / institutions

1. Invited talk at Aapali Psi-k meeting; 20/05/2025; IISER Pune, Pune; 19-21 May 2025
2. Invited talk at 2dTMDS 2025; 23/07/2025; Churchill College, Cambridge, UK; 20-24 July 2025
3. Invited talk at EMRS 2025; 16/09/2025; Warsaw, Poland; 15-18 September 2025
4. Invited talk at NanoBioSim 2026; 25/01/2026; IISER Kolkata; 23-26 January 2026
5. Invited talk at SMS3 2026; 22/01/2026; IIT Hyderabad; 21-24 January 2026
6. Invited talk at ACS Spring Digital meeting in Computational Materials Discovery session; 23/03/2026; Virtual meeting; 22-26 March 2026
7. Invited talk at ACS Spring Digital meeting in Halide Perovskites session; 23/03/2026; Virtual meeting; 22-26 March 2026
8. Invited talk at Discussion meeting on quantum materials and devices; 20/01/2026; SN Bose centre; 20 January 2026

Awards, Recognitions, if any

1. Editorial Board member of Pramana Journal of Physics
2. JC Bose Grant (2025-2030)
3. Editorial Board member of J. Solid State Chemistry

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Twistronics with transition metal dichalcogenides; ANRF; 2020-2026; PI
2. Optimizing hybrid perovskite solar cells; ANRF; 2025-2030; PI
3. Exploring the electronic properties of lateral heterostructures of transition metal dichalcogenides; DST-NCMST; 2026-2029; PI

Conference / Symposia / Schools organized

1. 2dmat2026; 16/03/2026; SN Bose Centre; 16-17 March 2026

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Exploring the suitability of hybrid perovskites as xray detectors with the group of Sayan Bhattacharya at IISER Kolkata; Sl. No. 1; National
2. Examining the ground state of Ca3CoMnO6 to explore when the unusual magnetic configuration up-up-down-down could be stabilized with the group of Debraj Choudhary of IIT Kharagpur; Sl. No. 2; National
3. The excitation spectra of Mn doped CsPbCl3 with the group of Prof. D.D. Sarma at IISc Bengaluru; Sl. No. 3; National
4. Understanding the excitation spectra of Mn doped MoSe2 with the group of A. Singha at Bose Institute; Sl. No. 4; National
5. Examining the optically induced metallic state in NdNiO3; Sl. No. 5; National

Outreach program organized / participated

1. Invited speaker at "Emerging trends in photovoltaic research" at Ramanand College at Bishnupur

Areas of Research

1. Understanding the properties of hybrid perovskites: A key requirement that limits the widespread use of hybrid perovskites in solar cells is the problem with their stability. We have examined routes to improve their stability by functionalization with molecules. This was shown to increase the stability in some instances. Another factor that contributes in reducing the stability of the perovskite materials is the presence of defects. The dominant defects are anion vacancies which additionally become mobile and finally lead to a degradation of the material. We have shown how the functionalization can increase the defect formation energy in addition to increasing migration barriers for anion diffusion. Another aspect that aids the carrier migration to the hole transporting layer and the electron transporting layer are the band offsets of those materials with the solar cell material. However, we found another aspect that might be encountered in the quasi two-dimensional hybrid perovskites. Experiments have found that these systems have a dual band gap, the origin of which we have identified for the n=1 quasi 2d members. A complex defect involving the molecule and the anion is found to form easily at the surface. This defect leads to an enhanced gap at the surface compared to the bulk. A consequence of this would be that an electron hole pair that is generated by photo excitation would be confined in the bulk, as a result of this natural barrier creation. This would be useful while using the material for optoelectronic applications, but in photovoltaic materials it could pose a problem.

2. Magnetism in complex oxides: We have examined magnetism in a complex oxide which has chains of alternating Co and Mn atoms running along the z direction. These chains are weakly coupled in the xy plane. We have examined what would be the minimal magnetic model to describe this system using density functional theory calculations as well as a mapping onto a model Hamiltonian. Early experiments had pointed out that the stabilization of the up-up-down-down magnetic order in this system would be accompanied with the onset of ferroelectricity. We have shown that this magnetic order would not be stabilized in the pristine system as it would require second neighbour interactions to dominate over the nearest neighbour interactions. However, antisite order can allow the stabilization of up-up-down-down magnetic order.

1. Why do we have dual emission in two dimensional hybrid halide perovskites?

The emission in a certain class of two dimensional hybrid halide perovskites have been seen to have a dual peak associated with them. We associate this with a dual band gap found in these systems, with a larger band gap found at the surface (Fig. 1) associated with the low formation energy of a defect complex involving a molecule and an anion at the surface. The formation energy of this defect is higher in the bulk. As a result the defect does not form so easily in the bulk. The advantage of the larger band gap at the surface than in the interior of the hybrid perovskite is that there is no recombination loss due to carrier funneling to lower energy states at the surface happening in these systems. This is useful for using the materials in optoelectronic applications, though it might not be an advantage for photovoltaic applications where one wants the carriers generated to funnel to low energy states at the interface, associated with the electron and hole transport layer.

The latter would face a barrier before they tunnel into the electron and hole transport layer. While the study was carried out for the class of two dimensional hybrid halide

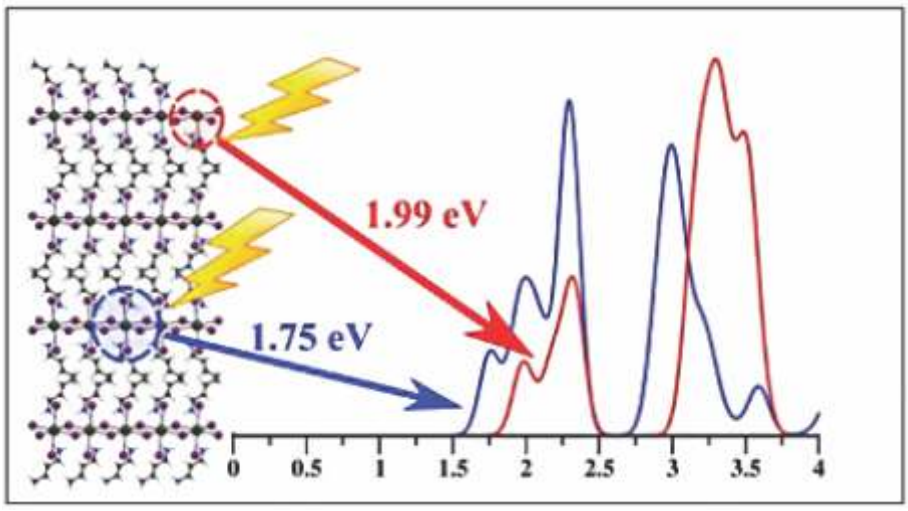


Fig. 1. Schematic representation of a slab of BA_2PbI_4 in which a BA-I unit has been removed from the surface. The density of states of the conduction band associated with different regions have been shown. The zero of energy corresponds to the valence band maximum.

perovskites that have one inorganic layer sandwiched between molecular layers on either side, the presence of more than one inorganic layer might not have this problem.

2. Do we understand the semiconducting state found in Mo and W based transition metal dichalcogenides?

The Mo and W based transition metal dichalcogenides have been extensively studied in recent times as a part of twisted heterostructures that have been constructed. The interest in these materials has emerged from the interesting phenomena that one finds on doping a small concentration of holes and simultaneously subjecting them to external electric and magnetic fields. These phenomena include possibilities of magnetic order, charge ordering etc are expected in strongly correlated systems. We have recently shown that even the origin of the semiconducting state, which was so far believed to arise from the degeneracy lifting of the transition metal d orbitals due to crystal field effects, is not adequate. One has a reversal in the ordering of the transition metal d levels in going from the high symmetry points G to K, while maintaining a band gap of ~ 1.5-2 eV throughout. Setting up a tight-binding model involving Mo d and S p orbitals in the basis for MoS2, one finds that the hopping between Mo d orbitals plays an important role in keeping the system semiconducting. Switching off the Mo d – Mo d hopping makes the system metallic.

Plan of Future Work Including Project

1. Hybrid perovskites:

We will be examining routes to improve the stability of hybrid perovskites. This will be done by adsorbing molecules and assessing the improved stability. More recent approaches involve growing overlayers of a two-dimensional perovskite on the three-dimensional perovskite. It has been seen in experiments that although this route might improve the stability, the interface is the region which could determine the performance of the device. So, our approach would be to evaluate the improved stability obtained by growing two dimensional perovskites on the three dimensional perovskites. The relative band offsets, the defect formation energies will be examined to quantify the quality of the interface. A key defect that forms in three-dimensional perovskites are anion vacancies. In an earlier work, we had seen that the adsorbed molecule could increase the defect formation energy of the anion vacancy. This would make the occurrence of the defect less probable in comparison with the three dimensional perovskite. Additionally the overlayers also made the barrier for anion diffusion higher. We would like to understand the microscopic factors that control this in order to use this as one of the design principles in choosing the two dimensional perovskite overlayers.

We have in an earlier work determined the band gap of hybrid perovskites as a function of temperature. The dependence in the orthorhombic phase is different from that in the tetragonal phase. We would like to understand the origin that leads to the variations.

2. 2d materials:

Fe intercalated into NbSe2 has been seen to have interesting magnetic properties. In a complex system as we have here, there are several exchange pathways possible between the Fe atoms. We would like to examine the role of each of the pathways in stabilizing the observed magnetic structure. A phase diagram as a function of composition and temperature will be constructed. In an earlier work we had shown that as time reversal symmetry is not broken in homobilayers of Mo and W-based transition metal dichalcogenides, the spin splitting that one as a function of twist angle is equal and opposite at the symmetry points K and -K, though the layer contributions at the top of the valence band have some symmetry associated with them. We would like to examine the consequences of hole doping in the two instances, considering large twist angles. The aim is to examine if a magnetic ground state can be stabilized.



Saquib Shamim

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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Subhajit Mondal; Topological phenomena in atomically thin materials; Under Progress
2. Najrul Islam; Strongly correlated phases in transition metal dichalcogenides; Under Progress
3. Nilesh Bauri; Electrical and thermal transport in topological materials; Under Progress
4. Bipasa Hazra; Topology and correlations in 2D Materials; Under Progress
5. Sourav Mondal; Role of Geometry, Magnetic Charges, and Dipolar Coupling in Spin-Wave Dynamics of Magnonic Systems; Under Progress; Prof. Anjan Barman (Supervisor)

b) Post-Docs

1. Dibyashree Chakraborti; Study of spin charge inter-conversion and its control mechanism in van-der Waals heterostructure stacks and striving towards development of topological spintronics

c) External Project Students / Summer Training

1. Tajinder Kaur; Device fabrication and characterization of MoTe_2 flakes; DAV College, Chandigarh, affiliated to Punjab University
2. Shreerama Pradhan; Fabrication and noise measurements in few layers of MoTe2; TRC, SNBNCBS
3. Suman Halder; Low-frequency noise in topological materials; TRC, SNBNCBS

Teaching

1. Autumn Semester; PHY 503: Condensed Matter Physics; Integrated PhD; 11 students; Shared with Dr. Nitesh Kumar
2. Autumn Semester; PHY 603: Condensed Matter Physics; PhD; 6 students; Shared with Dr. Nitesh Kumar
3. Autumn Semester; PHY 601 Research Methodology; PhD; 35 students; Shared with Sanjoy Choudhury

Talks / Seminars Delivered in reputed conference / institutions

1. Colloquium lecture in physics at the Presidency University; 16/04/2025; Presidency University; 1 hour
2. Invited talk at the conference "Quantum Materials and Devices" 2026; 20/01/2026; S. N. Bose National Centre for Basic Sciences; 1 day
3. Invited talk at the conference on "2D Materials 2026 (2dMAT 20026)"; 16/03/2026; S. N. Bose National Centre for Basic Sciences; 2 days, from 16th to 17 March

Administrative duties

1. Member of SCOLP and Departmental Seminar Coordinator (Continuing from 01-04-2023)
2. Member of Placement and Alumni Cell
3. Member of the Space Committee of the Centre
4. Member of the Brochure Committee
5. Faculty in-charge of HRTEM
6. Faculty in-charge of XRD
7. Member of the Guest House and Canteen Monitoring committee
8. Warden of Students' Hostel
9. Member of the Syllabus Modification Committee

Awards, Recognitions, if any

1. Member of the Early Career Advisory Board of the journal Physical Review B by the American Physical Society

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. CRG/2023/002082: Quantum spin Hall insulators: Investigation of electrical and thermal

properties; ANRF (Erstwhile SERB, DST); 36 months; PI

Conference / Symposia / Schools organized

1. Co-convener for the conference, "2D Materials 2026 (2dMAT 2026)"; 16/03/2026; S. N. Bose National Centre for Basic Sciences; 2 days
2. Organizer of the Program, "Interaction with German Universities, Research Institutions and Research funding Organizations"; 28/08/2025; S. N. Bose National Centre for Basic Sciences; 1 day

Outreach program organized / participated

1. Lecture delivered for the C. K. Majumdar Memorial lectures for B.Sc and M.Sc. students of various colleges on 18th July, 2025
2. Popular outreach talk "Redefining the kilogram using two macroscopic quantum phenomena: the quantum Hall effect and the Josephson effect " delivered for school & college students and general public on 25th April 2025

Areas of Research

1. Seebeck coefficient for bulk samples: Investigating Goniopolarity in $LaCrGe_3$

The Seebeck coefficient is defined as $S = V_{th}/dT$, where Vth is the thermal voltage developed due a temperature difference dT between the two ends of a sample. A setup has been designed and built in-house to measure the Seebeck coefficient of bulk samples over the temperature range from 77 K to 350 K. Our setup can measure Seebeck coefficient in the range of ~ nV/K. This setup has been used for collaborative research work with Prof. Kumar's group to investigate goniopolarity in $LaCrGe_3$. The attached figure below shows the measured Seebeck coefficient along the in-plane (S_{xx}) and the out-of-plane (S_{zz}) as a function of temperature from 77 K to 300 K. Both S_{xx} and S_{zz} exhibit a change in sign as a function of temperature; however, between the temperature range of 108 K and 257 K, S_{xx} and S_{zz} exhibit opposite signs, being positive and negative, respectively. This anisotropy in the sign of the Seebeck coefficient is due to the anisotropy in the sign of the effective mass along the different crystallographic directions. This observation has been supported by temperature-dependent Hall measurements and theoretically calculated Fermi surface geometry. **[Ref: Phys. Rev. B 113, 144409 (2026)]**

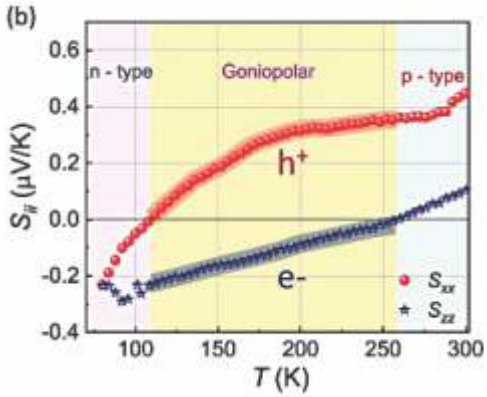


Figure 1: The measure Seekbeck coefficient Sxx and Szz as a function of temperature.

2. Probing temperature-dependent Fermi surface topology using resistance fluctuations

We have used resistance fluctuations spectroscopy to probe the evolution of Fermi surface topology in Td-WTe_2 as a function of temperature. T_d-WTe_2 shows several temperature-dependent Fermi surface transitions. At low temperatures (1.4 K), the transport is due to two electron and two hole pockets. As the temperature increases, the electron and hole pockets disappear, signatures of which has been seen in temperature-dependent ARPES measurements. While standard transport measurements like resistivity cannot capture these changes in Fermi surface topology, resistance fluctuations show a pronounced maximum at temperatures at which such changes occur. We also investigate the effect of time-reversal symmetry breaking by measuring noise in the presence of an external magnetic field.

3. Higher-order moments of resistance fluctuations across the superconducting transition in FeSe thin films

MBE-grown FeSe thin films (obtained from our collaborators at Penn State) show a superconducting transition where the critical temperature can be tuned from 2 K to 20 K by varying the annealing conditions. We have measured low-frequency noise as a function of temperature across the superconducting transition in FeSe thin films with varying critical temperatures. The power spectral density of noise increases by more than four orders of magnitude as the films transition of superconducting phase, while the second spectrum shows signatures of non-Gaussianity indicative of vortex correlations. We are preparing the manuscript on the results.

Plan of Future Work Including Project

1. Non-Gaussian conductance fluctuations across the BKT transition in FeSe thin films: We are investigating the statistics of fluctuations in FeSe thin films, which show a BKT-type superconductivity. By measuring resistivity fluctuations in films with different critical temperatures, we plan to investigate the role of phase fluctuations in these films. Further into the superconducting regime, we plan to measure fluctuations as a function of current to investigate vortex correlations by estimating the second spectrum of noise.

2. Exploring the structural phase transition from 1T' phase to Td-phase in MoTe using noise spectroscopy: MoTe2 is layered transition metal dichalcogenide that undergoes a first-order structural phase transition between the monoclinic 1T' phase and the orthorhombic Td phase as a function of temperature. We use low-frequency noise as a sensitive and non-invasive probe to study the dynamics of the phase transition.



Sujit Deshmukh

Ramanujan Fellow
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Guidance of Students/Post-Docs

a) Post-Doc (Visiting)

1. Sudipta Choudhury (Joint supervision with Prof Anjan Barman); Laser Processed Single Atom Catalysts for Overall water Splitting

b) External Project Students / Summer Training

1. Nilabha Chatterjee; Prepare Thiazole-Linked Dithiophenedione-Functionalized Covalent Organic Framework for Zinc Ion Battery; ad *hoc* project assistant for 6 months

Talks / Seminars Delivered in reputed conference / institutions

1. Invited lecture at the 4th international young researchers' conclave (IYRC 2026); 26th to 28th February 2026; University of Petroleum and Energy Studies (UPES) Dehradun

Awards, Recognitions, if any

1. Received Ramanujan Fellowship, research grant 35 lakhs for the period of 5 years, funded by ANRF

Scientific collaborations with other national / international institutions

1. Collaboration with Prof Martin Pumera, Central European Institute of Technology, Brno University of Technology, Czech Republic; International

Areas of Research

- Laser Processed 2D Materials for Zn-Ion Batt
- Redox Active 2D Materials for Zn Ion Battery
- Prepare Single Atom Catalysts for Zn -Air Battery

The report includes a short initial period of work from January 6th to March 31st, 2026.

- We are trying to develop a simplified methodology to prepare metal nitrogen carbon (M-N-C) catalysts (where M can be Fe, Co, Mn, Cu, Ni etc.), where individual metal atoms will be atomically dispersed on photothermal converted laser-induced graphene or other 2D material (covalent organic framework) support.

  The aim is to use the electrocatalyst for oxygen reduction reaction (ORR) performance, which is critical for next generation zinc air battery development. The concept will be adapted for roll-to-roll production
- In another project we are trying to find out the applicability of 2D functionalized covalent organic frameworks (COFs) for sustainable energy (Zn/Na ion battery) storage devices. Currently we are using the redox active COFs as cathode material for the development of aqueous based Zn ion battery devices.

Plan of Future Work Including Project

In the next reporting period, I will focus on device-level implementation and materials characterization. The key objectives include:

- Assembly of zinc-ion battery devices using the synthesized redox active COF materials as cathode.
- Electrochemical performance evaluation of the assembled devices.
- Comprehensive material and device characterization.
- Implementation of operando characterization techniques to understand charge storage mechanisms and structural evolution during battery cycling.

These steps will be critical in validating the functionality of the synthesized materials and advancing the project toward a good manuscript and potential to publish in reputed journal.

In terms of teaching, I am planning to take the course CB 641: SURFACES & INTERFACES from January 2027 onwards.



Tanusri Saha Dasgupta

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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Anutosh Biswas; Quantum spin systems; Under Progress; Manoranjan Kumar (Supervisor)
2. Sweta Ghosh; Topological Materials; Under Progress; Sudipta Kanungo, IIT Goa (Supervisor)
3. Avik Sasmal; Large Scale simulation of confined systems; Under Progress; Jaydeb Chakraborty (Supervisor)
4. Sourav Das; DFT + DMFT study of materials; Under Progress; Arijit Haldar (Co-Supervisor)
5. Proshanta Sarkar ; First principles study of oxides; Under Progress; Goutam Dev Mukherjee, IISER K (Co-Supervisor)
6. Rajdeep Biswas; Electronic Structure of Materials; Under Progress
7. Manoj Gupta; Electronic structure of correlated electrons; Thesis Submitted
8. Koushik Pradhan; Electronic structure of transition metal compounds; Thesis Submitted
9. Aishwaryo Ghosh; Machine learning in solving Materials Science problems; Thesis Submitted

b) Post-Docs

1. Devaparna Bhattacharya; Cerium superconductivity under pressure
2. Arun Maurya; Nickelate superconductors

c) External Project Students / Summer Training

1. Shivam Randive; Machine learning

Publications

a) In journals

1. Koushik Pradhan, Dipayan Sen, Prabuddha Sanyal and **Tanusri Saha-Dasgupta**, *Two-sublattice double exchange driven magnetism in Cr-based two-dimensional magnets*, Physical Review B, 111, L180404, 2025
2. Swagata Das, Uttam Pal, **Tanusri Saha-Dasgupta**, Susanna Leong, *Combating Fuel Biocontamination: Tailored Antimicrobial Peptides and an Innovative Delivery Strategy*, ACS Applied Bio Materials, 8, 7672-7683, 2025
3. Bidhan Kumbhakar, Avanti Chakraborty, Uttam Pal, Gaurav Jhaa, Sukanta Mondal, Abhik Banerjee, **Tanusri Saha-Dasgupta**, Pradip Pachfule, *A Dimolybdenum Paddlewheel Embedded Covalent Organic Framework for Photocatalytic Hydrogen Peroxide Generation*, Small, 21, 2501823, 2025
4. **Tanusri Saha-Dasgupta** and Rupamanjari Ghosh, *India's women of quantum*, Physics World, 38, 8, 2025
5. Arnab Paul, Samir Rom, Prabuddha Sanyal and **Tanusri Saha Dasgupta**, *Origin of ferromagnetism and trends in Berry curvature driven anomalous Hall conductivity in the metallic rare-earth antimonides R* $CrSb_3$ *(R = La, Ce, Nd)*, Physical Review B, 112, 094427, 2025
6. Arnab Bera, Riju Pal, Buddhadeb Pal, Samir Rom, Suchanda Mondal, Deepti Rana, Aastha Vasdev, Sandeep Howlader, Manish Jana, Tanmay Maiti, Rafikul Ali Saha, Biswajit Das, **Tanusri Saha-Dasgupta**, Prabhat Mandal, Atindra Nath Pal and Mintu Mondal, *Observation of superconductivity and weak ferromagnetism in the quasi-one-dimensional chain compound* $(TaSe_4)_3I$ *at ambient pressure*, Physical Review B, 112, L180502, 2025
7. Shatabda Bhattacharya, Shubhadip Moulick, Chinmoy Das, Shiladitya Karmakar, Hirokazu Tada, **Tanusri Saha-Dasgupta**, Tatsuhiko Ohto,

Shinji Kitao, Makoto Seto, Pradip Chakraborty and Atindra Nath Pal, *Engineering Fe(II) spin-crossover/2D reduced graphene oxide heterostructures for tunable cooperativity, magnetic coupling, and conductance switching*, Nanotechnology, 36, 455702, 2025

8. Avanti Chakraborty, Uttam Pal, Sonali Priyadarshini Swain, Sudipa Mondal, Akhtar Alam, **Tanusri Saha-Dasgupta** and Pradip Pachfule, *Engineering intermolecular charge transfer in covalent organic frameworks for photocatalytic hydrogen peroxide generation*, Journal of Materials Chemistry A, 2026, DOI: 10.1039/d5ta09118g
9. Prosanta Sarkar and **Tanusri Saha-Dasgupta**, *Interplay of charge transfer, charge disproportionation, and Jahn-Teller distortion, and its implication for the properties of mixed $CaFeO_3 - LaMnO_3$ compounds*, Physical Review B, 113, 094202, 2026
10. Sweta Ghosh, Sudipta Kanungo and **Tanusri Saha Dasgupta**, *Topology, electric field induced Rashba effect and metal-insulator transition: A case study with bulk and nanostructured layered Zintl compound, KCdBi*, Physical Review Materials, 10, 034202, 2026

Talks / Seminars Delivered in reputed conference / institutions

1. Invited Talk at International Conference on Electronic-Structure Theory and Applications (AAPALI PSI-K 2025) IISER Pune; May 2025; IISER Pune
2. Invited Talk in the "Joint ICTP-WE Heraeus School and Workshop on Advances in Quantum Matter: Pushing the Boundaries"; 11/08/2025; Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy
3. Invited Talk at University of Toronto Canada; 28/08/2025; University of Toronto Canada
4. Invited Talk at 5th National Conference on the Physics of Strongly Correlated Electron System (PSCES - 2025); 14/09/2025; IIT (BHU) Varanasi
5. Invited Talk at "Driving Discovery through Synergy - 2025"; 16/09/2025; JNCASR, Bangalore
6. Invited Talk at "16th IACS-APCTP-INST Joint Activity on Novel Quantum Phases in Oxide Materials and Low Dimensional Systems; 24/10/2025; INST, Mohali
7. Colloquium at TIFR Hyderabad; 27/10/2025
8. Invited Lecture at International Winter School-2025; 03/12/2025; JNCASR Bangalore
9. Invited Talk at ICTS Program "Frontiers in Quantum Condensed Matter Physics"; 16/12/2025; ICTS, Bangalore
10. Invited Talk at "Symposium on Magnetism and Spintronics"; 22/01/2026; IIT Hyderabad
11. Invited Talk at Max-Planck Institute for Solid State Research, Stuttgart Germany; 13/02/2026; MPI Stuttgart
12. International Conference on Materials Genome ICMG-II; 20/02/2026; SRM University, Amravati

Administrative duties

1. Director, SNBNCBS

Awards, Recognitions, if any

1. D.Sc. (Honoris Causa) by the University of Engineering and Management (UEM) January 2026

Membership of Learned Societies

1. American Physical Society

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. JC Bose National Fellowship; SERB; 2021-2025; PI
2. Technical Research Centre - extension phase; DST; 2022-2026; PI

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. S. Kanungo; Sl. No. 10; National
2. Mintu Mandal; Sl. No. 6; National
3. R Ghosh; Sl. No. 4; National
4. S Leong; Sl. No. 2; International

Outreach program organized / participated

1. Invited talk at University of Kalyani (International Women's Day Celebration)
2. Invited Institute Public Lecture "VIMARSH", IIT Indore

Areas of Research

Computational Materials Physics

Machine learning and material informatics

Interplay of spin-orbit and Correlation in Quantum Materials

2D materials

Topology

Energy Materials; Earth Materials

Tuning magnetic ground states of RMn6Sn6 (R = Lu, Mg) kagome metals by dimensionality reduction: Route to ferromagnetism and large anomalous Hall effect

The ternary intermetallic compounds, RMn6Sn6 (R = rare-earth or alkali or alkaline-earth metal) hosting Kagome bilayer of Mn, present a class of systems that naturally allows for the interplay of magnetism and topology. In search of ferromagnetic members in these systems, we show that dimensional reduction can be an effective means to achieve ferromagnetism and large anomalous Hall conductivity. Focusing on two specific members with R = Lu and Mg, our first-principles calculations show that dimensional confinement through the construction of experimentally relevant atomistically thin single bilayer kagome geometry of Mn atoms gives rise to a ferromagnetic metal with multiple Weyl points along with spin-orbit-coupling induced gapped bands. The calculated Berry curvature driven (see Fig1) anomalous Hall conductivity in the thin film geometry turns out to be 287 and 178 Omga-1cm-1, comparable to that found for bulk RMn6Sn6 with alkali or alkaline-earth metal at R site. This is of interest as thin-film geometry can be efficiently integrated to devices. Rajdeep Biswas, Jyoti Sharma, Aftab Alam, Tanusri Saha Dasgupta, Phys. Rev. Materials 9, 104205 Editors Choice (2025).

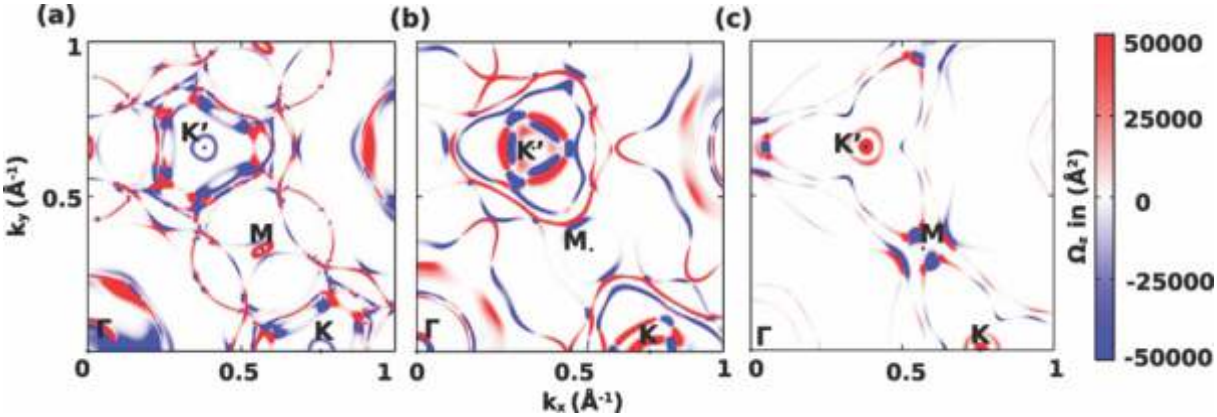


Figure1: Momentum-resolved z component of Berry curvature for the bulk and thin films of studied compounds

Multiple Dirac spin-orbital liquids in SU (4) Heisenberg antiferromagnets on the honeycomb lattice

Motivated by transition-metal trihalides, we study the strong-coupling model of d1 honeycomb lattice systems in the large spin-orbit coupled limit. By considering different possible hopping pathways, SU(4) symmetry is found to emerge at multiple points in the parameter space of the hopping parameters. The resultant Dirac spin-orbital liquids, within the parton mean-field description, provide distinct realizations of symmetry fractionalization. The calculated dynamical spin-structure factor (see Fig 2) fingerprints this distinctive nature, measurable in experiments. The conclusions are found to be perturbatively robust upon inclusion of low-energy gauge fluctuations. Manoj Gupta, Arijit Haldar, Subhro Bhattacharjee, Tanusri Saha-Dasgupta, Physical Review B 113 (20), L201110 (2026).

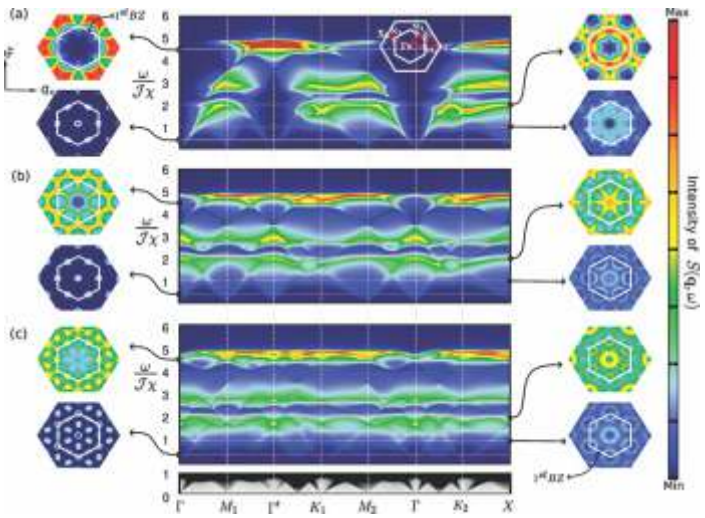


Figure2: Calculated Dynamical dipole structure factor for different parameter regimes of the model

Plan of Future Work Including Project

1. Nickelate superconductity in multilayer systems
2. Machine learning in Quantum architecture
3. Giant magnetostriction in rare-earth ferrites
4. Metal-insulator transition in dimensionally reduced system



Thirupathaiah Setti

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Condensed Matter and Materials Physics
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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Susanta Ghosh; Topological Quantum Materials; Awarded; Kalyan Mondal (Co-Supervisor)
2. Anupam Barik; Topological Quantum Materials; Under Progress
3. Soumya Ghorai; Oxide Double Perovskites; Under Progress
4. Ankita Das; 2D Magnetism; Under Progress
5. Arindam Jana; Topological Semimetals; Under Progress

b) Post-Docs

1. Subhadip Chakrabartty; Topological Superconductors
2. Achintya Low; Synthesis of Topological Quantum Materials
3. Susanta Ghosh; Synthesis of Topological Quantum Materials

c) External Project Students / Summer Training

1. Alipriya Chatterjee; Synthesis and Electronic Properties Studies of Topological Semimetal; IISER Berhampur

Teaching

1. Autumn Semester; PHY 491: Basic Laboratory I; Integrated PhD; 14 students; Shared with Dr. Avijit Chaudhury
2. Spring Semester; PHY 492: Basic Laboratory II; Integrated PhD; 14 students; Shared with Prof. Kalyan Mondal

Publications

a) In journals

1. Susanta Ghosh, Achintya Low, Nayana Devaraj, Susmita Changdar, Awadhesh Narayan, **Setti Thirupathaiah**, *Extremely large and angle-dependent magnetoresistance in kagome Dirac semimetal RFe_6Sn_6 (R = Ho, Dy)*, Journal of Alloys and Compounds, 1040, 183506, 2025
2. Susmita Changdar, Oleksandr Suvorov, Andrii Kuibarov, **Setti Thirupathaiah**, Grigory Shipunov, Saicharan Aswartham, Sabine Wurmehl, Iryna Kovalchuk, Klaus Koepernik, Carsten Timm, Bernd Büchner, Ion Cosma Fulga, Sergey Borisenko & Jeroen van den Brink, *Topological nodal i-wave superconductivity in $PtBi_2$*, Nature, 647, 613-618, 2025
3. Susanta Ghosh, Tushar Kanti Bhowmik, Achintya Low, and **Setti Thirupathaiah**, *Spin-reorientation-driven temperature-dependent intrinsic anomalous Hall conductivity observed in Fe_3Ge: A ferromagnetic topological metal*, Physical Review Materials, 9, 084201, 2025
4. Achintya Low, Tushar Kanti Bhowmik, Susanta Ghosh, Susmita Changdar, and **Setti Thirupathaiah**, *Topological Hall effect in ferromagnetic Weyl semimetal Mn_5Ge_3 originating in competing dipolar interaction and magnetocrystalline anisotropy*, Physical Review B, 111, 144422, 2025
5. Anjan Kumar N M, Soumya Mukherjee, Abhirup Mukherjee, Ajinkya Punjal, Shubham Purwar, **Thirupathaiah Setti**, Shriganesh Prabhu S., Siddhartha Lal and N. Kamaraju, *Revealing the magnetic dimensional crossover in the*

Heisenberg ferromagnet $CrSiTe_3$ through picosecond strain pulses, Physical Review B, 111, L140414, 2025

6. Anumita Bose, Shubham Purwar, **Setti Thirupathaiah** and Awadhesh Narayan, *Anomalous and parallel Hall effects in ferromagnetic Weyl metal Cr_3Te_4*, Physical Review Materials, 9, 044413, 2025
7. Anyesh Saraswati, Jyotirmoy Sau, Vera Misheneva, Rui Lou, Sudipta Chatterjee, Sandip Kumar Kuila, Bibhas Ghanta, Anup Kumar Bera, Partha Pratim Jana, Alexander Fedorov, **Setti Thirupathaiah**, Manoranjan Kumar and Nitesh Kumar, *Accessing quasiflat f bands to harvest large Berry curvature in NdGaSi*, Physical Review Materials, 10, L031202, 2026

Talks / Seminars Delivered in reputed conference / institutions

1. ARPES studies on Transition Metal Dichalcogenides; 04/02/2026; SNBNCBS; 4th - 5th February 2026
2. Colloquium on Electronic Band Structure of Topological Transition Metal Dichalcogenides (TMDC); 13/02/2026; University of Duisburg-Essen, Germany; 13th February 2026
3. Investigation of the Skyrmion Lattice Superconductivity; 21/11/2025; IISER Bhopal; 21st-23rd November 2025
4. $Sn_{0.06}Cr_3Te_4$: A Skyrmion Lattice Superconductor; 26/06/2025; IFW Dresden; 23rd-27th June, 2026

Administrative duties

Administrative duties: Hostel Warden, in charge of FESEM-EDAX, PanAnalytical XRD, PHI-XPS, and Rigaku XRD instruments under the Technical Cell Working Group, and served as a member and as a chairperson in several of the committees formed by the competent authority of the Centre

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Novel Magnetism and Topological Materials; DST-RSF (Indo-Russian Project); 2022-2025; Co-PI
2. Investigation of the effect of magnetic impurity doping in topological transition-metal monosilicide semimetals; DST-CRG; 2024-2027; PI
3. Exploring 2D Magnetism and Skyrmion Superconductivity in Layered van der Waals Systems for Topological Hall Sensors; ANRF-ARG; 2026-2029; PI
4. Probing ultrafast nonequilibrium excitonic condensates in magnetic van der Waals quantum materials using Femtosecond and Terahertz Spectroscopy; ANRF-ARG; 2026-2029; Co-PI

Conference / Symposia / Schools organized

1. Discussion Meeting on Quantum Materials and Devices; SNBNCBS; 20th January 2026
2. Quantum Materials and Emerging Concepts (QMEC-2025); IISER Bhopal; 22nd -24th December 2025
3. National Conference on Electronic Structure-2025 (NCES-25); IISER Bhopal; 19th -22nd November 2025
4. Driving Discovery through Synergy; JNCASR, Bengaluru; 15th - 17th September 2025
5. Disorder and Size Effects in Quantum Materials; SNBNCBS; 4th - 5th February 2026

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. IISER Kolkata, IISc, UGC-DAE CSR, IIT Kharagpur; Sl. No. 1, 5, 6, 7, 8; National
2. IFW (Germany), Kyiv Academic University (Ukraine), MPI Stuttgart (Germany), HZB Berlin (Germany); Sl. No. 2; International

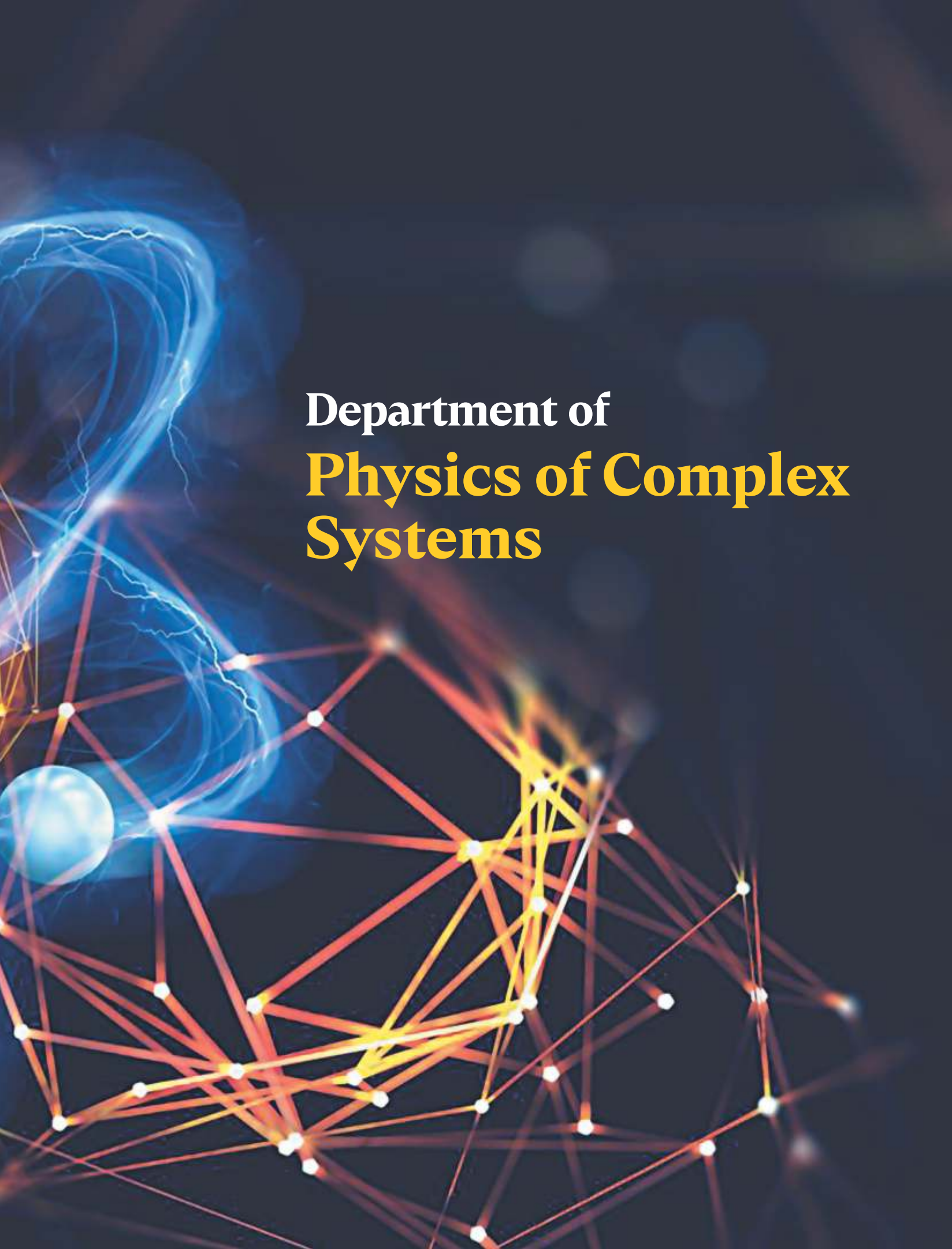
Areas of Research

Our group focuses on the topological properties of Dirac and Weyl semimetals, Transition metal dichalcogenides (TMDC), Quantum spin liquids (QSL), and Two-dimensional (2D) magnetic materials. We grow high-quality single crystals and study their physical & electronic properties to understand the physics of these materials and find their suitability for quantum computations.

Plan of Future Work Including Project

Growing high-quality single crystals of Dirac and Weyl semimetals, Transition metal dichalcogenides (TMDC), Quantum spin liquids (QSL), and Two-dimensional (2D) magnetic materials using the solid-state reaction route of molten-growth, flux-growth, and chemical vapor transport (CVT) techniques. As grown samples will be extensively studied for their electrical, magnetic properties, and electronic band structure to understand the underlying physics of these exotic quantum materials.





Department of Physics of Complex Systems



Arijit Haldar

Assistant Professor
Physics of Complex Systems
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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Anish Chaudhuri; Kinematic constraints, conservation laws and emergent gauge theories in many body systems; Under Progress
2. Sahanawaj Akhtar; Topology and transport in quantum spin systems; Under Progress
3. Sayan Mondal; Quantum and Classical many-body phenomena; Under Progress
4. Sourav Das; Application of DFT + DMFT to strongly correlated systems; Under Progress; Tanusri Saha-Dasgupta (Supervisor)

b) Post-Docs

1. Atul Rathor; Quantum magneto transport
2. Lokrshi Prawar Dadhichi; Constrained active matter

c) External Project Students / Summer Training

1. Aviral Verma; Magnon visualization system; National Institute of Science Education and Research (NISER)

Teaching

1. Autumn Semester; Atomic and Molecular Physics (PHY 501, Core course); Integrated PhD; 11 students; Shared with Manik Pradhan
2. Autumn Semester; Basic Laboratory II (PHY 492, Core course); Integrated PhD; 11 students; Shared with Avijit Chowdhury
3. Autumn Semester; Introduction to Programming and Computational Methods in Physics (PHY 407, Core course); Integrated PhD; 14 students; Shared with Punyabrata Pradhan
4. Autumn Semester; Molecular Physics and Spectroscopy (CB 627); PhD; 7 students; Shared with Manik Pradhan
5. Autumn Semester; Project Research (PHY 691); PhD; 1 student
6. Spring Semester; Quantum Mechanics 2 (PHY 406, Core course); Integrated PhD; 14 students

Publications

a) In journals

1. Rishik Perugu, **Arijit Haldar** and Sumilan Banerjee, *Universal nonequilibrium dynamics of pure states and density-dependent thermalization in the Sachdev-Ye-Kitaev model*, Physical Review B, 112, 184301, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Delivered an invited talk and attended StatPhys Kolkata XIII (12-16 Jan 2026); 15/01/2026; SNBNCBS Kolkata, India; 30 minutes
2. Delivered an invited talk and attended the 3rd Joint Workshop IFW Dresden - S.N. Bose National Center for Basic Sciences (23-27 June 2025); 26/06/2025; IFW Dresden, Germany; 45 minutes
3. Delivered an invited talk and attended the CKM memorial workshop (15-24 July 2025); 19/07/2025; SNBNCBS Kolkata, India; 75 minutes

Administrative duties

1. Active member of the Bhagirathi Guesthouse and Canteen Committee
2. Active member of the Bhagirathi Rooftop Cafeteria Committee
3. Active member of the Committee for Laboratory syllabus and equipment purchase for conducting IPhD/PhD courses.
4. Active member of the committee for NSM Paramrudra Supercomputing Facility.
5. Active member of the Cyber Crisis Management Plan committee.
6. Active member of the website committee.
7. Coordinated the 2025 DST review team's visit to the undergraduate (IPhD) laboratory and briefly presented the Centre's curriculum related to IPhD laboratory experiments. Also co-coordinated the visit to the computer and electronics laboratory with Prof. Suman Chakrabarty.
8. Facilitated the preparation of a report on many-body physics research conducted at the Centre for the 2025 DST Review Committee.
9. Interview panel member for the IPhD admissions 2025, and PhD admissions 2025.
10. Judge for the Bose Fest 2026 Poster session. Bose Fest is a multi-day event showcasing the research work of all students and faculty from the centre.
11. Member of the committee formed to assess the workings of the Centre's facebook page and other social handles.
12. Member of the PDRA selection committees.
13. Organizer and committee member for conducting "Outreach Programmes for the students of SC/ST communities under VASP".
14. Part of Faculty Advisory Committee for IPhD students
15. Sports Coordinator for the centre: Supervising the ongoing process of installing/maintaining exercise equipment in the gym based on feedback and organizing year round sports events.

Patents Taken and Process Developed with Details

1. Applied for patent at Indian patent office as co-inventor of "A MAGNETIC FIELD MEASUREMENT DEVICE". A. A Wagh (inventor), S. G. Bhat (inventor), A. Haldar (inventor), P.S.A. Kumar (inventor); Application no. 202641003720; Applied

Awards, Recognitions, if any

1. Our work "Hidden magnon Berry curvature drives vertical magnon transport" has been selected as an Editor's Suggestion in Physical Review B. Editors' Suggestions are selected papers chosen to direct readers to interesting, important, and well-written articles in areas of research beyond their usual interests. They garner, on average, more downloads and citations than other papers published in the journal and are more frequently covered by news outlets (text adapted from Physical Review B's website).
2. Our work "Multiple Dirac spin-orbital liquids in SU(4) Heisenberg antiferromagnets on the honeycomb lattice" has been accepted as a letter in Physical Review B. PRB publishes detailed research articles as well as Letters, which are short accessible papers of particular importance (text adapted from Physical Review B's website).

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Harnessing the Interplay of Quantum Entanglement, Topology, and Strong Correlations in Condensed Matter Systems for Near-term Quantum Applications and Beyond; DST-India, ANRF India; 2 years; PI

Conference / Symposia / Schools organized

1. Convenor and organizer for Conference on "Physics of Non-equilibrium Systems" (CQNS 2025); 22/05/2025; SNBNCBS; 3 days

Outreach program organized / participated

1. Organized and presented scientific lectures and demonstrations at outreach program held at Department of Chemistry, Suri Vidyasagar College, Suri-731101, Birbhum, WB, India held on 08/05/2025
2. Organized and presented scientific lectures and demonstrations at science outreach program held at Sir Rajendra Nath Mukherjee Govt. Polytechnic, Bhyabla, Basirhat-743422, WB, India from 22.12.2025 to 23.12.2025

Areas of Research

Theoretical condensed matter physics. Sub-fields: quantum many-body theory, physics of disordered systems, quantum entanglement, transport, quantum and classical non-equilibrium phenomena, quantum field theory and topological phases.

I am a theoretical condensed matter physicist by training, with a background in quantum many-body theory, phase transitions, non-equilibrium quantum phenomena, and topological phases. My current research focuses on the interplay between quantum entanglement, topology, and strong correlations in condensed matter systems. I joined the SNBNCBS team on September 5, 2022. Since then, we have developed and published original ideas addressing various aspects of condensed matter physics and critical phenomena.

In our recent works, we have discovered new insights in the areas of quantum magnon geometry, quantum spin liquids and hydrodynamics of active-matter. These works are as follows.

1. We have predicted a new geometric quantity for magnons that can drive a previously unexplored form of magnon transport in layered 2D magnets. We have named this new geometric property the hidden magnon Berry curvature (HMBC), and we have proposed that HMBC can drive vertical magnon transport in layered magnets. Our work has been published in Physical Review B and was selected as an Editor's Suggestion. The published study was carried out by two students from our institute working closely with a single principal investigator, and it reflects the effectiveness of a tightly coordinated in-house effort.
2. In our work on quantum-spin liquids, we have proposed the existence of an exotic form of correlated phase known as spin-orbital Dirac spin liquid in realistic candidate materials. These spin liquids are important from the perspective of quantum computation as they can serve as potential platforms for fractionalized quasiparticles known as anyons which have been theorized to be the ideal candidates for topological qubits. Our findings have been accepted as a letter in Physical Review B.
3. In another study, we have developed a general hydrodynamic theory for active-fluids, capable of describing living matter, that conserve dipole-moment or center-of-mass. Dynamics under dipole conservation has received significant attention in recent times due to its connection with an exotic form of immobile quantum matter called fractons. In a classical setting, dipole-conservation has been shown to cause a breakdown of hydrodynamics in passive ("non-living") fluids. We have shown that introducing activity (of the kind found in "living" fluids) can revive hydrodynamics even under the constraints imposed by dipole conservation and also leads to interesting phenomena such as superdiffusion.

Plan of Future Work Including Project

Constrained active matter. Understand the role of dipole and higher-moment conservation in more generalized theories of active matter and to explore novel emergent dynamical phases.

Emergent gauge theories in lattice systems. Investigate the effective gauge theories in lattice models as a framework for understanding complex collective phenomena in condensed matter systems.

Explore the role of quantum geometry as a precursor to novel topology. Quantum geometry characterizes the structure of Hilbert space and captures information invisible to topological invariants. Two central quantities in this context are the Berry curvature and the quantum metric. An intriguing direction would be to explore quantum-metric-induced transport phenomena.

Magnons and novel quasiparticles in quantum spin systems. Investigate the role of magnons and other emergent quasiparticles in quantum spin systems and related platforms, with an emphasis on unconventional magneto-transport phenomena in quantum materials.

Quantum entanglement and strong correlations

a. Enhance the fundamental understanding of quantum entanglement and strong electronic correlations, and explore their potential applications in future quantum technologies and devices.

b. Develop analytical and computational frameworks to characterize quantum entanglement in condensed matter systems exhibiting strong electron-electron interactions.



Jaydeb Chakrabarti

Senior Professor/CSIR Emeritus Scientist
Physics of Complex Systems
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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Anirban Pal; Biomolecular systems; Awarded
2. Kanika Kole; Biomolecular systems; Awarded
3. Anusree Sen; Biomolecular systems; Under Progress; Rajib Kumar Mitra, Supervisor
4. Sabuj Mandal; Soft matter systems; Under Progress; Punyabrata Pradhan, Supervisor
5. Avik Sasmal; Soft matter systems; Under Progress; Tanusri Saha Dasgupta, Joint-Supervisor

Teaching

1. Fall 2025; PHY 403: Classical Dynamics; Integrated PhD; 12 students

Talks / Seminars Delivered in reputed conference / institutions

1. Coarse grained simulation of proteins; 17-07-25; AISECT, Hazaribag; 3 days
2. From atoms to proteins: Molecular Dynamics as tool; 01-12-25; IIT Madras; 5 days
3. Conformational contribution to thermodynamics in Bio-molecular complexes; 18-07-25; VBU, Hazaribag
4. Coarse grained simulation of protein; 14-08-25; BHU

Conference / Symposia / Schools organized

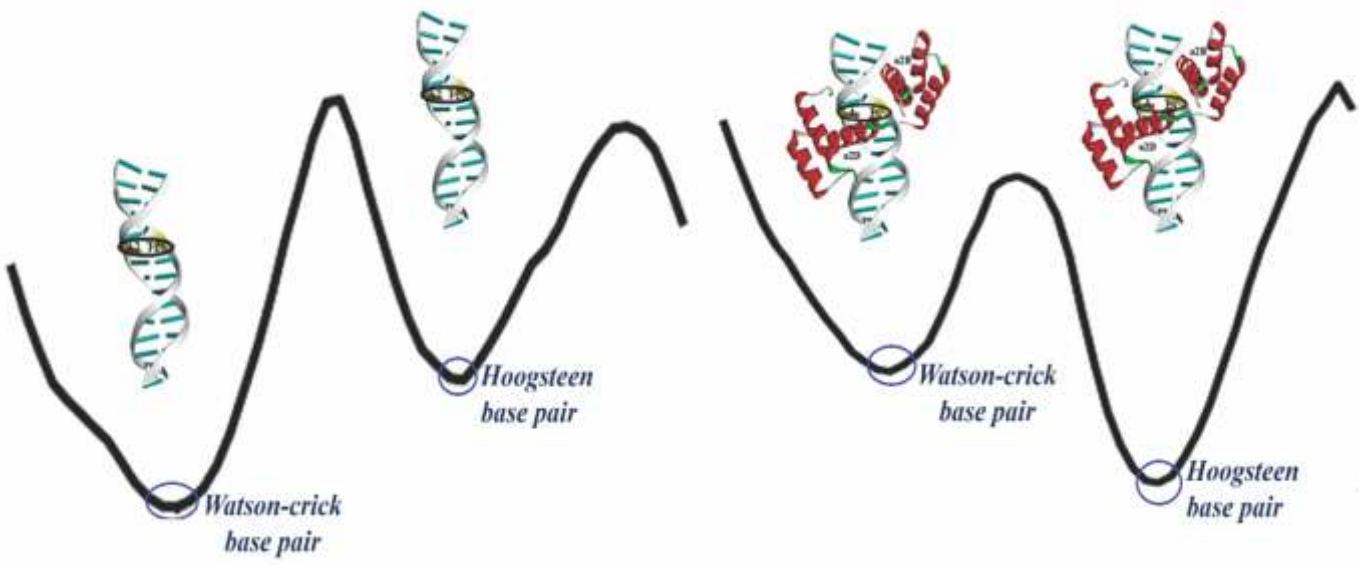
1. Stat Mech Meet Kolkata-2026; September, 2026; SNBNCBS; 2 days

Areas of Research

1. **Biomolecular Systems**: Kanika Kole and Jaydeb Chakrabarti, Free Energy Landscape between Watson–Crick to Hoogsteen Base Pairing Transitions. The Journal of Physical Chemistry B 129, 2025, 9600-9608.

The ability of individual Watson-Crick (WC) base pair (bp) in duplex DNA to transition to alternative pairing modes, such as Hoogsteen (HG) bp, on biologically relevant timescales has significantly influenced DNA research for many years. Such bp transitions in the presence of proteins are not well documented in the literature. Here, we employ the Well-Tempered Metadynamics (WT-MetaD) method to determine the lowest free energy path for the transition between WC and HG bp in naked DNA to standardize our protocol of using the glycosidic angle (c) as collective variable (CV) and reproduce previously reported experimental and simulation data. We use these protocols for the bp transition in the presence of proteins. For the transition between WC ® HG bp, the energy barrier decreases to approximately 8 kcal/mol in the presence of proteins compared to naked DNA, and the HG bp becomes ~ 4.0 kcal/mol more stable than the WC bp. In contrast, for the reverse HG ® WC transition, the energy barrier increases to nearly 12 kcal/mol, with the HG bp remaining ~ 3 kcal/mol more stable than its WC counterpart.

2. **Soft matter systems**: Tamisra Pal and Jaydeb Chakrabarti, "Molecular Dynamics Study on Polymer Nanocomposite on a Substrate with Different Nanoparticle Architecture", Adv. Theory Simul. 2026, 9, e01243



Here, the effects of nanoparticle (NP) architecture are investigated on polymer mobility in polymer films on a substrate. Our findings reveal that lower interaction strength between polymer and NP facilitates greater polymer mobility, reflected in increased diffusion coefficient values, while stronger interactions result in reduced diffusivity. Due to the asymmetric structure of tetrapod NPs, the polymer motion is faster compared to spherical and dumbbell NPs, respectively by creating more free volume around the NPs. This has been substantiated by the stronger local ordering of polymer chains around spherical NPs, where the simple geometry promotes tighter packing. In contrast, the complex architecture of tetrapod NPs reduces local ordering, introduces geometric frustration in the surrounding polymer matrix, leading to less effcient packing and more free volume, which enhances polymer mobility. Additionally, films with holes are healed faster in a polymernano composite with tetrapod NPs than the other architecture.



Manik Banik

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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Kunika Agarwal; Study of Quantum Information Theoretic Protocols and Their Implications in Quantum Foundations; Under Progress
2. Sahil Gopalkrishna Naik; A comprehensive study on composite physical systems and their application in information protocols; Thesis Submitted
3. Samrat Sen; A Study on Various Discrimination Tasks and Their Implications in Quantum Information Processing; Thesis Submitted
4. Ram Krishna Patra; Study of Quantum Resources to Devise Advanced Communication Protocols; Thesis Submitted
5. Snehasish R. Chowdhury; Exploring Non-classical Correlations: Insights from Thermodynamics and Information Theory; Under Progress; Prof. Guroprasad Kar (ISI, Kolkata), Supervisor
6. Ananya Chakraborty; Study of Information Processing Protocols and Exploring Quantum Advantages in Communication Task; Under Progress
7. Jayashree Karmakar; Quantum Foundations; Under Progress
8. Biswadeep Chatterjee; Mathematical structure underlying quantum protocols; Under Progress
9. Rafiuddin Gazi; Quantum Information Theory; Under Progress

b) Post-Docs

1. Subhendu B. Ghosh; Quantum Foundations and Quantum Imaging
2. Pratik Ghosal; Quantum Protocols
3. Ananda Gopal Maity; Quantum Imaging and Quantum Estimation Theory

Teaching

1. Spring Semester; PHY 524; Integrated PhD; 10 students
2. Spring Semester; PHY 624; PhD; 4 students

Publications

a) In journals

1. Ram Krishna Patra, Kunika Agarwal, Biswajit Paul, Snehasish Roy Chowdhury, Sahil Gopalkrishna Naik and **Manik Banik**, *Quantum Incompatibility in Parallel versus Antiparallel Spins*, Physical Review Letters, 136, 110402, 2026
2. Sahil Gopalkrishna Naik, Mani Zartab, Nicolas Gisin, **Manik Banik**, *No-go theorem for generic simulation of qubit channels with finite classical resources*, Proceedings of the Royal Society A, 482, 2333, 2026
3. Ananya Chakraborty, Kunika Agarwal, Sahil Gopalkrishna Naik and **Manik Banik**, *Advantage of Greenberger-Horne-Zeilinger correlation in communication complexity: A step beyond the conventional Greenberger-Horne-Zeilinger paradox*, Physical Review A, 112, 012214, 2025

4. Mir Alimuddin, Snehasish Roy Chowdhury, Ram Krishna Patra, Subhendu B. Ghosh, Tommaso Tufarelli, Gerardo Adesso and **Manik Banik**, *Ergodiscord: An operational and distinct notion of quantumness of correlations*, Physical Review Research, 7, 023200, 2025

Independent publications of student/s

5. Saheli Mukherjee, Bivas Mallick, Sahil Gopalkrishna Naik, Ananda G. Maity and A. S. Majumdar, *Detecting genuine multipartite entanglement using moments of positive maps*, Physical Review A, 112, 062428, 2025
6. Snehasish Roy Chowdhury, Subhendu B. Ghosh, Tathagata Gupta, Anandamay Das Bhowmik, Sutapa Saha, Some Sankar Bhattacharya and Tamal Guha, *Local inaccessibility of random classical information and their implications in the change-point problem*, Physical Review A, 112, 052401, 2025
7. Samrat Sen, *Conclusive local state marking: More nonlocality with no entanglement*, Physical Review A, 112, 052225, 2025
8. Saheli Mukherjee, Bivas Mallick, Arun Kumar Das, Amit Kundu and Pratik Ghosal, *Measurement-device-independent Schmidt number certification of all entangled states*, Physical Review A, 112, 062434, 2025
8. Joshua Carlo A. Casapao, Ananda G. Maity, Naphan Benchasattabuse, Michal Hajdušek, Rodney Van Meter & David Elkouss, *Disti-Mator, an entanglement distillation-based state estimator*, Communications physics, 8, 461, 2025

b) Other Publications

i) Conference proceedings / Reports / Monographs

Independent publications of student/s

1. J. C. A. Casapao, A. G. Maity, N. Benchasattabuse, M. Hajdusek, A. Soeda, R. Van Meter, and D. Elkouss; A Double Selection Entanglement Distillation-Based State Estimator, 2025 IEEE International Conference on Quantum Computing and Engineering (QCE), Albuquerque, NM, USA, 2025, pp. 1089-1097, doi: 10.1109/ QCE65121.2025.00122

Talks / Seminars Delivered in reputed conference / institutions

1. Configuration Dependent Complementarity: A New Perspective on Bohr's Principle; 08/12/2025; QWS 2025, Khalifa University of Science and Technology UAE; 60 minutes
2. Physics of Communication; 13/09/2025; TQC 2025, IISc, Bengaluru; 120 minutes
3. Measurement Complementarity in Parallel vs Anti-Parallel Qubits; 31/03/2025; CQuERE, TCG CREST, Kolkata; 60 minutes
4. Evolution of Physical Worldviews: The Shifting Foundations of Physics; 17/07/2025; C. K. M. memorial summer workshop in Physics at SNBNCBS; 60 minutes
5. Quantum Incompatibility in Parallel vs Antiparallel Spins; 23/05/2025; Physics of Nonequilibrium systems, SBNCBS; 45 minutes

Administrative duties

1. Convener of the Committee for conducting outreach programmes for the students of SC/ST communities under VASP
2, Member of Seminar & Colloquia Programme (SCOLP) sub-committee under EVLP
3. Member of Computer Service Cell Advisory Committee (CSA-AC)
4. Coordinator & Convener of Theoretical Physics Seminar Circuit (TPSC)
5. Member and Chairman of Media Cell of the Centre

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Design and Development of Quantum Entanglement Enhanced Imaging Systems; National Quantum Mission (NQM); DST, GoI; 6 years (up to 2031); PI

Conference / Symposia / Schools organized

1. Theory of Quantum Computation, Communication and Cryptography (TQC); 13/09/2025; IISc, Bengaluru; 13/09/2025 - 19/09/2025 (National Organizer)

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Prof. Nicolas Gisin, University of Geneva, Switzerland; Sl. No. 2; International
2. Prof. Gerardo Adesso, University of Nottingham, United Kingdom; Sl. No. 4; International
3. Prof. Tommaso Tufarelli, University of Nottingham, United Kingdom; Sl. No. 4; International

Outreach program organized / participated

1. Two-day Science outreach; Dec 22-23, 2025 at Sir R. N. Mukherjee Govt. Polytechnique, Basirha

Areas of Research

Quantum Information Theory, Quantum Technology, Quantum Foundations

Our group mostly investigates how information, correlations, and physical principles shape quantum theory and enable advantages beyond classical limits, thereby connecting foundational questions with emerging quantum technologies. The core research topic during the last one is covers study of non-classicality in multipartite systems, exploring quantum Communication protocol, and bridging quantum foundations with quantum technology. During last one year I have mentored nine PhD students (three received their PhD degree) and three Post-Doctoral Fellows. I have also taken a I-PhD and PhD course work on Quantum Information Theory.

Plan of Future Work Including Project

In the coming years, our group aims to advance research at the interface of quantum information theory and quantum foundations, with a particular focus on identifying operational advantages of quantum resources in realistic, near-term settings. Our overarching goal is to deepen the theoretical understanding of quantum resources while simultaneously developing concepts that are relevant for emerging quantum technologies.

Quantum Resources in Communication Complexity and Simultaneous Message Passing: A central theme of our research will be to explore the utility of elementary quantum resources-specifically qubits and entanglement-in communication complexity scenarios, with an emphasis on simultaneous message passing (SMP) models. We aim to identify tasks where quantum communication offers provable advantages over classical protocols, even under stringent constraints such as limited communication, absence of shared randomness, or noise. Beyond demonstrating separations, we will focus on understanding the structural origins of these advantages and their connections to foundational notions such as nonlocality, contextuality, and information causality.

Efficient Quantum State and Process Estimation: Another key objective is the development of efficient and resource-frugal methods for quantum state and process estimation. We will investigate novel estimation strategies that leverage quantum correlations, adaptive measurements, and informationally optimal POVMs to reduce experimental overhead. This direction aligns closely with the goals of the National Quantum Mission (NQM), particularly ongoing efforts on entanglement-enhanced quantum imaging. By integrating ideas from quantum estimation theory with practical imaging protocols, we aim to design schemes that achieve enhanced sensitivity and robustness under realistic noise and hardware limitations.

Measurement Incompatibility in Multicopy Scenarios: Measurement incompatibility is a fundamental nonclassical feature underlying quantum advantage in tasks such as steering, nonlocality, and quantum communication. We plan to systematically study measurement incompatibility in multicopy settings, where collective measurements across several copies of a quantum system can lead to emergent compatibility or enhanced operational power. Our goal is to characterize when and how incompatibility can be activated, suppressed, or transformed through multicopy strategies, and to connect these effects to concrete information-processing advantages. This line of inquiry will contribute to a deeper foundational understanding of quantum measurements while informing practical protocols that exploit collective quantum effects.

Expected Impact: Collectively, these research directions aim to establish new, scalable advantages of quantum resources in the near-term quantum regime, strengthen the conceptual foundations of quantum theory, and contribute directly to the development of quantum communication, sensing, and imaging technologies



Prosenjit Singha Deo

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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Naomi Karmakar; Condensed matter physics
2. Subhrajyoti Pal; Condensed matter physics

Teaching

1. Autumn Semester; Mathematical Physics; Integrated PhD; 14 students; shared with Pof. S. Gangopadhyay
2. Spring Semester; Superconductivity and magnetism; Integrated PhD; 4 students; shared with Prof. A. Barman

Talks / Seminars Delivered in reputed conference / institutions

1. Mesoscopic route to time travel; 09/03/2026; ISI Kolkata; 1 hour
2. Time travel: a reality in mesoscopic Physics; 09/03/2026; ISI Kolkata; 1 hour

Administrative duties

1. Library committee member

Scientific collaborations with other national / international institutions

1. K. Meena at Weizman Institute, Israel; International
2. Souvik Ghosh at National sun yat sen, Taiwan; International

Areas of Research

Mesoscopic Physics; Transport related problems in mesoscopic systems



Punyabrata Pradhan

Professor
Physics of Complex Systems
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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Animesh Hazra; Studies of dynamic properties of mass transport processes; Thesis Submitted
2. Aniket Samanta; Fluctuating hydrodynamics of conserved-mass transport processes; Under Progress
3. Sabuj Mandal; Equilibrium and non-equilibrium phenomena in the presence of impurities on a colloidal system; Under Progress; Jaydeb Chakrabarti (Supervisor)
4. Koushik Das; Studies of chiral matter; Under Progress
5. Anol Bandyopadhyay; Studies of two-species mass transport processes; Under Progress

b) Post-Docs

1. Olivia Mallick; Dynamic properties of Ising lattice gases

c) External Project Students / Summer Training

1. Debdita Ghosh; Density Relaxation in Exclusion Processes
2. Ritabrata Sarkar; Simulation And Hydrodynamic Analysis of Conserved Manna Sandpile

Teaching

1. Autumn Semester; PHY 407; Integrated PhD; 14 students; Shared with Arijit Haldar
2. Spring Semester; PHY 404; Integrated PhD; 14 students; Shared with Sunandan Gangopadhyay

Publications

a) In journals

1. Tanmoy Chakraborty and **Punyabrata Pradhan**, *Anomalous current fluctuations and mobility-driven clustering*, Journal of Statistical Mechanics: Theory and Experiment, 2025, 093203, 2025
2. Animesh Hazra, Tanmoy Chakraborty, Anirban Mukherjee and **Punyabrata Pradhan**, *Generic power laws in higher-dimensional lattice models with multidirectional hopping*, Physical Review E, 112, 044130, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Invited talk in an international conference "STATPHYS Kolkata XIII". Title: Power-law correlations in mass transport processes: Symmetries and conservation laws; 14/01/2026; S. N. Bose National Center for Basic Sciences, Kolkata; January 12 - 17, 2026
2. Invited talk in a conference "Nonequilibrium Systems and Stochastic Processes". Title: Generic power laws in higher-dimensional lattice models with multidirectional hopping; 24/11/2025; Raman Research Institute, Bengaluru; November 24 - 28, 2025
3. Invited talk in a conference "classical and quantum non-equilibrium systems". Title: Dynamic fluctuations in systems with broken time-reversal symmetry and centre-of-mass conservation; 22/05/2025; S. N. Bose National Center for Basic Sciences, Kolkata; May 22 - 23, 2025

Administrative duties

1. HOD (DPCS)
2. Chairperson of newsletter committee
3. Chairperson of the computer service cell working group (CSC-WG)

4. Media cell member
5. PhD and IPhD interview / admission committees
6. Various other technical committees

Conference / Symposia / Schools organized

1. Discussion meeting "Stat. Mech. Meet Kolkata" (SMMK); 19/09/2025; SN Bose National Centre for Basic Sciences, Kolkata; September 19, 2025

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Collaboration with Anirban Mukherjee, Institute of Physics, Academia Sinica, Taipei 11529, Taiwan; Sl. No. 2; International
2. Collaboration with Tanmoy Chakraborty, Department of Physics, Technion - Israel Institute of Technology, Haifa 3200003, Israel; Sl. No. 1; International

Areas of Research

Hydrodynamic (large-scale) characterization of non-equilibrium mass transport processes (such as conserved-mass fragmentation and aggregation models, self-propelled particles, and threshold-activated systems like sandpiles, etc.)

Fluctuation relations in and large-deviation properties of driven systems

Single-file transport through confined geometry in the presence of time-dependent drive

Hyperuniformity and studies of fluctuations

Symmetries and multiple conservation laws in determining relaxation and fluctuations in driven diffusive systems

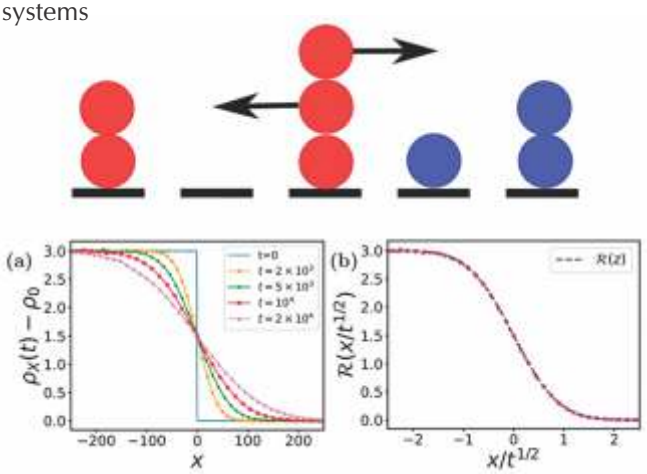


Figure 1: Density relaxation in a (hyperuniform) system with centre-of-mass conserving dynamics (analogous to dipole-conserving dynamics in quantum many-body systems)

The central theme of our current research involves characterization of out-of-equilibrium systems through studies of large-scale (hydrodynamic) properties of paradigmatic mass transport processes (such as sandpiles, mass aggregation and fragmentation processes, and run-and-tumble particles, etc.), fluctuation relations in driven systems, and single-file transport in the presence of external time-periodic drive, etc. From a general point of view, we aim to formulate a statistical mechanics framework for a broad class of driven systems, based on symmetries and conservation laws, which are expected to determine relaxation and fluctuations in such systems. A brief description of our recent work is presented below, with an emphasis on the key conceptual advances and exact results obtained last year.

(1) We identify a key dynamical ingredient - multidirectional hopping, where multiple particles simultaneously hop out from a site in several directions - that gives rise to scale-invariant feature in isotropic systems. In higher-dimensional, mass-conserving lattice models with such dynamics, power-law correlations emerge robustly across generic parameter regimes, even far from any absorbing-phase transition or critical point. Our findings are substantiated through detailed analysis of (i) conserved mass chipping models and (ii) conserved sandpile models. Our theory provides a unifying framework for understanding how scale-invariant spatial structures can naturally emerge in conserved, symmetry-preserving driven systems.

(2) Hyperuniform systems constitute a remarkable class of disordered yet strongly correlated state of matter where large-scale density fluctuations are anomalously suppressed and consequently the compressibility vanishes. Hyperuniformity has emerged as a fundamentally nonequilibrium phenomenon, observed in systems such as conserved sandpiles and biased random organization, etc. We have developed a microscopic theory for a broad class of nonequilibrium mass transport processes that conserve both mass and center of mass (CoM). These models - closely related to mass chipping models (MCMs), random average processes (RAPs), and continuous-mass variants of sandpiles - violate detailed balance and possess nontrivial correlated steady states. By focusing on analytically tractable CoM-conserving dynamics in one and two dimensions (with generalization to arbitrary dimensions), we uncover how multiple conservation laws fundamentally alter large-scale spatio-temporal behavior. Our results elucidate how conservation laws affect static and dynamic correlations in interacting nonequilibrium systems.

Plan of Future Work Including Project

1. Dynamic characterization of chiral active matter, nongradient lattice models and nonreciprocal systems.



Sakuntala Chatterjee

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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Deepsikha Das; Interacting particle systems with time-periodic drive; Awarded
2. Chandradip Khamrai; Ordered and disordered states in coupled driven systems; Under progress
3. Ramesh Pramanik; Bacterial chemotaxis in time-varying environment; Under progress
4. Pallabi Roy; Stochastic Response of Some Biochemical and Biophysical Systems; Under progress
5. Debojit Sen; Clustering and declustering in interacting particle systems; Under progress
6. Ajay Sharma; Study of Blazars in High Energy Regime; Thesis Submitted

b) Post-Docs

1. Ramu K Yadav; Hystereris in Bacterial Chemotaxis

c) External Project Students / Summer Training

1. Anurag Agarwal (Summer project) Run-tumble particle in external force field

Teaching

1. Spring Semester; PHY 494 Research Project 1 (Summer); Integrated PhD; one student
2. Autumn Semester; PHY 509 Project Research II; Integrated PhD; one student

Publications

a) In journals

1. Shobhan Dev Mandal and **Sakuntala Chatterjee**, *Bacterial chemotaxis in a traveling wave attractant environment*, Journal of Statistical Mechanics: Theory and Experiment, 2025, 063501, 2025
2. Ramesh Pramanik, Ramu K. Yadav & **Sakuntala Chatterjee**, *Dynamics of chemoreceptor activity with time-periodic attractant field*, European Physical Journal E, 48, 60, 2025
3. Chandradip Khamrai and **Sakuntala Chatterjee**, *A novel mechanism of ordering in a coupled driven system: vacancy induced phase separation*, Journal of Statistical Mechanics: Theory and Experiment, 2026, 023201, 2026 (DOI: 10.1088/1742-5468/ae373f)

Talks / Seminars Delivered in reputed conference / institutions

1. Invited talk at international conference "Hydrodynamics, Fluctuations, and Noise in quantum and classical systems"; 04/12/2025; ICTS Bangalore; December 1-12, 2025
2. Talk at Indian Statistical Physics Community Meeting; 23/04/2025; ICTS Bangalore; April 23-25, 2025
3. Invited talk at "Stat Mech Meet Kolkata"; 19/09/2025; SNB; September 19, 2025

Administrative duties

1. Served at many internal committees of the center

Awards, Recognitions, if any

1. Co-editor of the journal EuroPhysics Letters
2. Member of Editorial Board of Journal of Biosciences
3. Member of C6 commission of IUPAP

Membership of Learned Societies

Member of C6 commission of IUPAP; Editorial board member of EuroPhysics Letters, Journal of BioSciences

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. Bacterial Chemotaxis in presence of spatio-temporal variation in extra-cellular environment and of intra-cellular noise : a theoretical study; ANRF, DST; 11 June 2024 - 10 June 2027; PI

Conference / Symposia / Schools organized

1. StatPhys Kolkata XIII; 12/01/2026; SNB; January 12 - 16, 2026

Outreach program organized / participated

1. Online seminar organized by Bhauthiki, The Physics Association of NIT Calicut on 15th October 2025. Talk Title "Bacterial chemotaxis in time-varying environment"

Areas of Research

Nonequilibrium Statistical Physics, Biological Systems

Vacancy Induced Phase Separation:

We study a coupled driven system where two different species of particles, along with some vacancies or holes, move in a landscape whose shape fluctuates with time. The movement of the particles is guided by the local shape of the landscape, and this shape is also affected by the presence of different particle species. The nature of this coupling plays a crucial role in the formation of long range order in the system. When a particle species pushes the landscape in the same (opposite) direction of its own motion, it is called an aligned (a reverse) bias. Aligned bias promotes ordering while reverse bias destroys it. In the absence of vacancies, the system reduces to the previously studied light-heavy model for which different kinds of ordered and disordered phases were observed. These phases could be explained as a competition or cooperation between aligned bias and reverse bias coming from different particle species. This interplay is expected to remain unaffected even when vacancies are present since vacancies do not impart any kind of bias on the landscape. However, we find that the presence of vacancies effectively weakens the reverse bias and this significantly changes the outcome of the competition between the two bias types. As a result, novel ordered phases emerge which were not seen before. We analytically calculate the new phase boundaries within the mean field approximation. We show that even when the aligned bias is weaker than the reverse bias, it is possible to find long range order in the system. We discover two new phases where the particle species showing weak aligned bias phase separate and the other species with strong reverse bias stays mixed with the vacancies. We call these phases finite currents with partial phase separation (FPPS) and vacancy induced phase separation (VIPS). The landscape beneath the phase separated species takes the form of a macroscopic hill or valley in the FPPS phase. However, in the VIPS phase it has a shape similar to a plateau whose height scales as the square root of the system size. The landscape of the remaining part of the system is disordered in both these phases.

Hystereris in Bacterial Chemotaxis

When exposed to a time-periodic chemical signal, an E.coli cell responds by modulating its receptor activity in a similar time-periodic manner. However, there exists a phase lag between the applied signal and the activity response. We study the variation of the activity amplitude and phase lag as a function of the applied frequency. The amplitude shows a peak with frequency, while the phase lag increases monotonically and saturates for large frequency. The activity is no longer a single-valued function of the attractant signal, and plotting activity versus attractant concentration over one complete time period generates a hysteresis loop, which was never seen before. We explain these results as an interplay between the time scales associated with adaptation, activity switching, and applied signal variation.

Plan of Future Work Including Project

1. Using the technique of Reinforcement Learning to study bacterial chemotaxis in spatio temporally varying environments



Sanku Paul

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Guidance of Students/Post-Docs

a) Ph.D. Students

1. Avra Banerjee; Observing prethermal Mpemba effect in quantum chaotic system

b) External Project Students / Summer Training

1. Amrit Sagar Kar; Semiclassical Approach to Quantum Chaos; SNBNCBS, Kolkata

Publications

a) In journals

1. J. Bharathi Kannan, Sreeram PG, **Sanku Paul**, S. Harshini Tekur and M. S. Santhanam, *Probing the localization effects in Krylov basis*, Physical Review E, 112, 044203, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Controlling quantum correlation in out-of-equilibrium dynamics; 12/02/2026; Raman Research Institute, Bengaluru; 1 hour

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. DST INSPIRE Faculty Research Grant; DST INSPIRE; 01/04/2025-31/03/2026; PI

Areas of Research

1. Distinguishing Quantum Localization Phenomena using Krylov Complexity:

   Quantum localization refers to the suppression of wave propagation due to destructive interference effects. Localization phenomena play an important role in controlling quantum transport, designing stable quantum devices, and understanding quantum dynamics. Several types of localization have been identified, such as classical-induced localization, which arises from classical phase-space structures, localization due to quantum anti-resonance, dynamical localization, and power-law localization.

   Our question is that whether these distinct localization phenomena can be distinguished using a quantum state complexity measure such as Krylov complexity. Recently, quantum complexity has attracted significant attention, particularly in quantum many-body physics and quantum computation. Previous studies have demonstrated that Krylov complexity can effectively distinguish between chaotic and regular regimes. In our work [Phys. Rev. E 112, 044203 (2025)], we demonstrate that Krylov complexity is a powerful tool which successfully identifies and differentiates the distinct types of quantum localization phenomena.

2. Secure transmission of digital images:

   In the era of digitization, secure transmission of digital images has become essential in real world applications. Image encryption is an effective technique for protecting image data from unauthorized access. The security of encrypted data strongly depends on the quality of the

random numbers used as the encryption key. In this work, we developed a pseudo random number generator based on quantum fluctuations and an algorithmically inspired rotating wheel. The wheel contains integer values from 0 to 255 that are shuffled using quantum fluctuations generated by time-evolving the quantum kicked rotor model. We show that the random number generated has nearly zero correlation, indicating strong randomness. We further applied these generated sequences to the image encryption and analyzed cryptographically. Remarkably, the random number generator, we constructed, achieves efficient and high-security performance. [Int. J. Theor. Phys. 65, 164 (2026)]

Plan of Future Work Including Project

i) Quantum battery:

A quantum battery is a quantum mechanical device designed to store and release energy. It has become a major focus of current research due to their striking advantages over traditional chemical battery, as well as significant experimental advances in their development. While several approaches have enhanced the charging process of quantum battery displaying a superlinear behavior of charging power with number of cells, but scaling with time remains largely unexplored. Furthermore, it is known that quantum correlations can enhance the energy extraction process. However, the efficiency - the ratio of energy extracted to stored energy – is negatively affected by the quantum correlations. Our question is whether there exists a genuine quantum phenomenon that can simultaneously obtain near perfect efficiency even in the presence of strong entanglement and also obtain superlinear charging power with time. To this end, we consider two batteries composed of free rotors charged by time-periodic interaction potential. We tune the system to quantum resonance, a genuinely quantum phenomenon with no classical analogue, and investigate its positive role in enhancing the performance of quantum battery.

ii) Quantum Mpemba effect:

Systems out of equilibrium often shows phenomena which are beyond our conventional prediction. One such puzzling example is the Mpemba effect. It was originally observed in classical system where hot water freezes faster than cold water. Recently, a quantum analogue is observed, a state which is far from equilibrium relaxes faster than one closer to it. This phenomenon has found applications in quantum information, computation and technology, particularly, in initial state preparation. Our goal is to explore the interplay of disorder and chaos in observing quantum Mpemba effect. For this, we consider a disorder kicked rotor which is subjected to a non-linear interaction.



Urna Basu

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Guidance of Students/Post-Docs/Scientists

a) Ph.D. Students

1. Ritwick Sarkar; Activity driven transport; Under Progress
2. Debraj Dutta; Inertial active matter; Under Progress
3. Ayandip Roy; Nonequilibrium transport processes; Under Progress

b) Post-Docs

1. Suchismita Banerjee; Characterization of air pollutant fluctuations through statistical physics measures

Teaching

1. Spring Semester; PHY 502; Integrated PhD; 1 student
2. Autumn Semester; PHY 509; Integrated PhD; 1 student
3. Spring Semester; PHY 494; Integrated PhD; 1 student

Publications

a) In journals

1. Debraj Dutta, Ritwick Sarkar and **Urna Basu**, *Stochastic two-temperature nonequilibrium Ising model*, New Journal of Physics, 28, 034602, 2026
2. Koyena Ghosh, Suchismita Banerjee, **Urna Basu** & Banasri Basu, *Classifying urban regions by aggregated pollutant–weather correlation strength: a spatiotemporal study*, Stochastic Environmental Research and Risk Assessment, 40, 76, 2026
3. Ritwick Sarkar, Sreya Chatterjee and **Urna Basu**, *From attraction to repulsion: emergent interactions in harmonically coupled active binary system*, Journal of Physics A: Mathematical and Theoretical, 58, 415001, 2025
4. Ritwick Sarkar and **Urna Basu**, *Emergent short-range repulsion for attractively coupled active particles*, Soft Matter, 21, 3595-3603, 2025

Talks / Seminars Delivered in reputed conference / institutions

1. Invited talk at the international meeting 'Women at the Intersection of Mathematics and Theoretical Physics'; 29/12/2025; ICTS-TIFR, Bengaluru; 5 days
2. Invited talk at the international conference 'Advances in Nonequilibrium Systems and Stochastic Processes'; 24/11/2025; Raman Research Institute, Bengaluru; 5 days
3. Contributed talk at 10th Indian Statistical Physics Community Meeting; 23/04/2025; ICTS-TIFR, Bengaluru; 3 days

Administrative duties

1. Member, Internal Complaints Committee
2. Member, Faculty Search Committee
3. Member, CWEP subcommittee of EVLP

4. Member, Admission Committee
5. Member, Media Cell
6. Member, SCOLP
7. Member of several tender committees

Extramural Projects (DST, CSIR, DAE, UNDP, etc.)

1. MATRICS ANRF (erstwhile SERB); 3 years; PI

Conference / Symposia / Schools organized

1. STATPHYS KOLKATA XIII; 12/01/2026; SNBNCBS; 5 days
2. C. K. Majumder Memorial Workshop; 15-24 July 2025; SNBNCBS; 10 days

Scientific collaborations with other national / international institutions (Sl. No. of paper/s listed in 'Publications in Journals' jointly published with collaborators)

1. Collaboration with Prof. Banasri Basu, Indian Statistical Institute; Sl. No. 2; National

Outreach program organized / participated

1. Pedagogical lecture titled 'From Passive to Active: Exploring Nonequilibrium Dynamics' at C. K. Majumdar Memorial workshop in July 2025

Areas of Research

Statistical Physics, nonequilibrium dynamics, active matter systems, critical phenomena, pollutant fluctuations

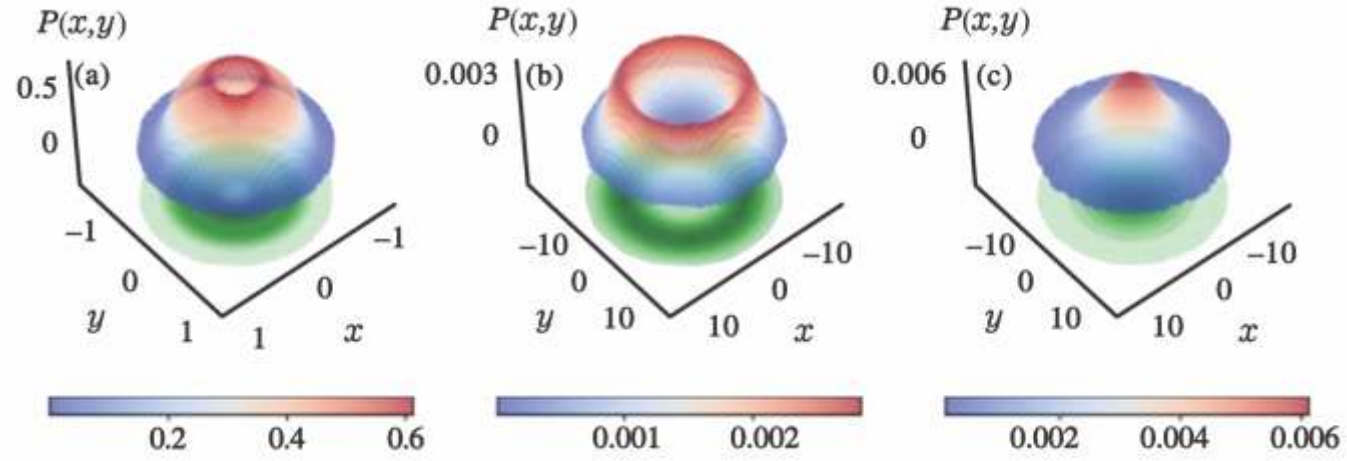
I work in the general area on nonequilibrium statistical physics with current focus in the areas of active particle dynamics, nonequilibrium transport and general properties of stochastic processes.

One of my main research interests is to study and characterize the properties of active particles, using simple, analytically tractable models. The properties of these particles are of immense interest as they behave very differently from their equilibrium counterparts. In a recent work, we have investigated the dynamics of a run-andtumble particle in a double-well potential and demonstrate that, in stark contrast to Brownian particles, active dynamics can lead to strong ergodicity breaking. When the barrier height exceeds a critical threshold, the long-time position distribution depends crucially on the initial condition: if the particle starts within the basin of attraction of one well, it remains trapped there, while if it begins between the two basins, it can reach either well with a finite probability, which we compute exactly via hitting probabilities. Below the critical barrier height, ergodicity is restored and the system converges to a unique stationary distribution, which we derive analytically. Using this result, we also estimate the characteristic barrier crossing time and show that it violates Kramer's-Arrhenius law, and displays a divergence near the critical height following a Vogel-Fulcher-Tammann-like form with an anomalous exponent 1/2.

In a different work, we have investigated the emergent interactions between two active Brownian particles coupled by an attractive harmonic potential and in contact with a thermal reservoir.

By analyzing the stationary distribution of their separation, we demonstrate that the effective interaction can be either attractive or repulsive, depending on the interplay between activity, coupling strength, and temperature. Notably, we find that an effective short-range repulsion emerges in the strong and moderate-coupling regimes, when the temperature is below some threshold value, which we characterizeanalytically [see Fig.]. In the strong-coupling regime, the repulsion emerges solely due to the difference in the self-propulsion speeds of the particles. We also compute the short-time position distribution of the centroid of the coupled particles, which shows strongly non-Gaussian fluctuations at low temperature.

I have also recently started using statistical physics techniques to understand and characterize fluctuations of air pollutants and how it depends on various climate variables. In another recent work, we develop an entropy-based statistical framework to analyze static and temporal dependencies between urban air pollutants and meteorological variables across multiple Indian cities. A key methodological contribution is a PCA-based composite indexing framework that integrates these heterogeneous metrics into a unified and interpretable correlation score. For each pollutant–meteorological pair within a city, PCA is used to extract a joint variability index, while spatial variability is assessed by aggregating correlations across cities. These indices are further combined to derive a comprehensive city-level correlation score that represents overall



pollutant–meteorology coupling strength and enables classification of cities into distinct interaction regimes. We also examine temporal dependencies using transfer entropy and time-delayed mutual information. Our results indicate that relative humidity generally leads changes in pollutant concentrations, whereas ambient temperature tends to lag, highlighting contrasting causal influences. Mutual information peaks at zero lag and decays rapidly following an exponential form, indicating strong short-term interactions with limited persistence. Overall, this framework provides a unified and interpretable approach for assessing complex pollutant–meteorology interactions across diverse locations and time.

Plan of Future Work Including Project

Presently we are studying the collective behaviour of a system of active particles with speed diversity. We find that dispersion in propulsion strength qualitatively alters collective behavior of active multi-particle systems interacting via short-range attractive potential, giving rise to novel ordered phases that combine spatial and orientational ordering. Considering a binary mixture of active Brownian particles with two distinct self-propulsion strengths, we find that, the interplay between interaction range, self-propulsion strengths and the relative numbers of the particles with different propulsion strengths can lead to three different phases, namely, a disordered one, and two ordered ones with partial and complete spatial and orientational ordering. We are currently focusing on characterizing these unusual phases and transitions between them

Another long-term project focuses on characterizing the air-pollutant fluctuations in Indian cities. Analysing long-term daily data, we find that despite diverse urban settings and heterogeneous climatic conditions, the fluctuations show strikingly universal behaviour in both the distributional properties and temporal dynamics. After removing slow trends and seasonal components, the rescaled probability density functions of the residual fluctuations collapse onto a single curve and are well described by an exponentially modified Gaussian distribution. We plan to investigate the temporal features and develop a minimal stochastic model for the residual dynamics, which explains the observed universal features.

Facilities










FOUR PILLARS



LIBRARY

About Library

Library of the Centre is the hub of learning and research activities. Since inception of the Centre in 1986, library has been playing an important role in providing information and various academic services to its users. The library also provides service to outside students, researchers and professionals working throughout the country and abroad in all possible ways.

Resources

The Library has a good and useful collection of documents. Presently library possesses more than 17748 books and 8000 bound volume journals. The Library subscribes to many useful journals published by reputed publishers mostly in electronic version. In addition, being a member of the National Knowledge Resource Consortium (NKRC), the library gets access to a wide range of online journals. The library is also equipped with databases like Web of Science, SciFinder Scholar, Mathscinet, ICSD (Inorganic Crystal Structure Database) etc. Library has a Fiction Section with popular books on English, Hindi and Bengali literature. It includes novels, short stories, biographies, dramas, and books on general interests aiming to satisfy all type of readers. The library has a good collection of audio-visual materials. In the magazine and newspaper reading section, 25 popular magazines and 13 daily newspapers in different languages have been subscribed regularly. The library is enriched with a valuable archive of S N Bose. This archive includes some personal belongings of S N Bose and some of his personal book collections. A digital version of the archive is available on the website.

Library Hours

The Library is open from morning 9.00 AM to 12.00 at night. During examination Library is open for whole night. Saturday 9.00 AM to 8.00 PM. However, circulation counter is open from 9:00 AM to 5:30 PM. Library is closed on Sundays and national holidays.

Library Users

On average, 50 users visit the library per day. Online journals and databases are accessible within the campus through the campus LAN and outside the campus through VPN. Therefore, users may use those online resources from their convenient places.

Services

1. **Reading Facility:** Library provides reading facility to its members as well as outside visitors. All the books including reference collections are classified and open-accessed.
2. **Document Lending Service:** Each member is entitled to issue 6 books and 2 bound volumes of journals at a time.
3. **Reference and Article delivery Service:** Reference service is provided via e-mail, telephone or personal interaction with the help of different reference tools like Web of Science, Annual Report etc. Non accessible journals' articles are collected from other libraries and provided to the faculty members and students on request.
4. **English language writing assistant software tool** : It is an AI-based software to review the spelling, grammar, and tone of a piece of writing as well as identifying possible instances of plagiarism.
5. **OPAC:** Library offers Online Public Access Catalogue (OPAC) which allows user to browse library collection by author, title, subject, classification number, etc. through web OPAC.
6. **E-resources and Internet Facility:** Library is well equipped with sufficient number of computers with internet connectivity through cable LAN and wireless networking facility for laptop users. The library has access to plenty of electronic journals, databases, archives, and consortium resources. Users have full access to the subscribed e-resources.
7. **Reprographic Services:** Library has printer cum copier, good colour printer, photocopy machine and poster printer for providing extensive reprographic services.
8. **Bibliometric Services:** Library helps to prepare various bibliometric reports, especially usage statistics, citation analysis, h-index, Impact factor of Journals, etc., as per users' requirements.

9 **Library Resource Sharing Activities:** The library shares its resources with all important academic/research institutions in India. As a member of the National Knowledge Resource Consortium (NKRC), the library keeps close contact with libraries under DST and CSIR. SNB library has institutional membership in the British Council Library (BCL), Kolkata and American Library Kolkata.

10 **Library is for Leisure:** Library has a separate section for Bengali, Hindi, and English literature, fiction, classic literature, novel, history, and books on general interest.

11 **Documentation Service:** Library has been compiling the Annual Report in Hindi and English versions, Diary, and Calendar of the Centre, and coordinating the process of printing. Printing and designing of different documents of the Centre like poster, conference brochure etc.

12 **New arrival Section:** The Library has a section where newly processed books are displayed for users every month. The same list is uploaded on the website every month, and an email notification is given to all library members.

13 **Research publication status and citation received:** Every month Library has been preparing pictorial research publication status of the Centre and citation received by those publications. The report also includes h-index, citation received per year etc. It is being uploaded to the website on a regular basis.

14 **S N Bose Archive and Museum:** The library has been maintaining the S N Bose Archive and Museum, where documents and articles related to S N Bose have been preserved. Library staff guide the visitors to explore the museum.

15 **Plagiarism detection facility :** Library is equipped with an international standard plagiarism detection facility.

16 The library has been getting access to major journals and databases through the 'One Nation One Subscription (ONOS)' scheme under the Ministry of Education

Resources and Services Added in the F.Y. 2025-26

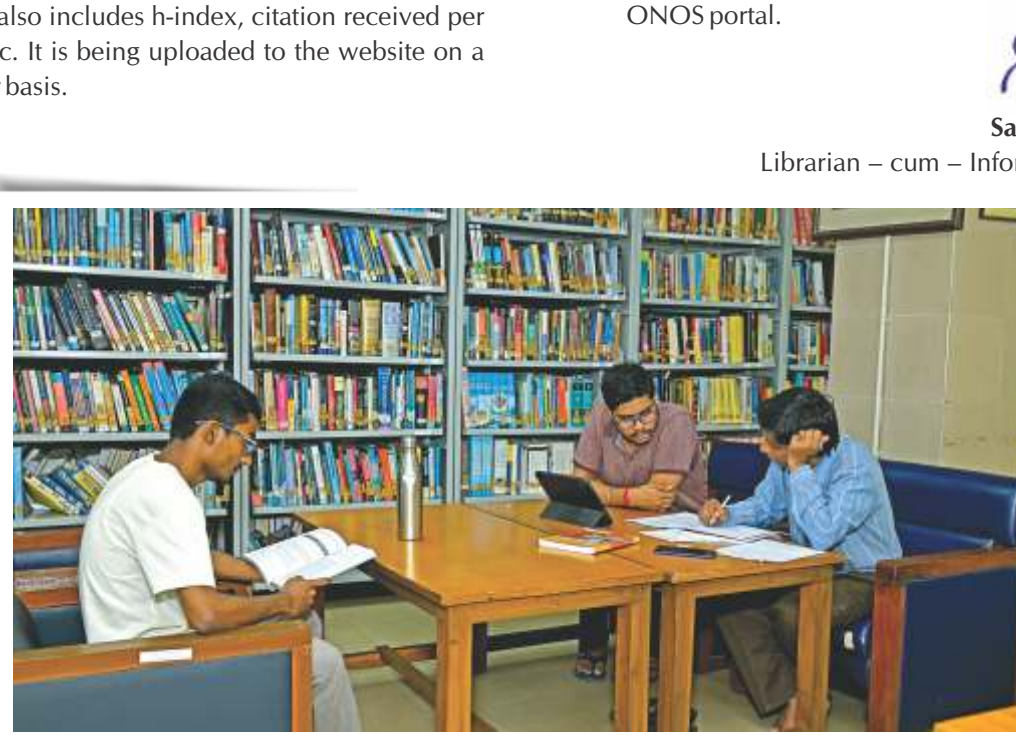
1 Approximately 260 new books and some new journals have been added to the library collection during the above-mentioned financial year.

2 Library has developed an institutional digital repository for PhD thesis.

3. In the Financial Year 2025-26, the Fiction Section has been enriched by procuring 15 books of classic literature, novels, short stories, biographies, and books of general interest.

4. 26 Hindi books have been added to the Library collection for the mentioned financial year.

5. The library has been providing support for the Article Processing Charges (APC) through the ONOS portal.



Saumen Adhikari
Librarian – cum – Information Officer

ENGINEERING SECTION

(Infrastructure Development, Maintenance & Housekeeping and Support Services)

A. Civil Work

1. Carpeting of Existing Bituminous Road along with Repairing of Pathway from Main Building to Bhagirathi Guest House at SNBNCBS
2. Renovation of Security Room near Main Gate, SNBNCBS
3. Replacing of Damaged Roof Sheet and Minor Civil works at Liquid Helium Plant, AHU Room adjacent of Clean Room and Old Workshop, SNBNCBS
4. Replacing of Damaged Roof Sheet and Minor Civil Repairing Works at Mechanical Workshop, SNBNCBS
5. Temporary Enclosure around Scrap Yard near Radhachura Hostel, Leveling-Dressing of Ground behind New Sub-station, Replacing of Damaged Wooden Door Frames of Krishnachura and Replacing of Damaged Wooden Door Shutters at Mumty Roof of Radhachura.
6. Lab rooms at ground floor of Main Building which were in dilapidated condition due to natural wear and tear have been repaired by damp proofing work, floor repairing, concreting and fresh painting.

B) Estate Office

Beside the upkeepment of the Centre's infrastructure and its assets, the Centre remains committed in promoting environmental sustainability and adopting eco-friendly practices across the campus. The following initiatives have been undertaken to strengthen the Centre's commitment towards sustainable development and cleanliness:

1. The campus landscape is regularly maintained and enhanced through effective horticultural and gardening practices to preserve its aesthetic appeal and ecological balance.
2. The Centre continues to uphold the concept of a "Zero Plastic Green Campus" by strictly discouraging the use of single-use plastic carry bags and plastic bags having a thickness of less than 75 microns.
3. As part of the "Swachhata Hi Seva" campaign, Sanitary Pad Vending Machines along with Disposal Units were installed on 15 May 2025 to provide a safe, hygienic and gender-friendly environment for the women employees of the Centre.
4. Waste generated from kitchens, canteens and garden areas is systematically segregated and processed through a Waste Compactor installed within the campus, thereby reducing the overall quantity of waste requiring disposal.



Carpeting of Existing Bituminous Road



Repairing of Lab rooms



DG Set Installation at SNBNCBS



Modification of street light

5. In line with sustainable waste management practices, organic fertilizers are prepared from biodegradable waste generated within the campus and are subsequently utilized for maintaining the Centre's green spaces.
6. World Environment Day was observed on 5 June 2025 through a sapling plantation drive organized within the campus premises, reinforcing the Centre's commitment towards environmental conservation and community participation.

C) Electrical

1. Operation & Maintenance of 02 Nos. of indoor type 11KV/0.433KV Electric Sub-stations that is delivering power to all its desired locations through 04 nos. of 630 KVA Transformers having 100 % DG back-up.
2. Maintenance of VRF Air-conditioning machines installed at both the Laboratory Buildings and Basundhara Building.
3. Various procurement of electrical items through GeM portal and upkeep the inventory/electrical store.
4. The Centre has modified its street light arrangement system by retrofitting, repairing to provide proper illumination at the entire Campus controlled and operated by GIS based automatic digital timer control panel.

Ayan Deb

Ayan Deb
Campus Engineer
cum Estate Officer



COMPUTER SERVICES CELL

Dr. Sanjoy Choudhury

Scientist – E

Guidance of Students/ Post-Docs

a) Post-Doc

1. Hermann DJEUGOUE NZEUGA; AI and Machine Learning-Based; Under Progress

Teaching

1. Autumn Semester; PHY 601; PhD; 41 students; Shared with Dr. Saquib Shamim

Administrative duties

The nature of work at the Centre falls into two key areas:

Administrative/Technical and Academic

The Administrative/Technical aspect involves the design, evaluation, procurement, installation, maintenance, optimal utilization, and upgradation of the Centre's advanced facilities. Meanwhile, the Academic component encompasses research activities, including both individual and collaborative research initiatives.

1. Administrative/Technical nature: 70% of works handling Central Computational facilities maintenance, proper utilization, up gradation of sophisticated facility under Computer Services Cell as Scientist I/C of the Cell.
2. Academic nature: Rest of the work research activities, individual and along with Collaborative research work.

- Lead the Computer Services Cell, managing HPC supercomputers, networks (LDAP/DHCP), and cybersecurity.
- Research focus: Energy-aware IoT systems, AI/ML for Neural networks model, AI analyzes DNA sequences to identify disease markers and predict gene functions, ML decodes neural activity patterns and models and AI develops new algorithms for solving complex optimization problems etc, and HPC optimization.
- Collaborated on 5 + peer-reviewed publications in IEEE, Springer, and Elsevier
- Internal Committee Members: Computer Center In-charge
- Members of the CSC-Working Group (CSCWG)
- Members of the CSC-Advisory Committee
- Members of the Internal E-Procurement Committee
- Nodal Officer of the Central Public Procurement Portal, Government of India
- Members of the Procurement of New Laptop/Desktop Committee
- Members of the Procurement of New Generation Firewall Technical Committee
- Members of the Procurement of Video Conferencing Facility Committee
- Members of the Fire-Safety Technical Committee
- Members of the Student Advisory Committee (SAC)
- Members of the Development and Implementation of Asset Tracking Application Committee
- Nodal Officer Central Public Procurement Portal, Govt. of India.
- Nodal Officer GeM, Govt Portal, Govt. of India
- One of the Nodal coordinators PARAM Rudra BOSON supercomputing Facility
- Nodal Officer Cyber Crisis Management Group (CCMG), Govt Portal, Govt. of India.
- Nodal officer Sthitra ERP

Outreach program organized / participated

- Cybersecurity Awareness: Participated in multiple interactive online sessions organized by the Department of Science & Technology (DST), Government of India.
- IGOT Karmayogi Portal: Completed various technical courses on the IGOT Karmayogi platform, Government of India.
- C-DAC & NSM Training Programs: Attended a series of technical training sessions hosted by C-

DAC and the National Supercomputing Mission (NSM), Government of India, covering the period from January 1, 2025, to January 1, 2026.

- Workshop / Training Organized - Conducted a workshop session on High-Performance Computing (HPC) on June 14, 2025.

Areas of Research

Interdisciplinary Computational Researcher bridging HPC, IoT, and AI/ML. Primary objective: optimize edge/fog computing integration with renewable energy systems for sustainable, efficient, and economically viable solutions.

Key Focus Areas:

i. Energy-Aware Edge/Fog Computing: Resource allocation for IoT environments with renewable integration (solar, wind, grid-interactive) to reduce carbon footprint and operational costs.

ii. AI/ML for Scientific Discovery & Renewable Optimization: Neural networks for DNA analysis and gene function prediction; ML decoding of neural activity; novel AI algorithms for real-time energy distribution in renewable-powered edge networks.

iii. HPC + Molecular Modeling: Hybrid AI/classical MD workflows accelerating free-energy calculations and reaction pathways for energy storage and photovoltaic materials.

iv. Parallel Algorithm Design: GPU/CUDA-accelerated simulations for meteorology (renewable forecasting), genomics, and materials science.

v. AI/ML for Autonomous Systems: IEEE award-winning real-time perception models for autonomous vehicles, transferable to microgrid energy management.

vi. Sustainable HPC: Green computing strategies for large-scale workloads, applied to renewable-powered edge data centers and fog nodes.

Integrates computational methods across molecular systems to renewable-powered IoT infrastructure.

Plan of Future Work Including Project

- AI-Driven Fog Computing for Renewable Energy Integration: Expand existing fog computing models to enhance real-time data processing, load balancing, and energy distribution in renewable-powered smart grids.
- Hybrid Quantum-Classical Algorithms for HPC: Design and implement hybrid quantum-classical algorithms optimized for high-performance computing environments, targeting complex scientific simulations and optimization problems.
- Sustainable Smart Infrastructure Collaborations: Pursue collaborative research proposals under the NSF-DST joint funding framework, focusing on sustainable, intelligent infrastructure systems that integrate IoT, AI, and green energy technologies.

Any other Relevant Information including social impact of research

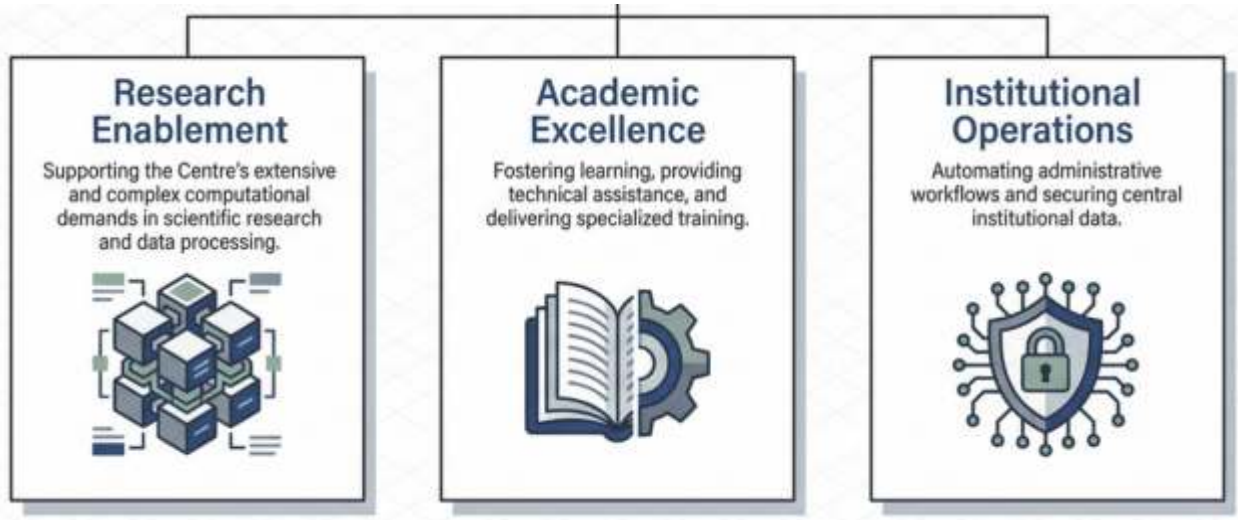
- Social Impact: Research enables energy-efficient IoT solutions for smart cities, reducing carbon footprints.
- Mentorship: Supervised summer research students and interns in computational research methodologies.
- Open-Source Contributions: Co-contributed to tools for energy-aware edge computing optimization.
- Policy Advisories: Provided technical inputs for smart city sustainability frameworks.
- Academic Service: Peer reviewer for Cluster Computing, The Journal of Networks, and Software: Tools and Applications.
- Workshops: Organized training sessions on HPC and AI/ML applications

Computer Services Cell (CSC)

Mission and Strategic Role in Academic Excellence

At the S.N. Bose National Centre for Basic Sciences (SNBNCBS), the Computer Services Cell (CSC) operates as the Centre's strategic nerve centre. In the current era of computational sovereignty, institutional excellence is inextricably linked to technological agility; computational latency is, quite simply, research latency. The CSC transcends the role of a traditional utility provider to act as the critical backbone for both high-performance scientific inquiry and administrative modernization. By integrating advanced high-performance computing (HPC) with bespoke automation, the CSC ensure that the Centre remains a global leader in the basic sciences.

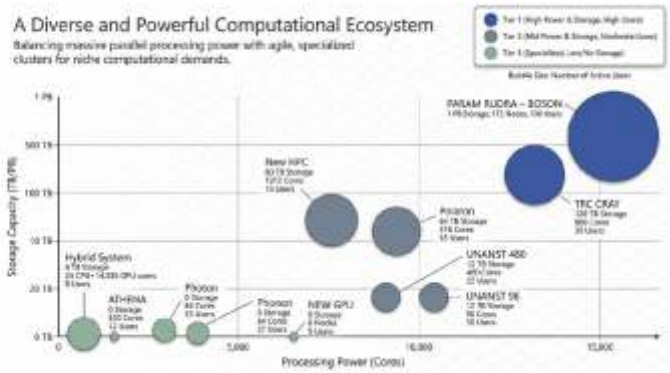
The CSC is mandated to develop and sustain a dual-purpose infrastructure that serves the following core functions:



This alignment of technological capability with academic mission ensures that the Centre possesses the computational sovereignty required to achieve global breakthroughs.

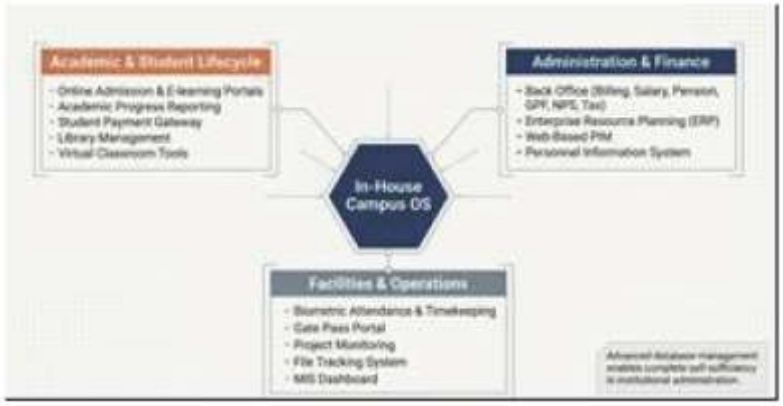
The Centre's participation in India's National Supercomputing Mission (NSM) is a transformative milestone that elevates our standing in the international scientific community.





Bespoke Software Ecosystem and Digital Transformation:

A core pillar of our technology strategy is the development of in-house software. By building rather than buying, we achieve greater institutional agility and significant cost-efficiency. Our custom-built ERP and MIS solutions allow the Centre to pivot quickly to new regulatory or academic requirements without the constraints of restrictive third-party vendor roadmaps.

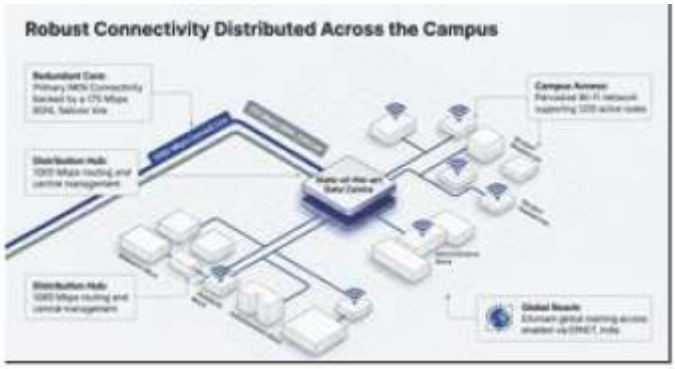


To prevent "shadow IT" and ensure compliance, the CSC provides a curated suite of industry-standard tools, including **Mathematica, MATLAB, MS 365, ChemDraw, Overleaf,** and **Antivirus Endpoint Protection**. This balanced approach combines the flexibility of bespoke code with the reliability of established research platforms, all delivered via a high-availability network.



Network Infrastructure and Data Centre Operations:

Modern scientific research demands "always-on" connectivity. The CSC prioritizes redundancy and high-speed throughput to safeguard institutional continuity. By maintaining a 1000 Mbps primary NKN link supplemented by a 175 Mbps BSNL backup, we ensure that the Centre's global research collaborations are never interrupted.





Operational Excellence, Security, and Best Practices:

Our operational philosophy is built on the principle that secure, reliable systems are the foundation of scientific productivity. By conducting regular security audits and maintaining active monitoring (Firewalls/IDS.

Our commitment to operational excellence is defined by the following standards:

The achievements of the 2025-26 period provide the firm foundation required for the S.N. Bose National Centre for Basic Sciences to lead the next generation of computational and scientific discovery.





sanjoy choudhury

Sanjoy Choudhury
In-charge, Computer Services Cell



PROJECT AND PATENT CELL

The Project and Patent Cell acts as the record keeping Cell of the Projects and Patents of the Centre. It keeps tracks of the project proposals submitted for extramural funding, the sanctioned projects, the patent proposals filed and the patents granted to the Centre. It also coordinates with the Committee(s) constituted by the Authority for evaluating proposals to be filed for grant of patent and also takes care of the administrative matters during the filing of patents under the instruction of the inventor(s).

The members of the Project and Patent Cell during the year 2025-26:

Prof. Rajib Kumar Mitra	Convener
Prof. Manik Pradhan	Member
Prof. Soumen Mondal	Member
Dr. Atindra Nath Pal	Member
Deputy Registrar (Administration)	Member
Deputy Registrar (Finance)	Member
Dealing Assistant, Office of Dean (Faculty)	Member
Office Assistant, Academic Section	Member

The Project Officer of TRC acted as a Member of the Project & Patent Cell while dealing with Patents under TRC.

PA to Director renders Secretarial Assistance to the Project & Patent Cell.

The following table summarizes the details of the externally funded projects in the Centre, for the last five years:

Year	No. of Projects	Amount Received (Rs.)
2021-2022	34	3,22,95,557=00
2022-2023	40	3,55,46,511=00
2023-2024	33	2,49,73,471=00
2024-2025	28	2,19,59,593=00
2025-202	63	32,89,66,729=00

Apart from this, the Centre has also received the TRC project during January 2016.
S. N. Bose National Centre for Basic Sciences

Details of Externally Funded Projects at SNBNCBS (2025-26)

Project Title	PI / Co – PI	Funding Agency	Duration of the Project	Total Sanctioned	Remarks
DST/AB/19-20/246 – "Development of strongly spin orbit coupled topological quantum heterostructures for spintronic applications"	Prof. Anjan Barman	DST DST/NM/TUE/QM-3/2019-1G-SNB	21-10-2021 to 20-10-2026	1,28,43,000/-	
DST/TSD-AP/19-20/249 – "Consortium for Collective and Engineered Phenomena in Topology Concept"	Investigators from SNBNCBS: Dr. Atindra Nath Pal	(DST) DST/NM/TUE/QM-10/2019 (G)/2 (Nano Mission)	28-03-2023 to 27-03-2028	1,40,65,189/-	
PM/SERB/19-20/250 – "Twistronics with Transition Metal Dichalcogenides"	Prof. Priya Mahadevan	SERB IPA/2020/000021	30-03-2020 to 29-03-2025 Extended till 29-03-2026	2,17,60,250/-	
SERB/TSD/20-21/260 – "J.C. Bose Fellowship"	Prof. Tanusri Saha Dasgupta	SERB JCB/2020/000004 Dairy No. SERB/F/3797/2020-2021	12-10-2020 to 11-10-2025	95,00,000/-	
RSF-DST/TSD/21-22/268 – "Search for Novel Magnetic and Topological Materials"	Prof. Tanusri Saha-Dasgupta	DST DST/INT/RUS/RSF/P-53/2021 (G)	20-01-2023 to 19-01-2026	82,52,170/-	
Max Planck/NK/21-22/275 - "Novel quantum states in quasi-one-dimensional materials"	Dr. Nitesh Kumar	Max Planck	01-09-2022 to 31-08-2027	Euro 1,00,000	
SERB/AHK/21-22/278 – "Doped 2D Nanocrystals for Photonic Applications (Ramanujan Fellowship)	Dr. Ali Hossain Khan	SERB RJF/2020/000091	01-11-2021 to 31-03-2026	Credited Till Date: 11,62,598/- + 19,14,000/- + 23,70,000/-	
SERB/AHK/22-23/283 – "Heavy-Metal-Free Photonic Colloidal 2D Nanocystals"	Dr. Ali Hossain Khan	SERB CRG/2022/006225	08-02-2023 to 07-02-2026 Extn till 07-08-2026	42,26,428/-	
SERB/AC/22-23/284 – "Development and testing of broadband optoelectronic synaptic devices employing ferroelectric / photoelectric 2D material hybrid system"	Dr. Avijit Chowdhury	(SERB) CRG/2022/001145	09-03-2023 to 08-03-2026	22,08,600/-	
SERB/AH/22-23/295 – "Harnessing the Interplay of Quantum Entanglement, Topology, and Strong Correlations in Condensed Matter Systems for Near-term Quantum Applications and Beyond"	Dr. Arijit Haldar	SERB (SRG) SRG/2023/000118	22-12-2023 to 21-12-2025	19,33,200/-	

Project Title	PI / Co – PI	Funding Agency	Duration of the Project	Total Sanctioned	Remarks
SERB/SC/22-23/296 – "Bacterial Chemotaxis in presence of spatio-temporal variation in extra-cellular environment and of intra-cellular noise : a theoretical study"	Dr. Sakuntala Chatterjee	ANRF (SERB) CRG/2023/000159	Sanction Date: 28-05-2024 3 Years	27,62,650/-	
SERB/TS/22-23/297 – "Investigation of Magnetotransport, Magnetic, and Electronic Band Structure in Transition-metal Monosilicides (MSi; M = Fe, Cr, Co, Mn, and Rh) under Time Reversal Symmetry Breaking"	Dr. T. Setti	ANRF (SERB) CRG/2023/000748	Sanction Date: 24-05-2024 3 Years	34,49,905/-	
SERB/RKM/22-23/298 – "Biomolecular condensates: Exploring the associated hydration and energetics using THz spectroscopy"	Prof. Rajib Kumar Mitra	SERB CRG/2023/001034	Sanction Date: 23-02-2024 3 Years	44,49,597/-	
SERB/SS/22-23/300 – "Quantum spin Hall insulators: Investigation of electrical and thermal properties"	Dr. Saquib Shamim	ANRF (SERB) CRG/2023/002082	Sanction Date: 24-05-2024 3 Years	41,94,126/-	
SERB/UB/22-23/301 – "Activity driven transport in low dimensional systems"	Dr. Urna Basu	SERB MTR/2023/000392	Sanction Date: 23-01-2024 3 Years	6,60,000/-	
SERB/RB/22-23/302 – "A Theoretical Approach to Predict Deep Eutectic Formation: Locating the Lowest Melting Point"	Prof. Ranjit Biswas	SERB MTR/2023/000336	Sanction Date: 30-01-2024 3 Years	6,60,000/-	
IHQTF/AB/23-24/304 – "Two-dimensional ferromagnetic and organic molecule spinterfaces as molecular spin qubits for quantum technologies and energy harvesting applications – Chanakya Post Doctoral Fellowship under mentorship of Dr. Anjan Barman"	Prof. Anjan Barman	I-Hub Quantum Technology Foundation (IHQTF) I-HUB/PDF/2022-23/001	17-08-2023 to 16-08-2025 Extended till 21/01/2027	12,60,000/-	Chanakya Post-Doctoral Research Fellow: Sumaiya Parveen 17-11-2023 to 28-06-2024 Soma Dutta 21-10-2024 to 20-04-2025
Sarfez/SC/19-20/232(II) – "Tuning electrostatics and dynamics of the flexible areas of PCSK9 protein towards controlling interactions with LDLR: A computational approach"	Dr. Suman Chakrabarty	Sarfez Cure India	01-07-2024 to 30-06-2025	8,80,000/-	

Project Title	PI / Co – PI	Funding Agency	Duration of the Project	Total Sanctioned	Remarks
"Design and Development of Quantum Entanglement – Enhanced Imaging Systems" Technology Vertical: "Quantum Sensing & Metrology"	Dr. Manik Banik	DST (NQM) (QTC) DST/FFT/NQM/QSM/ 2024/3	06-12-2024 to 05-12-2030	1,54,47,000/-	
ANRF/PD/24-25/347 – "Renormalisation group flows in conformal field theories near wedge"	Dr. Parijat Dey	ANRF ANRF/ECRG/2024/ 000247/PMS	Sanction Date: 02-06-2025 3 Years	33,64,130/-	
ANRF/BG/24-25/348 – "Material-Specific Modeling of Novel Responses in Quantum Materials"	Dr. Barun Ghosh	ANRF ANRF/ECRG/2024/ 003677/PMS	Sanction Date: 02-06-2025 3 Years	37,50,560/-	
DST (WIDUSHI)/BGS-AC/ 24-25/351 – "Synthesis, Physics and Technological applications of 2D Perovskite Halides"	Dr. Barnali Ghosh Saha Dr. Avijit Chowdhury (Co.PI)	DST / WIDUSHI-A / PM / 2023 / 16 (G)	01-08-2025 to 31-07-2030	90,24,000/-	
CSIR/VR/25-26/383 – "Probing Protein Aggregation Inhibition Using Terahertz Spectroscopy and Multi-Modal Experimental Approaches"	Dr. V. Rupreo (Supervisor: Prof. Rajib Kumar Mitra)	CSIR-HRDG App No: 323-995-7865/2K24/1 File No: 09/0575(23716)/ 2025-EMR-I	Joining Date: 06-08-2025 Resigned on 19-12-2025	4,67,661/- (Till 31-03-2026)	
ANRF (NPDF)/ND/25-26/384 - "Chaperone-Mediated Folding of Mechanosensitive Proteins in Macrophages: Insights Using Single-Molecule Technique"	Dr. Nicky Didwania (Mentor: Dr. Shubhasis Haldar)	ANRF PDF/2025/004824	11-11-2025 to 10-11-2027	30,96,000/-	
ANRF (NPDF)/SM/25-26/385 – "Characterizing Nonlocal and Contextual Correlations in Multipartote Quantum State Discrimination: Foundations and Applications to Quantum Communication Protocols"	Dr. Sumit Mukherjee (Mentor: Prof. Archan Majumdar)	ANRF PDF/2025/000262	01-12-2025 to 30-11-2027	30,96,000/-	
ANRF (NPDF)/SK/25-26/386 – "Structure-Property Correlation in *R*AlGa Quantum Materials to realize Topological Spin Textures"	Dr. Sourav Kanthal (Mentor: Dr. Nitesh Kumar)	ANRF PDF/2025/005876	01-12-2025 to 30-11-2027	30,96,000/-	
ANRF (NPDF)/PJ/25-26/387 – "Anionic Covalent Organic Frameworks for Uranium Extraction from Seawater: Synergistic Adsorption and Photocatalytic Approaches"	Ms. Pampa Jhariat (Mentor: Dr. P S Pachfule)	ANRF PDF/2025/002193	01-12-2025 to 30-11-2027	21,60,000/-	
ANRF (NPDF)/RG/25-26/388 – "Exploration of Magnetization Dynamics in Polymer / Ferromagnet Interfaces for Plastic Spintronics"	Dr. Rubina Ghosh (Mentor: Prof. Anjan Barman)	ANRF PDF/2025/000281	18-12-2025 to 17-12-2027	30,96,000/-	

Project Title	PI / Co – PI	Funding Agency	Duration of the Project	Total Sanctioned	Remarks
CSIR (HRDG)/JC/25-26/389 – "Coarse Grained Description of Misfolded Proteins in an aqueous dispersion"	Prof. Jaydeb Chakrabarti	CSIR (HRDG) 21/1189/25/EMR-II	02-02-2026 to 01-02-2029	Research Grant: 80,000/- per annum Scientist Allowance: 20,000/- per month	1 RA position danctioned
DAE (RRC)/PM/25-26/390 – "Basic Research & Development: Emergent Quantum Phenomena in Topological and Van-der Waals Systems"	Prof. Prabhat Mandal	DAE (Raja Ramanna Chair) 1003/17/2025/R&D-II/RRC/DAE 16971	02-02-2026 to 01-02-2029	13,50,000/-	
ANRF/SD/25-26/391 – Ramanujan Fellowship	Dr. Sujit Deshmukh	ANRF RJF/2025/000151	Sanction Date: 19-01-2026 5 Years	1,19,00,000/-	
ANRF/TS/25-26/368 – "Exploring 2D Magnetism and kyrmion Superconductivity in Layered van der Waals Systems for Topological Hall Sensors"	Dr. Thirupathaiah Setti	ANRF ANRF/ARG/2025/ 007085/PS	31-03-2026 to 30-03-2029	28,64,702/-	
ANRF/NK-MK/25-26/370 – "Exploration of non-trivial spin textures in centrosymmetric metallic magnets and their attributes in electrical transport"	Dr. Nitesh Kumar	ANRF ANRF/ARG/2025/ 004788/PS	31-03-2026 to 30-03-20290	54,51,609/-	

*** Apart from this, the Centre has also received the TRC project during January 2016.

Postdocs & Scientists under Projects; DST INSPIRE Faculty & Others (2025-26)

Sl.	Name	Designation	Project Name	P. I. of Project	Joined on	Appt. upto
1	Dr. Ali Hossain Khan	Ramanujan Fellow	Doped 2D Nanocrystals for Photonic Applications	Self	01.11.2021	31.03.2026
2	Dr. Barnali Ghosh (Saha)	WIDUSHI - A Scientist under WISE KIRAN	Synthesis, Physics and Technological applications of 2D Perovskite Haldies	Self	01.08.2025	31.07.2030
3	Dr. Bhaskar Mukherjee	DST INSPIRE FACULTY	Exploration of non-ergodic quantum many body systems without disorder	Self	17.09.2024	31.03.2026
4	Prof. Jaydeb Chakrabarti	CSIR Emeritus Scientist	Coarse grained description of misfolded proteins in an aqueous dispersion	Self	02.02.2026	01.02.2029
5	Dr. Jiban Kangsabanik	DST INSPIRE FACULTY	Optimization of point defects and associated	Self	17.09.2024	22.04.2025
6	Prof. Prabhat Mandal	Raja Ramanna Chair	Basic Research & Development Emergent quantum phenomena in topological and van der Waals systems	Self	02.02.2026	01.02.2029
7	Dr. Sanku Paul	DST INSPIRE FACULTY	Hidden quantum criticality and its application in data hiding	Self	22.05.2023	21.05.2028
8	Dr. Sujit Deshmukh	Ramanujan Fellow	Laser-Assisted Synthesis of Single-Atom Catalysts for Zinc-Air Battery	Self	06.01.2026	5 years
9	Dr. Ananda Gopal Maity	Senior Project Scientist (DST-NQM)	Design and development of quantum entanglement – enhanced imaging systems	Dr. Manik Banik	21.02.2025	31.08.2025

Sl.	Name	Designation	Project Name	P. I. of Project	Joined on	Appt. upto
10	Mr. Anil K Singh	RA-I	Twistronics with transition metal dichalogenides	Prof. Priya Mahadevan	29.01.2026	29.03.2026
11	Mr. Arka Prava Sarkar	RA-I (Adhoc)	Optimising hybrid perovskite Solar Cells	Prof. Priya Mahadevan	05.01.2026	30.06.2026
12	Dr. Arun K Maurya	Research Associate – I (Ad-hoc)	JC Bose Award Fellowship	Prof. Tanusri Saha-Dasgupta	02.01.2025	31.05.2025
13	Dr. Dibyashree Chakraborti	CSIR RA	Study spin charge inter-conversion and its control mechanism in van-der Waals heterostructure stacks and striving towards development of topological spintronics	Dr. Saquib Shamim	27.10.2025	2 years
14	Dr. Indrani Bhattacharyya	Project Associate–I	Biomolecular Condensates: Exploring the associated hydration and energetics using Thz spectroscopy	Prof. Rajib K Mitra	10.01.2025	14.05.2026
15	Dr. Nicky Didwania	NPDF	Chaperone-Mediated Folding of Mechanosensitive Proteins in Macrophages: Insights Using Single-Molecule Technique	Dr. Shubhasis Haldar	11.11.2025	2 years
16	Dr. Pampa Jhariat	NPDF	Anionic Covalent Organic Frameworks for Photocatalytic Uranium Extraction from Seawater	Dr. Pradip Pachfule	01.12.2025	16.04.2026
17	Mr. Prasun Boyal	RA - I	Twistronics with transition metal dichalogenides	Prof. Priya Mahadevan	16.05.2025	21.11.2025
18	Dr. Rubina Ghosh	NPDF	Anionic Covalent Organic Frameworks for Photocatalytic Uranium Extraction from Seawater	Prof. Anjan Barman	18.12.2025	2 years
19	Dr. Sakila Khatun	CSIR RA	Nonprecious Topological Quantum Materials for Electrocatalytic Water Splitting	Dr. Nitesh Kumar	22.09.2025	2 years
20	Ms. Soma Dutta	Chanakya PDF (Ad-hoc)	Two-dimensional Ferromagnetic and Organic Molecule Spinterfaces as Molecular Spin Qubits for Quantum Technologies and Energy Harvesting Applications	Prof. Anjan Barman	21.10.2024	20.04.2025
21	Dr. Sourav Kanthal	NPDF	Structure-property correlation in RAlGa quantum materials to realize topological spin textures	Dr. Nitesh Kumar	01.12.2025	2 years
22	Dr. Subhas Chandra Bera	DBT - RA I	Development of a high-throughput single-molecule magnetic tweezers setup for automated antiviral drug screening	Dr. Shubhasis Haldar	01.05.2025	2 years
23	Dr. Subhendu Bikash Ghosh	Project Post-doctoral Fellow (DST-NQM)	Design and development of quantum entanglement – enhanced imaging systems	Dr. Manik Banik	07.02.2025	2 years
24	Dr. Sumit Mukherjee	NPDF	Characterizing Nonlocal and Contextual Correlations in Multipartite Quantum State Discrimination: Foundations and Applications to QuantumCommunication Protocols	Prof. Archan S Majumdar	01.12.2025	2 years
25	Dr. Vibeizonuo Rupreo	CSIR RA	Probing Protein Aggregation Inhibition Using Terahertz Spectroscopy and Multi-Modal Experimental Approaches	Prof. Rajib K Mitra	06.08.2025	19.12.2025

LIST OF STUDENTS UNDER PROJECT

F.Y. 2025-2026

Sl	Name of The Student	Current Designation	Project Instructor	Dept.	Name of The Project	Tenure of The Project	Date of Admission	Continuing / Resigned On
1	Payal Bhattacharjee	Project JRF	Anjan Barman	CMMP	Development of strongly spin orbit coupled topological quantum heterostructures for spintronic applications	20.10.2026	20.01.2025	19.07.2025
2	Thansingh Jankawat	Project JRF	Barun Ghosh	CMMP	Material-specific Modeling of novel Responses in Quantum Materials	Sanction Date: 02-06-2025 3 Years	10.09.2025	09.03.2026
3	Saikat Mitra	Project Assistant	Barnali Ghosh (Saha)	CMMP	Synthesis, Physics and Technological Applications of 2D Perovskite Halides	31-07-2030	17.10.2025	16.04.2026
4	Shinjini Paul	Project SRF	Priya Mahadevan	CMMP	Twistronics with transition metal dichalcogenides	29.03.2026	27.10.2025	29.03.2026
5	Soumya Dasgupta	Project JRF	Atindra Nath Pal	CMMP	Consortium for Collective and Engineered Phenomena in Topology Concept	27.03.2028	25.02.2026	24.02.2027
6	Nilabha Chatterjee	Project Assistant	Sujit Deshmukh	CMMP	Laser-assisted Synthesis of Single Atom Catalysis for Zn Battery	Sanction Date: 19-01-2026 5 Years	23.03.2026	22.09.2026
7	Bikram Das	Project JRF	Ali Hossain Khan	CBS	Heavy-Metal-Free Photonic Collodial 2D Nanocrystals	07.08.2026	12.06.2023	07.08.2026
8	Sourik Dutta	Project JRF	Ali Hossain Khan	CBS	Doped 2D Nanocrystals for Photonic Applications	31.03.2026	13.06.2023	31.03.2026

Rajib Kumar Mitra

Rajib Kumar Mitra
Convenor, Project & Patent Cell

TECHNICAL RESEARCH CENTRE (TRC)

The Technical Research Centre (TRC), funded by the Department of Science & Technology, Ministry of Science & Technology, Government of India, at S. N. Bose National Centre for Basic Sciences, was launched on 1st January 2016. The aim is to establish an innovation cum translational research centre within the S. N. Bose National Centre that would build harnessable science and technology platforms by leveraging its existing core strength in materials science and spectroscopic techniques. The extension phase of TRC (Phase II) commenced formally in January 2021, with the budget funding for Phase II sanctioned by the DST in February 2023.

Major Target Areas in the Extended Phase (Phase II):

- **Computational Materials Sciences**: Computation Modelling for Technologically Important Indigenous New Materials and New Functionalities; etc.
- **Nano-fabrication for Quantum Technology & Nanodevices**: Innovation in Technology development - Nano-fabrication for Quantum Technology & Nanodevices; Development of sensors and opto-electronic devices using ultra-thin layered materials; Prototyping thin film devices using functional oxide patterned films, etc.
- **Bio-medical Instrumentation**: Spectroscopic and Optical techniques -Triboelectric Nanogenerators for Biomedical and Health Care Applications; An optical emission spectroscopy-based sensor for minimally-invasive detection of essential electrolytes in the human body, like sodium, lithium, and potassium (NaLiK); Modulation of THz-FIR radiation using patterned materials and its application to authenticate pharmaceutics; etc.
- **Food Adulteration and Environmental Mitigation**: Prototype development of Optical/NIR spectroscopic instrumentation for applications - A spectroscopy-based fluoride sensor in drinking water (FeFlu); Adulteration in Milk using spectroscopic techniques (Mil-Q-Way); etc.

Project Investigators (TRC Phase II):

Prof. Rajib K. Mitra (Nodal Officer); Prof. Pradip S. Pachfule (Associate Nodal Officer); Prof. Tanusri Saha-Dasgupta; Prof. Soumen Mondal; Prof. Anjan Barman; Prof. Jaydeb Chakrabarti; Prof. Atindra Nath Pal; Prof. Suman Chakrabarty; Prof. Avijit Chowdhury; Prof. Nitesh Kumar; Prof. Saquib Shamim; Prof. Shubhasis Haldar; Dr. Ali Hossain Khan and Dr. Barnali Ghosh (Saha).

Manpower details in this period:

Number of Scientists (C & D): 05 | Number of Project Students: 08

Number of Project Assistants: 01 | Number of Project Officers: 01

Research Outputs of TRC (2025-26):

The research activities during 2025–2026 encompassed interdisciplinary investigations across condensed matter physics, materials science, nanotechnology, computational biophysics, and sustainable energy materials. Significant advances were achieved in the study of quantum materials, including topological and correlated systems exhibiting unconventional Hall responses, skyrmionic transport, quasiflat-band-induced Berry curvature, superconductivity, altermagnetism, and chiral magnetic states. Extensive efforts in spintronics and magnonics explored spin pumping, spin–orbit torque, spin-wave dynamics, and interfacial magnetic interactions in low-dimensional heterostructures and nanomagnetic systems.

A major focus was directed toward the development of covalent organic frameworks and related functional materials for photocatalytic hydrogen peroxide generation, hydrogen evolution, CO_2 reduction, water oxidation, pollutant degradation, and sustainable organic transformations. Research also addressed triboelectric nanogenerators, MXene-based multifunctional devices, neuromorphic materials, semiconductor nanocrystals, and layered perovskites for sensing, energy harvesting, and optoelectronic applications.

Complementary theoretical and computational studies advanced understanding of biomolecular interactions,

protein folding, allosteric regulation, amyloidogenesis, membrane dynamics, and solvation phenomena using molecular dynamics simulations, enhanced sampling approaches, and machine-learning-assisted methodologies. Novel computational tools were developed for rare-event pathway generation, hotspot mapping in protein–protein interactions, and automated identification of complex molecular phases.

Collectively, these works demonstrate strong integration of experimental, theoretical, and computational approaches toward addressing fundamental scientific questions and developing technologically relevant materials and methodologies in quantum science, sustainable chemistry, nanodevices, and biomolecular engineering.

Total Number of Publications in 2025-26: 67

Average Impact Factor of the Journals: 7.304

Memorandum of Understandings:

On 25th April 2025, an MOU was signed between RISE Foundation, IISER Kolkata, and S.N. Bose National Centre for Basic Sciences to develop the innovation and entrepreneur ecosystem to foster an entrepreneurial and innovative mindset amongst students and faculty members.

On 6th November 2025, a renewal of the Memorandum of Agreement between S.N. Bose National Centre for Basic Sciences, Kolkata, and National Research Development Corporation (NRDC) was signed for commercialization and technology transfer.

Impact on societal challenges, industry relevance, and economic outcomes.

Advancements in science, technology, and innovation are powerful drivers of progress, shaping economies and enhancing the quality of life. The Technical Research Centre of the S.N. Bose National Centre for Basic Sciences, Kolkata, is an initiative aimed at fulfilling the goal of *Atmanirbhar Bharat* by focusing on Materials Science, Nanoscience and Nanotechnology, and Biomedical Science. All the technologies developed at the Centre are primarily focused on healthcare, the environment & inclusiveness for socio-economic well-being.



Commercialised and to be Commercialised Technologies from TRC

Rajib Kumar Mitra
Nodal Officer
Technical Research Centre

TECHNICAL CELL

Technical cell was established in the year of 2008 to maintain the central experimental facilities of SNBNCBS which can be availed by any researcher from our Centre as well as from other institutions / laboratories. The details of the available experimental facilities and the terms and conditions for using the s e facilities are mentioned in the website : https://newweb.bose.res.in/facilities/TechnicalCell/. The activities of Technical Cell during April 2025 - March 2026 are reported in the following sections:

I. Equipments available under technical cel'

Sl. No.	Name of the equipment
1.	Transmission electron Microscope (TEM) with other attachments
2.	Thermo Gravimetry/Differential Thermal Analyzer (TG-DTA)
3.	Dynamic Light Scattering (DLS)
4.	Clean Room
5.	E-beam evaporator
6.	ICP-RIE
7.	Dual beam FIB/SEM
8.	Wire Bonder
9.	Mask aligner
10.	3K Resistivity Measurement Setup
11.	Field Emission Scanning Electron Microscopy (FESEF) Quanta FEG 250
12.	X-ray Diffraction
13.	UV Visible Spectrometer (UV-VIS) (2600)
14.	UV Visible Spectrometer (UV-VIS) (2450)
15.	Circular Dichroism (CD)
16.	Chemical Lab
17.	Ellipsometer
18.	Viscometer
19.	Densitymeter
20.	X-ray Diffractometer (XRD) (PANalytical X-PERT PRO
21.	Pulsed Laser Deposition (PLD) Unit
22.	Helium Leak Detector
23.	Liquid Nitrogen and Gases for Laboratory Use
24.	Fluorescence spectrometer (Fluorolog)
25.	Spevtrofluorometer (Fluoromax)
26.	Fourier Transform Infrared Spectrometer (FTIR)
27.	Mechanical workshop, Sputtering Unit, Millipore Water
28.	Vibrating Sample Magnetometer (VSM)
29.	Differential Scanning Calorimeter (DSC)
30.	Atomic Force Microscope (AFM)
31.	X-ray photo absorption spectroscopy (XPS)

II. Support to research activities

Around 100 students and post-doctoral fellows of the Centre avail the above-mentioned experimental facilities extensively for their Ph.D. thesis work. 10 students completed their M.Sc. / M.Tech. project work; 15 students completed their summer projects performing extensive work using the equipment under the Technical Cell. About 80 external users used the Technical Cell facilities for their research work.

III. Support to the teaching activities of SNBNCBS

Students of the Centre's IPhD programme use the Technical Cell facilities and perform some of the experiments like Xray diffraction, UV – VIS spectroscopy, Differential Scanning Calorimetry as a part of their Advanced Experimental course (PHY 391). Also, they did their project works as a part of their IPhD curriculum.

IV. Utilization of some equipment

ITEM	Usage time (in hours)	UP time %	Down time %	No of external users
PLD	690 hrs	90%	10%	-
FESEM	1200 hrs	90%	10%	25
Mini XRD Rigaku	400 hrs	90%	10%	-
Panalytical XRD	500 hrs	60%	40%	-
HRTEM	1000 hrs	80%	20%	20
TG/DTA	500 hrs	70%	30%	12
PPMS	2880 hrs	32%	78%	02
RAMAN	1700 hrs	90%	10%	06
HRXRD	1020 hrs	90%	10%	20
XPS	1500 hrs	95%	5%	04
ELLIPSOMETRY	20 hrs	80%	20%	04
DLS	131 hrs	100%	NIL	08

V. Revenue Generation

Some revenue has been generated from the external users for using the facilities of Technical Cell.



Rajib Kumar Mitra
In-charge, Technical Cell

MECHANICAL WORKSHOP

Mechanical workshop at the center is an important part, particularly to the experimental faculties. Throughout the year mechanical workshop functioned and catered to the demands of different departments and to the outside. It is handled by a mechanic in all days of the week and the users are required to enter their demands of major jobs in a log book for record, along with at least a rough sketch each. Total number of jobs finished: mechanical workshop – 101.

Month wise breakups are given below: (2025 – 2026). Three major equipment were procured during this time: CNC Milling Machine, All Gear Lathe Machine and Welding Machine from Center's TRC project. Also, whole workshop has moved to the old AC plant in the main building premises. With these new facilities will definitely help to make more sophisticated research equipment in future.



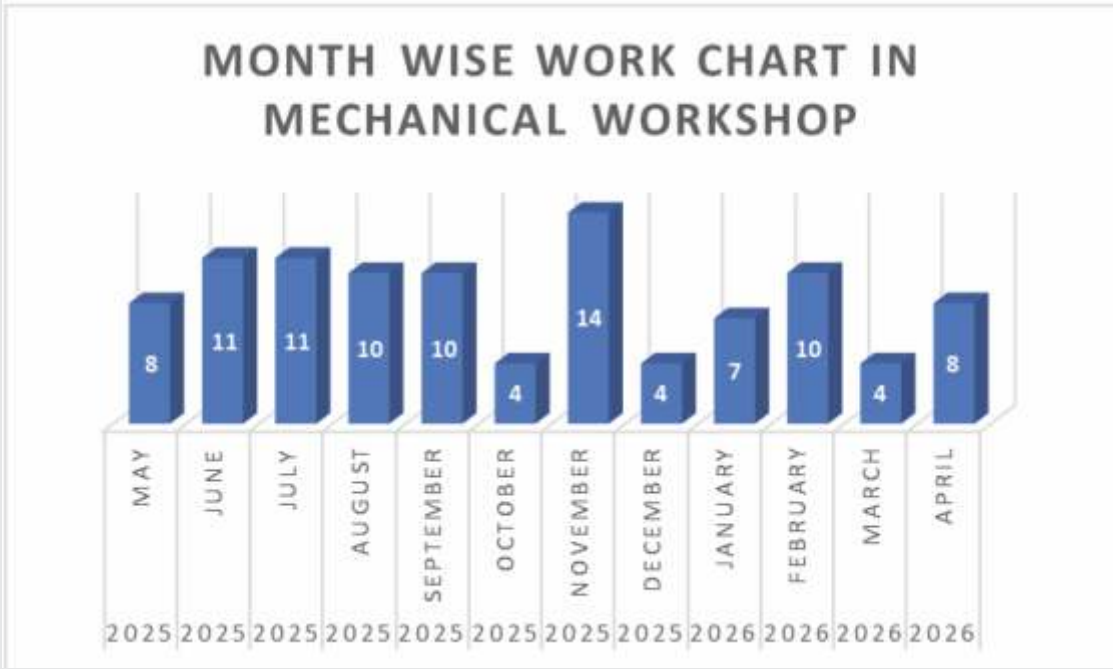
All Gear Lathe Machine



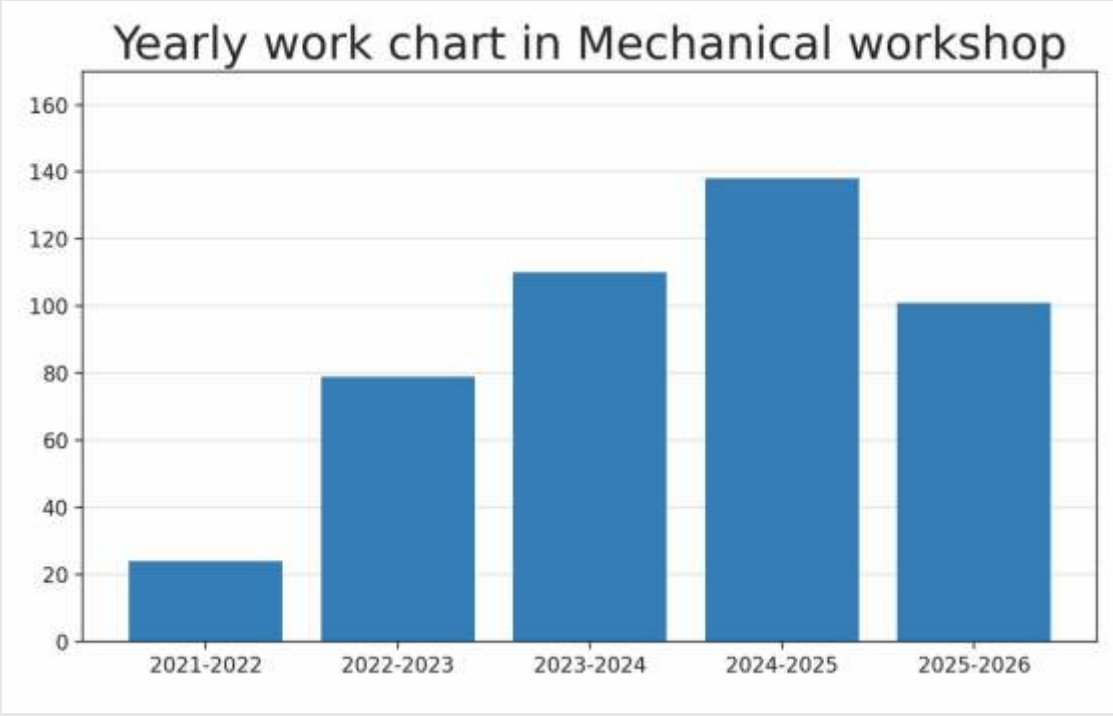
CNC Milling Machine



Welding Machine



TOTAL JOB DONE ON 01 APRIL 2025 TO 31 MARCH 2026: **101 nos**



Pictures of the work have been done in work shop:













Atindra Nath Pal

Dr. Atindra Nath Pal
In charge of the Mechanical Workshop

GUEST HOUSE

BHAGIRATHI – THE GUEST HOUSE

The Centre has its own upfront modern guest house named 'Bhagirathi' located within the premises. It houses eight fully air-conditioned suites, each having attached bath and kitchenette. The kitchenettes are equipped with refrigerators, microwave-ovens & toasters. There are also eight (8) double-bedded rooms and forty-six (46) single bedded rooms. All the rooms are air-conditioned and are fully furnished with attached baths. All rooms are provided with basic amenities like round-the clock hot and normal water, intercom telephone, television with DTH connection, electric kettle etc. The Guest House is Wi-Fi enabled. A state-of-the-art display unit is installed in the Guest House Front Desk displaying various information about the Guest House & the Centre. The guests' rooms spread across the ground floor, first floor and second floor of the Bhagirathi building. Presently, the third floor of the building comprising of twenty-two (22) single bedded rooms and four (4) double bedded rooms are being used as hostel rooms for accommodating Centre's students. There is a seminar room cum dining room within the guest house for hosting small meetings and gatherings. The Guest House also houses the Medical Cell of the Centre. The Centre's Canteen within the Guest House has a Dining Hall with a state-of-art Kitchen. Apart from serving regular meals to the staff members of the Centre and to the visitors, the Dining Hall also serves as a venue for hosting lunches, dinners and high-tea on special occasions. There is a Rooftop Cafeteria above the Dining Hall serving snacks & beverages to the users. Apart from accommodating Centre's own guests and visitors, the Centre extends its guest house facilities for guests of staff members and students; and to guests of various government departments, organizations, research laboratories, universities, academic institutes etc on payment basis. The guest house of the Centre extends warm hospitality to the guests availing the services and the facility is utilised by the visitors throughout the year.

Shohini Majumder
Registrar



Crèche

Kishlay, the Creche facility of the Centre is functional for children of staff of the Centre upto the age of 6 years. Kishlay is presently operating from 9.30 a.m. to 6.00 p.m. and closed on Sunday and Centre's holidays. In this facility an array of toys, books for kids and other activity items are kept. At present there are three kids in the Creche. The Centre arranges Caregivers to take care of the children. CCTVs are installed in the Creche and parents are given the access to the same.

Smajumder

Shohini Majumder
Registrar









List of Publications



List of Journal Publications 2025-2026

Department of Astrophysics and High Energy Physics

1. **Ajay Sharma**, Raj Prince and Debanjan Bose, *Searching for quasi periodic oscillations in optical and gamma-ray emissions and black hole mass estimation of blazar ON 246*, Publications of the Astronomical Society of Australia, 42, e112, 2025
2. **Ajay Sharma**, **Sakshi Chaudhary**, Aishwarya Sarath, Debanjan Bose, *Exploring year-timescale transient and long-term quasi-periodic oscillations in optical and gamma-ray light curves of blazars*, Journal of High Energy Astrophysics, 50, 100466, 2026
3. Riya Barick & **Amitabha Lahiri**, *Torsional modulation of atmospheric neutrino oscillation*, Journal of High Energy Physics, 2025, 17, 2025
4. Saurav Kantha and **Amitabha Lahiri**, *Fermion-vortex interactions in axion electrodynamics*, Annals of Physics, 480, 170085, 2025
5. Indrajit Ghose and **Amitabha Lahiri**, *Effects of spacetime geometry on neutrino oscillation inside a core-collapse supernova*, Journal of Cosmology and Astroparticle Physics, 2025, DOI: 10.1088/1475-7516/2025/05/020
6. Shantonu Mukherjee, **Amitabha Lahiri**, *Skyrmion-vortex hybrid and spin wave solutions in ferromagnetic superconductors*, SciPost Physics, 19, 022, 2025
7. Joshua Carlo A. Casapao, **Ananda G. Maity**, Naphan Benchasattabuse, Michal Hajdušek, Rodney Van Meter & David Elkouss, *Disti-Mator, an entanglement distillation-based state estimator*, Communications physics, 8, 461, 2025
8. Saheli Mukherjee, Bivas Mallick, Sahil Gopalkrishna Naik, Ananda G. Maity and **A. S. Majumdar**, *Detecting genuine multipartite entanglement using moments of positive maps*, Physical Review A, 112, 062428, 2025
9. Subhankar Bera, Soumyakanti Bose, Hyunseok Jeong, and **A. S. Majumdar**, *Sharing quantum nonlocality and teleportation over long distances using optical hybrid states*, Journal of the Optical Society of America B, 42, 2505-2513, 2025
10. Subhadeep Mukherjee, Shashank Shekhar Pandey and **A. S. Majumdar**, *Constraining the Hubble parameter with the 21-cm brightness temperature signal in a universe with inhomogeneities*, Physical Review D, 112, 063520, 2025
11. Pritam Roy, Subhankar Bera & **A. S. Majumdar**, *Secure one-sided device-independent quantum key distribution under collective attacks with enhanced robustness*, Quantum Information Processing, 25, 46, 2026
12. Bivas Mallick, Saheli Mukherjee, Nirman Ganguly and **A. S. Majumdar**, *Detection of nonabsolute separability in quantum states and channels through moments*, Physical Review A, 113, 012433, 2026
13. Arun Kumar Das, Saheli Mukherjee, Debashis Saha; Debarshi Das, **A. S. Majumdar**, *Classifying measurement incompatibility under classical pre- and post-processing operations*, Proceedings of the Royal Society A, 482(2329), 20250045, 2026
14. Bivas Mallick, Ananda G. Maity, Nirman Ganguly and **A. S. Majumdar**, *Higher-dimensional-entanglement detection and quantum-channel characterization using moments of generalized positive maps*, Physical Review A, 112, 012416, 2025
15. Pritam Roy, Subhankar Bera, **A. S. Majumdar** and Shiladitya Mal, *Robust certification of quantum instruments through a sequential communication game*, Physical Review A, 113, 022611, 2026
16. Soumyabrata Hazra, Debashis Saha, Anubhav Chaturvedi, Subhankar Bera and **A. S. Majumdar**, *Efficient Computation of Generalized Noncontextual Polytopes and Quantum violation of their Facet Inequalities*, Quantum, 10, 2015, 2026
17. **Ariful Hoque** et al., *A misaligned protostellar disk fed by gas streamers in a barred spiral-like massive dense core*, Science Advances, 11, 38, 2025

18. Aayushi Verma, Saurabh Sharma, Lokesh K. Dewangan, Tarak Chand, **Ariful Hoque**, Devendra K. Ojha, Harmeen Kaur, Ram Kesh Yadav, Mamta, Manojit Chakraborty, and Archana Gupta, *Unraveling the Feedback-regulated Star Formation Activities around the Expanding Galactic Mid-infrared Bubble [HKS2019] E71*, Astrophysical Journal, 990, 2, 2025

19. Komal Kumar, **Bivas Mallick**, Tapaswini Patro & Nirman Ganguly, *Fidelity of entanglement and quantum entropies: unveiling their relationship in quantum states and channels*, The European Physical Journal Plus, 140, 989, 2025

20. **Debanjan Bose** et al., *Sensitivity of the Hyper-Kamiokande experiment to neutrino oscillation parameters using accelerator neutrinos*, European Physical Journal C, 86, 170, 2026

21. Gopal-Krishna, **Dusmanta Patra** & Ravi Joshi, *Sample of 25 radio galaxies with highly unusual radio morphologies, selected from the LoTSS-DR2 survey at 144 MHz*, Journal of Astrophysics and Astronomy, 46, 36, 2025

22. **Parijat Dey**, Zhongjie Huang & Arthur Lipstein, *de Sitter locality from conformal field theory*, Journal of High Energy Physics, 2025, 166, 2025

23. **Parijat Dey**, Nirmalya Kajuri and Rhitaparna Pal, *Bulk reconstruction in 2D multihorizon black hole*, Physical Review D, 111, 126003, 2025

24. **Rabin Banerjee** et al., *Supernova pointing capabilities of DUNE*, Physical Review D, 111, 092006, 2025

25. **Rabin Banerjee** et al., *Neutrino interaction vertex reconstruction in DUNE with Pandora deep learning*, European Physical Journal C, 85, 697, 2025

26. Ashis Saha, **Rabin Banerjee** & **Sunandan Gangopadhyay**, *Gauge interactions and the Galilean limit*, European Physical Journal C, 85, 1140, 2025

27. Ashis Saha, **Rabin Banerjee** & **Sunandan Gangopadhyay**, *Null reduction and dynamical realization of Carrollian conformal symmetries*, European Physical Journal C, 86, 72, 2026

28. Soumya Chakrabarti, Soumya Bhattacharya, **Rabin Banerjee** & **Amitabha Lahiri**, *Curvature-driven acceleration and a notion of vacuum in Nash theory*, European Physical Journal Plus, 140, 337, 2025

29. Tridib Roy, Mayuresh Surnis, Mageshwaran Tamilan, Monalisa Halder, **Siddhartha Biswas**, *Multifrequency evolution of the integrated pulse profile of radio pulsars by implementing the inverse compton mechanism*, Journal of High Energy Astrophysics, 51, 100557, 2026

30. Rajib Kumbhakar, **Soumen Mondal**, Samrat Ghosh, Diya Ram, and Dorothy M. Mwanzia, *Probing Starspot Dynamics on the Active M Dwarf TIC 272272592: A Multiyear TESS Study*, Astrophysical Journal, 994, 150, 2025

31. Diya Ram, **Soumen Mondal**, Samrat Ghosh, and Rajib Kumbhakar, *Magnetic Activities of Wolf 359: Starspot Distribution and Quasiperiodic Pulsation Using TESS Data*, Astrophysical Journal, 988, 2, 2025

32. Dorothy M. Mwanzia, Sneh Lata, W. P. Chen, **Soumen Mondal**, Geoffrey Okeng'o, John Buers, Samrat Ghosh, Athul Dileep, Arjav Jain, Alisher S. Hojaev, and Santosh Joshi, *Stellar Variability toward the Galactic Open Cluster NGC 7209*, Astrophysical Journal, 985, 985, 2025

33. Sneh Lata, Dorothy M. Mwanzia, Geoffrey Okeng'o, **Soumen Mondal**, John Buers, Alisher S. Hojaev, *A study of detached eclipsing binary systems towards the open cluster NGC 7209*, New Astronomy, 125, 102530, 2026

34. Suman Kumar Mondal, Takashi Shimonishi, **Soumen Mondal**, Prasanta Gorai, Kei E. I. Tanaka, Kenji Furuya, and Ankan Das, *ALMA Observations of Cold Methanol Gas in the Large Magellanic Cloud: N79 South Giant Molecular Cloud,* Astrophysical Journal, 998, 2, 2026

35. Tapan K. Sasmal, Soumen Kumar Bera, Xuelei Chen, Yougang Wang, **Soumen Mondal** and Taotao Fang, *A Morphological Identification and Study of Radio Galaxies from LoTSS DR2 II. Strange and Odd Morphology Extragalactic Radio Sources 'STROMERSs'*, Galaxies, 13, 6, 2025

36. Diya Ram, **Soumen Mondal**, Anandmayee Tej, **Tapas Baug**, **Ramkrishna Das**, Dusmanta Patra, Samrat Ghosh, and Rajib Kumbhakar, *Magnetic Activities of GJ 1151: Flares in TESS Data and Radio Observation in uGMRT*, Astrophysical Journal, 994, 120, 2025

37. Surojit Dalui, **Soumya Bhattacharya**, Chiranjeeb Singha, *Probing chaos in Schwarzschild-de Sitter spacetime: The role of black hole and cosmological horizons*, Physics Letters B, 872, 140028, 2026

38. **Sudip Chakrabarty**, **Bivas Mallick**, **Saheli Mukherjee** and Ananda G. Maity, *Probing Kirkwood-Dirac nonpositivity and its operational implications via moments*, Physical Review A, 113, 032434, 2026

39. Gopinath Guin, Souvik Paul and **Sunandan Gangopadhyay**, *Barrow holographic dark energy interacting model in the presence of radiation and matter*, Journal of Cosmology and Astroparticle Physics, 2025, DOI: 10.1088/1475-7516/2025/11/048

40. Soham Sen, Manjari Dutta and **Sunandan Gangopadhyay**, *Density matrix analysis of systems with periodic Hamiltonians*, European Physical Journal D, 79, 118, 2025

41. Ashmita Das, Anjana Krishnan, Soham Sen and **Sunandan Gangopadhyay**, *Derivative coupling in horizon brightened acceleration radiation: A quantum optics approach*, Physical Review D, 112, 065006, 2025

42. Souvik Paul and **Sunandan Gangopadhyay**, *Noncommutative p-wave holographic superconductors*, Classical and Quantum Gravity, 42, 185016, 2025

43. Souvik Paul, Gopinath Guin & **Sunandan Gangopadhyay**, *Holographic entanglement entropy and complexity for the cosmological braneworld model*, Journal of High Energy Physics, 2025, 164, 2025

44. Soham Sen and **Sunandan Gangopadhyay**, *Quantum nature of gravity in a Bose-Einstein condensate*, Physical Review D, 111, 066002, 2025

45. Aslam Halder, **Sunandan Gangopadhyay** and Anirban Saha, *Gauge-invariant description of a Dirac electron moving in a noncommutative gauge field background*, Europhysics Letters, 149, 60001, 2025

46. Arpita Jana, Soham Sen and **Sunandan Gangopadhyay**, *Inverse logarithmic correction in the horizon brightened acceleration radiation entropy of an atom falling into a renormalization group improved charged black hole*, Physical Review D, 111, 085017, 2025

47. Ashis Saha, Anirban Roy Chowdhury & **Sunandan Gangopadhyay**, *Investigating the role of mutual information in the Page curve for a functional renormalization group improved Schwarzschild black hole*, European Physical Journal C, 85, 837, 2025

48. Ashis Saha, Anirban Roy Chowdhury and **Sunandan Gangopadhyay**, *A holographic realization of correlation and mutual information*, Physics Letters B, 870, 139933, 2025

49. Arpita Jana, Soham Sen & **Sunandan Gangopadhyay**, *Black hole as coherent signal amplifier*, European Physical Journal C, 86, 183, 2026

50. Dongting Yang, Hong-Li Liu, **Tapas Baug** et al., *The ALMA-QUARKS Survey: Evidence of a Candidate High-mass Prestellar Core Aside a Bright-rimmed Cloud IRAS 18290-0924*, Astrophysical Journal, 995, 193, 2025

51. A. Koley, A. M. Stutz, F. Louvet, F. Motte, A. Ginsburg, R. Galván-Madrid, R. H. Álvarez-Gutiérrez, P. Sanhueza, **T. Baug**, N. Sandoval-Garrido, J. Salinas, G. Busquet, J. Braine, H.-L. Liu, T. Csengeri, A. Gusdorf, M. Fernández-López, N. Cunningham, L. Bronfman and M. Bonfand, *ALMA-IMF: XIX. $C^{18}O$ (J = 2–1): Measurements of turbulence in 15 massive protoclusters*, Astronomy & Astrophysics, 702, A133, 2025

52. Tarak Chand, Saurabh Sharma, Koshvendra Singh, Joe P. Ninan, Arpan Ghosh, Devendra K. Ojha, **Tapas Baug**, D. K. Sahu, Bhuwan C. Bhatt, Pramod Kumar, Ram K. Yadav, Neelam Panwar, Aayushi Verma, Harmeen Kaur, Mamta, Manojit Chakraborty, Kartik Gokhe, and Ajay Kumar Singh, *Unveiling the Dual Nature of V1180 Cas: UXor-like Dips and EXor-like Bursts across a Decade*, Astrophysical Journal, 998, 2, 2026

53. Shivani Gupta, **Tapas Baug**, Archana Soam, Tie Liu, Fengwei Xu, Satyajeet Moharana, Guido Garay, Chang Won Lee, Siju Zhang, Ariful Hoque, Puja Porel, Lei Zhu, Dongting Yang, HongLi Liu, Wenyu Jiao, Xunchuan Liu, Alik Panja, Xiaofeng Mai, Yankun Zhang, and Shinyoung Kim, *ATOMS-QUARKS Survey: Inflow and Infall in Massive Protocluster G318.049+00.086- Evidence of Competitive Accretion*, Astrophysical Journal, 999, 2, 2026

54. Jiahang Zou, Tie Liu, Fengwei Xu, Xindi Tang, Dezhao Meng, Yan-Kun Zhang, Aiyuan Yang, **Tapas Baug**, Chang-Won Lee, L. Viktor Tóth, Ariful Hoque, Sami Dib, Pablo Garcia, Hong-Li Liu, Prasanta Gorai, Swagat R. Das, Guido Garay, Patricio Sanhueza, Li Chen, Di Li, Jihye Hwang, Dongting Yang, and The ATOMS-QUARKS collaboration, *The ALMA-ATOMS-QUARKS Survey: Resolving a Chemically Rich Massive Protostellar Outflow*, Astrophysical Journal, 995, 1, 2025

55. Qian-Ru He, Won-Ju Kim, Gary A. Fuller, Alessio Traficante, Seamus D. Clarke, Yu Gao, Xue-Peng Chen, Min Fang, Ke Wang, En Chen, **Tapas Baug**, Xiao-Long Wang, Chen Wang, and Yong-Xiong Wang, *The Structure of an 80 Parsec Long Massive Filament*, Astronomical Journal, 171, 4, 2026

56. **Tapas Baug** et al., *The ALMA-QUARKS Survey. III. Clump-to-core Fragmentation and Searches for High-mass Starless Cores*, Astrophysical Journal, 280, 1, 2025

57. Ariful Hoque, **Tapas Baug**, Tirthendu Sinha et al., *The ALMA-ATOMS Survey: Exploring Protostellar Outflows in HC_3N*, Astrophysical Journal, 987, 2, 2025

Department of Chemical and Biological Sciences

1. Debasrita RoyChowdhury, Soumyananda Chakraborti, Sukhendu Mandal, **Ali Hossain Khan**, Kunal Sikder, Dipak Manna, Abhrajyoti Ghosh, Subhash Haldar, Poulami Mukherjee & Arnab Basu, *Nitroxoline Shows Synergy with Colistin Potentiating its Bactericidal Efficacy in Opportunist Pathogen Pseudomonas aeruginosa*, Current Microbiology, 82, 587, 2025

2. Sujata Saha, Debasrita RoyChowdhury, **Ali Hossain Khan**, Sukhendu Mandal, Kunal Sikder, Dipak Manna, Amit Ranjan Maity, Soumyananda Chakraborti, Arnab Basu, *Harnessing the effect of iron deprivation to attenuate the growth of opportunistic pathogen Acinetobacter baumannii*, Antimicrobial Agents and Chemotherapy, 69, 5, 2025

3. Chandrasekhar Mutyala, **Ali Hossain Khan**, Jari Leemans, Carmelita Rodà, Zeger Hens, Iwan Moreels, *Impact of a CdS Crown on Optical Gain in CdSe/CdS Core/Crown Nanoplatelets*, Advanced Optical Materials, 13, 26, 2025

4. Purvi Kishore, Sourav Barman, Rimpa Dey, Ankita Jana, Malabika Ghosh, Pousali Bag, Tapas Ghatak, Partha Sona Maji, Chitrita Ghosh, Nayana Mukherjee, Ankan Dutta Chowdhury, Souvik Ghatak, Rupam Mukherjee, Arnab Basu, **Ali Hossain Khan**, Surya K. Ghosh, Sadananda Mandal, Amit Ranjan Maity, *Delivering Drugs to Cancer Cells and inside the Mitochondria Using a Dual-Ligand Installed Targeted Drug Delivery System*, ACS Applied Nano Materials, 8, 19668-19678, 2025

5. Anisa Mukherjee, **Anannya Bhattacharya**, Nilayan Paul, Aditya Tiwari, Sayan Kanungo & Sanatan Chattopadhyay, *Exploring the Ga-doping dependent optical transparency and electrical conductivity of thermally evaporated P-type ZnO films*, Journal of Materials Science: Materials in Electronics, 36, 2304, 2025

6. Susmitha Kumar, Pekham Chakrabortty, Bipasha Banerjee, **Bidhan Kumbhakar**, Nasir Ali Siddiqui, Swarbhanu Ghosh, Sk. Manirul Islam, *Silver Nanoparticles Embedded in COFs as Reusable Photocatalyst for Oxidative Coupling of Benzylic Amine and Carboxylation of Benzyl Alcohol Derivatives*, ACS Applied Nano Materials, 8, 12946-12956, 2025

7. Bishal Boro, Tao Zheng, Ankita Boruah, Ravi Kumar, Dibyendu Bhattacharyya, Abhijit Shrotri, Qing-Xiao Tong, **Bikash Mishra**, Jing-Xin Jian, John Mondal, *Tailoring the Cu^{2+} Coordination Microenvironment in Porous Organic Frameworks for Switchable CO_2 Photoreduction to CO or CH_4*, Small, 21, e06582, 2025

8. Anirban Karmakar and **Gautam Gangopadhyay**, *Coherent control of steady state and dynamic ergotropy in bipartite quantum batteries*, Physica Scripta, 100, 105007, 2025

9. Soumyadipta Chakraborty, Indrayani Patra, Arup Biswas and **Manik Pradhan**, *High-resolution cavity ring-down spectroscopic investigation of the fundamental symmetric stretch ($_1$) band of $^{14}N^{15}N^{16}O$ isotopologue in the 7.8 m mid-IR region,* Journal of Molecular Spectroscopy, 413-414, 112056, 2025

10. Soumen Mandal, Dinesh Chandra Dey, Anuradha Sett and **Manik Pradhan**, *Photonic spin splitting with orbital angular momentum pointer states via modified weak measurement*, Physical Review A, 112, 033511, 2025

11. Soumyadipta Chakraborty, Jayeta Banerjee, Indrayani Patra, Puspendu Barik and **Manik Pradhan**, *Gold Nanoparticle Aggregation Pathways Probed by Evanescent Wave Cavity Ringdown Spectroscopy: The Role of Guanidine Hydrochloride and $_L$-Tryptophan*, Analytical Chemistry, 97, 17296-17306, 2025

12. Dinesh Chandra Dey, Soumen Mandal, Anuradha Sett, Jayeta Banerjee, and **Manik Pradhan**, *Observation of the non-cyclic Pancharatnam–Berry phase in monolayer $ReSe_2$*, Journal of the Optical Society of America B, 42, 1746-1752, 2025

13. Indrayani Patra, Soumyadipta Chakraborty, Biswajit Panda and **Manik Pradhan**, *Simultaneous measurement of NO_2 and NH_3 using a quantum cascade laser coupled wavelength modulation spectrometer in the mid-IR region*, Laser Physics, 35, 055701, 2025

14. Soumen Mandal, Abdul Rehman, Dinesh C. Dey, Anuradha Sett, Mark W. Horn, **Manik Pradhan**, and Akhlesh Lakhtakia, *Transmission-mode geometric phases and photonic-spin-dependent splitting characteristics of circular Bragg phenomenon through quantum weak measurements [Invited]*, Optical Materials Express, 16, 359-374, 2026

15. Anuradha Sett, Soumen Mandal, Dinesh Chandra Dey and **Manik Pradhan**, *Investigation of orbital angular momentum sidebands in anisotropic few-layered ReS_2*, Journal of Optics, 27, 085401, 2025

16. Priyanka Dobariya, Vinay Thakur, Amrutha A, Karan Marvaniya, Ashish Maurya, **Pradip Pachfule**, Prashant Kumar, Raghavan Ranganathan, Shilpi Kushwaha, Ketan Patel, *Large-Area Supramolecular Crystalline Thin Films of Polyoxometalates with Controlled 1-nm Pores Enabling Ultra-Selective Molecular Transport*, Journal of the American Chemical Society, 2026 (https://doi.org/10.1021/jacs.5c17644)

17. Aparna Tiwari, Supriti Dutta, Bikash Mishra, Pekham Chakrabortty and **Pradip Pachfule**, *An anthraquinone-based covalent organic framework for sustainable photocatalytic oxidative degradation of polystyrene*, Chemical Communications, 62, 1581-1585, 2026

18. Supriti Dutta, Monojit Roy, Shyamali Maji, Bikash Mishra, Anirban Sen, Aparna Tiwari, Tarak Nath Das, Sukanta Mondal, Abhik Banerjee, Debashis Adhikari, **Pradip Pachfule**, *Cationic Covalent Organic Framework for Photocatalytic Defluorinative Amination of Fluoroarenes*, Angewandte Chemie, 65, e16235, 2026

19. Bikash Mishra, Shyamali Maji, Monojit Roy, Supriti Dutta, Archisman Sinha, Tarak Nath Das, Sukanta Mondal, Abhik Banerjee, Arne Thomas, **Pradip Pachfule**, Debashis Adhikari, *A Thiazole-Linked Dithiophenedione-Functionalized Covalent Organic Framework for Photocatalytic Oxidative Dehydrogenation Reactions*, Chemistry of Materials, 37, 8775-8786, 2025

20. Amit Nagar, Akhtar Alam, **Pradip Pachfule** and C. M. Nagaraja, *Isomeric cyano-vinylene-linked covalent organic frameworks and their impact on photocatalytic hydrogen evolution*, Journal of Materials Chemistry A, 13, 14304-14313, 2025

21. Akhtar Alam, Pekham Chakrabortty, Avanti Chakraborty, Samrat Ghosh, **Pradip Pachfule**, *Donor-Acceptor Covalent Organic Frameworks for Photocatalytic Water Oxidation and Oxygen Reduction Reactions*, ChemCatChem, 17, e01000, 2025

22. Supriti Dutta, Akhtar Alam, Pekham Chakrabortty, **Pradip Pachfule**, *Metal-Free Covalent Organic Frameworks for Photocatalytic CO_2 Reduction*, Chemistry Europe, https://doi.org/10.1002/ceur.202500176

23. Anurupa Maiti, **Pradip Pachfule**, Amit Biswas, Venkataramanan Mahalingam, Anup Bhunia, *Controlled Heterogeneous Electrocatalytic Oxidation of Carboxylates and Halides for the Synthesis of Novel Chemicals*, ChemCatChem, 2025

24. Bikash Mishra, Akhtar Alam, Avanti Chakraborty, Bidhan Kumbhakar, Samrat Ghosh, **Pradip Pachfule**, Arne Thomas, *Covalent Organic Frameworks for Photocatalysis*, Advanced Materials, 37, 2413118, 2025

25. Akhtar Alam, Monojit Roy, Shyamali Maji, Avanti Chakraborty, Vikramjeet Singh, Amit Kumar, Sukanta Mondal, Abhik Banerjee, Kamalakannan Kailasam, Debashis Adhikari, **Pradip Pachfule**, *Xantphos–Cu-Decorated Covalent Organic Frameworks for C–H Arylation through Sensitized Electron Transfer*, Advanced Materials, 37, 2416100, 2025

26. Aritra Marick, Ria Saha, Soumya Mondal, Tarak Karmakar and **Rajib Kumar Mitra**, *Revisiting Lanthanide Solvation: The "Gadolinium Break" That Does Exist*, The Journal of Physical Chemistry Letters, 17, 623-629, 2026

27. Vibeizonuo Rupreo, Ria Saha, Jhimli Bhattacharyya, **Rajib Kumar Mitra**, *Molecular mechanisms of Lobeline-mediated inhibition of lysozyme amyloidogenesis: A synergistic approach using biophysical and cheminformatics techniques*, Biophysical Chemistry, 326, 107502, 2025

28. Shah Imtajul Haque, Ria Saha, Vibeizonuo Rupreo, **Rajib Kumar Mitra**, *Lysozyme Amyloid Modulates Membrane Structure and Hydration and Impacts Its Fusogenicity*, Langmuir, 41, 15918-15925, 2025

29. Swapnil Barman, Pratap Kumar Pal, **Rajib Kumar Mitra**, *External Control Over Magnon-Magnon Coupling in a Two-Dimensional Array of Square-Shaped Nanomagnets*, Advanced Quantum Technologies, 8, 2500181, 2025

30. Indrani Bhattacharya, Alexander Hautke, Emma Rossi, Laurie Stevens, Aritra Marick, Asesh Bera, Tanushree Das, Alberta Ferrarini, Marialore Sulpizi, Simon Ebbinghaus, **Rajib Kumar Mitra**, *Non-monotonous Concentration Dependent Solvation of ATP Could Help to Rationalize Its Anomalous Impact on Various Biophysical Processes*, Journal of Physical Chemistry Letters, 16, 4305-4314, 2025

31. Ayishwarya Dutta, Sumana Pyne, **Rajib Kumar Mitra**, Hemant K. Kashyap, *Insights into the Destabilizing Effect of Fluorinated Ethanol on Biomimetic Membranes*, Journal of Physical Chemistry B, 130, 1598-1608, 2026

32. Indrani Bhattacharya, Asesh Bera, Aritra Marick and **Rajib Kumar Mitra**, *Revisiting the Environment Specificity of the Protein (De)solubilization Ability of ATP*, Langmuir, 41, 28750-28759, 2025

33. Jayanta Mondal, Dhrubajyoti Maji, **Ranjit Biswas**, *Characterization of water in (glucose + urea + water) deep eutectic solvent through dielectric relaxation spectroscopy: Temperature dependent measurements and computer simulations*, Journal of Chemical Physics, 163, 184502, 2025

34. Sudipta Mitra, **Ranjit Biswas**, *Correlations between ionic conductivity and co-solvent modulated water structure and dynamics in aqueous Zn-ion battery electrolytes*, Journal of Chemical Physics, 163, 164502, 2025

35. Amrita Mondal, Asmita Dey, Kajal Kumbhakar, Priyadarsi De, **Ranjit Biswas**, *Dynamical signature of the onset of sol-gel phase transition in aqueous solutions of hydrophobically modified poly(acrylic acid)-based copolymers*, Journal of Chemical Physics, 162, 164903, 2025

36. Rik N. Mukherjee, Pradip K. Ghorai, **Ranjit Biswas**, *Entropy of Mixing: Contributions from Interparticle Interactions and Its Relevance to Deep Eutectic Solvents*, Journal of Physical Chemistry B, 129, 4410-4419, 2025

37. Dhrubajyoti Maji and **Ranjit Biswas**, *Solvation structure of paracetamol in ChCl-based polyol deep eutectic solvents: Microscopic insights into increased solubility*, Journal of Molecular Liquids, 423, 127042, 2025

38. Dipanwita Roy, Satadru Chakraborty, Saba Suladze, Minsu Kim, Narayan Chandra Maity, Kamal Mroue, **Ranjit Biswas**, Bernd Reif, DongKuk Lee, Prasenjit Bhaumik, Anirban Bhunia, *Generation of Membrane-Damaging hIAPP Oligomers via Direct Interaction with DOPC/DOPS Nanodiscs*, Langmuir, https://doi.org/10.1021/acs.langmuir.5c05718

39. Karishma Biswas, Sudipta Mitra, Dibakar Roy, Sanhita Roy, Dibakar Sarkar, DeokHyun Son, Rohit Das, Anuradha Roy, Dulal Senapati, Humaira Ilyas, A. Harikishore, **Ranjit Biswas**, **Suman Chakrabarty**, DongKuk Lee, Indranil Biswas, Sudipto Saha, Pallob Kundu, Anirban Bhunia, *Transgenic Tobacco Plants Expressing Synthetic Peptides: A Functional and Structural Analysis for Pathogen Resistance*, Plant Biology Journal, 2025, (DOI: https://doi.org/10.1111/pbi.70287)

40. Kundan Lal, **Rituraj Dubey**, *Sustainable nano-biosensing advances in environmental, food safety, agricultural and healthcare applications*, Microchemical Journal, 218, 115742, 2025

41. Naglaa Atif Alhadi, Surajit Sadhukhan, Nivedita Pan, Gourab Ghosh, Lopamudra Roy, Jhimli Sengupta, Monojit Das, Jhuma Bhadra, Ranjan Das & **Samir Kumar Pal**, *A Nanosensor Detects Nerve Gas Simulants in Model Public Water Using a Nano-Formulation to Preserve Integrity of the Test Samples*, Journal of Fluorescence, 2025, DOI: https://doi.org/10.1007/s10895-025-04590-7

42. Naglaa Atif Alhadi, Monojit Das, Nivedita Pan, Susmita Mondol, Ranjan Das, Samir Kumar Pal, Photo-Responsive Nano-Enzyme Catalysis for Controlled ROS Generation, ChemCatChem, 17, e00280, 2025

43. Shreyansh Priyadarshi, Camellia Mazumder, Bhavesh Neekhra, Sayan Biswas, Debojyoti Chowdhury, Debayan Gupta & **Shubhasis Haldar**, *OncoMark: a high-throughput neural multi-task learning framework for comprehensive cancer hallmark quantification*, Communications Biology, 8, 1434, 2025

44. Deep Chaudhuri and **Shubhasis Haldar**, *Single-Molecule Force Spectroscopy Reveals the Mechanical Role of p47 in Protein Stabilization*, Biochemistry, 64, 3272-3279, 2025

45. Manju Siyaram Yadav, **Sk. Samir Ahamed** and Amit Kumar Paul, *Analytic potential energy functions for*

benzene–water interactions based on accurate ab initio calculations and the ghost atom formalism, Physical Chemistry Chemical Physics, 27, 16923-16934, 2025

46. Sutanu Mukhopadhyay & **Suman Chakrabarty**, *PPIscout: Protein-protein interaction site hotspot mapping using mixed amino acid-water molecular dynamics simulation*, Journal of Chemical Sciences, 137, 106, 2025

47. Sutanu Mukhopadhyay, Krishnendu Sinha, **Suman Chakrabarty**, *Harnessing Allostery to Modulate Protein–Protein Interactions: From Function to Therapeutic Innovations*, Journal of Molecular Biology, 437, 169382, 2025

48. Sayari Bhattacharya and **Suman Chakrabarty**, *Mapping conformational landscape in protein folding: Benchmarking dimensionality reduction and clustering techniques on the Trp-Cage mini-protein*, Biophysical Chemistry, 319, 107389, 2025

49. Dibyendu Maity, Shaheerah Shahid and **Suman Chakrabarty**, *PathGennie: Rapid Generation of Rare Event Pathways via Direction-Guided Adaptive Sampling Using Ultrashort Monitored Trajectories*, Journal of Chemical Theory and Computation, 21, 11377-11389, 2025

50. Sutanu Mukhopadhyay and **Suman Chakrabarty**, *Mixed-Solvent Molecular Dynamics Simulation Reveals a Druggable Allosteric Pocket in the PCSK9 C-Terminal Domain*, Journal of Physical Chemistry B, 129, 11737-11744, 2025

51. Krishnendu Sinha, Amit Kumawat, Hyunbum Jang, Ruth Nussinov, **Suman Chakrabarty**, *Phosphorylation induces altered protonation states and allosterically regulates Rac1–RhoGDI complex*, Protein Science, https://doi.org/10.1002/pro.70413

52. SK. Samir Ahamed, **Suman Chakrabarty** & **Ranjit Biswas**, *Why $[BMIM]^+[PF_6]^-$ is hydrophobic and $[BMIM]^+[BF_4]^-$ hydrophilic in nature? A quantum chemical investigation*, Journal of Chemical Sciences, 137, 92, 2025

53. Soham Chakraborty, Shivam Pandit, Krishnendu Sinha, Madhu Bhatt, Debojyoti Chowdhury, **Suman Chakrabarty**, **Shubhasis Haldar**, *Unraveling antibody-induced mechanical stability of antigen: Insights from single-molecule studies*, Protein Science, 34, e70201, 2025

Department of Condensed Matter and Materials Physics

1. Pratap Kumar Pal, Raisa Fabiha, Amrit Kumar Mondal, Supriyo Bandyopadhyay, **Anjan Barman**, *Harnessing GHz Frequency Spin-Orbit Torque for Spin-Wave Amplification in Nanomagnets*, Advanced Functional Materials, e22422, 2025, DOI: https://doi.org/10.1002/adfm.202522422

2. avid Muradas-Belinchón, Suchetana Mukhopadhyay, Francesco Foggetti, Surya N. Panda, Olof Karis, Peter M. Oppeneer, **Anjan Barman** and M. Venkata Kamalakar, *Electrical Control of Ultrafast Magnetic Speeds in Graphene Spin Field-Effect Junctions*, Physical Review Letters, 135, 097001, 2025

3. Sreya Pal, Md Nur Hasan, Himanshu Bangar, Nastaran Salehi, Sayan Mathur, Manuel Pereiro, Patrik Thunström, Pranaba Kishor Muduli, Debjani Karmakar and **Anjan Barman**, *Deciphering Interfacial Dzyaloshinskii–Moriya Interaction in Transition-Metal Dichalcogenide/Permalloy Heterostructures by Brillouin Light Scattering and First-Principles Calculations*, ACS Nano, 19, 23564-23574, 2025

4. Arundhati Adhikari, Piotr Graczyk, Avinash K. Chaurasiya, Sayanti Mondal, Jarosław W. Kłos and **Anjan Barman**, *Optical probing of magnons and phonons in $Ni_{80}Fe_{20}$ nanodot arrays*, Nanoscale, 2026, DOI: 10.1039/d5nr04628a

5. Raisa Fabiha, Pratap Kumar Pal, Michael Suche, Amrit Kumar Mondal, Erdem Topsakal, **Anjan Barman**, Supriyo Bandyopadhyay, *Spin Hall Nano-Antenna*, Advanced Science, e20505, 2026, https://doi.org/10.1002/advs.202520505

6. Karabi Chatterjee, **Anupam Gorai**, Abu Jahid Akhtar, Sanjit Sarkar, Sudip K. Saha, *Modulation of photodetection characteristics in MAPbBr3 perovskite NCs via Sn doping*, Optical Materials, 171, 117762, 2026

7. Binoy Das, Moumita Patra, Julekha Khatun, **Atindra Nath Pal**, Bipan Tudu, Nityananda Das, *Design and Study of Voltage-Dependent Capacitor Using BJT and Its Application as A Reactance Modulator*, International Journal of Electrical and Electronics Engineering, 12, 5, 2025

8. Biswajit Pabi, Štěpán Marek, Tal Klein, Arunabha Thakur, Richard Korytár, **Atindra Nath Pal**,

Unconventional Electromechanical Response in Ferrocene-Assisted Gold Atomic Chain, Nano Letters, 25, 13511-13518, 2025

9. Zarina Azmi, Deepak Deepak, Aruna Kadadevar, **Avijit Chowdhury**, Manjula G. Nair, Susanta Sinha Roy, Arpita Das, Saumya R. Mohapatra, *Unveiling the synergy of MXene supported ZIF-8 hybrid catalyst for enhanced oxygen evolution reaction*, Surface and Coatings Technology, 512, 132401, 2025
10. Farhana Yasmin, Rajesh Deb, Yamineekanta Mishra, Asim Roy, **Avijit Chowdhury**, Saumya R. Mohapatra, *Tuning the nucleation barrier energy of nonvolatile polymeric memristor by reducing its active layer thickness for threshold switching*, Applied Physics Letters, 127, 25, 2025
11. Subarna Datta, **Barnali Ghosh**, and Soumyadipta Pal, *Investigation of Size-Dependent Electrical Transport in Single Nanowire $La_{1-x}A_xMnO_3$ (x = 0.3 & 0.5 for A = Ca and x = 0.5 for A = Sr) Using Nanolithography-Based Device Fabrication*, IEEE Transactions on Nanotechnology, 24, 593-601, 2025
12. Parushottam Majhi, Anirban Goswami, Subarna Datta, Ravindra Singh Bisht, **Barnali Ghosh** and A K Raychaudhuri, *Phase coexistence and evolution of insulator-metal transition in $Nd_{1-x}La_xNiO_3(0\leq x\leq 1)$ in presence of correlation and disorder*, Journal of Physics: Condensed Matter, 37, 325601, 2025
13. D. Banerjee, Snehamoyee Hazra, Subarna Datta, Jipin Peter, Raju K. Biswas, **Barnali Ghosh**, *The effect of Nd-doping on polymorphic behavior and dielectric properties of HfO_2: An experimental study and DFT calculation*, Journal of Alloys and Compounds, 1029, 180724, 2025
14. Saikat Mitra, Sayan Routh, **Barnali Ghosh**, **Avijit Chowdhury**, *Influence of Cation on X-Ray Detection Performance in Mixed-Halide 2D Ruddlesden-Popper Perovskite*, Physica Status Solidi A, 222, 2500439, 2025
15. **Barun Ghosh** et al., *Observation of the axion quasiparticle in 2D $MnBi_2Te_4$*, Nature, 641, 62-69, 2025
16. Sougata Mardanya, **Barun Ghosh**, Mengke Liu, Christopher Broyles, Junyeong Ahn, Kai Sun, Jennifer E. Hoffman, Sheng Ran, Arun Bansil, Su-Yang Xu, Sugata Chowdhury, *Layer-Dependent Antiferromagnetic Chern and Axion Insulating States in UOTe*, Advanced Science, e10247, https://doi.org/10.1002/advs.202510247Digital Object Identifier (DOI)
17. Nabil Atlam, Swati Chaudhary, Arpit Raj, Matthew Matzelle, **Barun Ghosh**, Gregory A. Fiete and Arun Bansil, *Giant shift current in electrically tunable superlattice bilayer graphene*, Physical Review B, 112, 245409, 2025
18. Rahul Mondal, Mukul Biswas, Koyendrila Debnath, Snehasish Das, Uday Narayan Maiti, Sanat Kumar Adhikari, **Barun Ghosh** and **Avijit Chowdhury**, *Spatially confined surface-terminated MXene nanosheets as a multifunctional platform for triboelectric sensing and logic gates*, Journal of Materials Chemistry C, 2026 (https://doi.org/10.1039/D5TC03448E)
19. Saikat Mitra, Parushottam Majhi, Ganga S Kumar, Subarna Datta, **Barun Ghosh**, Arnab Bera, **Avijit Chowdhury**, Dipten Bhattacharya, **Barnali Ghosh**, *Multiple Ferroelectric Resonance in 2D Organic-Inorganic Halide Perovskite*, ACS Applied Electronic Materials, 7, 5485-5494, 2025
20. Anup Pradhan Sakhya, Brenden R. Ortiz, Nabil Atlam, Matthew Matzelle, **Barun Ghosh**, Milo Sprague, Mazharul Islam Mondal, Iftakhar Bin Elius, Nathan Valadez, Arun K. Kumay, David G. Mandrus, Jonathan D. Denlinger, Arun Bansil and Madhab Neupane, *Diverse electronic topography in a distorted kagome metal $LaTi_3Bi_4$*, Physical Review Materials, 9, L111201, 2025
21. Mazharul Islam Mondal, Anup Pradhan Sakhya, Milo Sprague, Brenden R. Ortiz, Matthew Matzelle, Arun K. Kumay, Avike Seal, **Barun Ghosh**, Arun Bansil et al., *Observation of multiple flat bands and Van Hove singularities in the distorted kagome metal $NdTi_3Bi_4$*, Physical Review B, 112, L121104, 2025
22. **Bhaskar Mukherjee**, Christopher J. Turner, Marcin Szyniszewski and Arijeet Pal, *Symmetric Tensor Scars with Tunable Entanglement from Volume to Area Law*, Physical Review Letters, 136, 090401, 2026
23. Deblina Majumder, Shailza Saini, William S. J. Skinner, Alex Martinez Martin, Gwilherm Kerherve, David J. Payne, **Debayan Mondal**, Evangelos I. Papaioannou and Kalliopi Kousi, *Exsolution of Fe-based pyramidal nanostructures from a noble metal doped perovskite matrix*, Nanoscale Advances, 7, 6426-6437, 2025

24. Mississippi Missouri Bhunia, **Dipanwita Mitra**, Kalyan Kumar Chattopadhyay, Paramita Chattopadhyay, *Porous Boron Nitride Nanostructures Infused Transformer Oil Nanofluids With Superior Thermal and Insulating Properties*, IEEE Transactions on Dielectrics and Electrical Insulation, 33, 285-293, 2025

25. **Jiban Kangsabanik** and Kristian S. Thygesen, *Defect-Assisted Recombination in Semiconductors and Photovoltaic Device Parameters from First Principles*, Journal of the American Chemical Society, 148, 316-329, 2026

26. Soham Saha and **Kalyan Mandal**, *Multifunctional Bi_2O_2S Nanosheet Interface Enabling Co-Pi-Coupled $ZnFe_2O_4$ Nanorods for Enhanced Solar-Driven Water Oxidation*, ACS Applied Energy Materials, 2026 (https://doi.org/10.1021/acsaem.5c03413)

27. Arka Chaudhuri, Anupam Gorai and **Kalyan Mandal**, *Fabrication of NiS nanoparticles by Microwave technique and its effectiveness in electromagnetic interference shielding*, Physica Scripta, 100, 115917, 2025

28. Mily Kundu, Sourav Sarkar, **Kalyan Mandal**, *Investigation of magnetocaloric properties and critical phenomenon of the intermetallic compound DyCoAl across magnetic transition*, Journal of Magnetism and Magnetic Materials, 629, 173290, 2025

29. Sourav Sarkar, Anupam Gorai, **Kalyan Mandal**, *A Ferromagnetic Resonance Study of $MgFe_2O_4$ Nanoparticles as Efficient Microwave Absorber for Different Frequency Bands*, ACS Applied Nano Materials, 9, 756-766, 2026

30. Sourabh Saha, Jeroen van den Brink, **Manoranjan Kumar** and Satoshi Nishimoto, *Polarization-Driven Charge Frustration and Emergent Phases in the One-Dimensional Extended Hubbard Model*, Physical Review Letters, 135, 206504, 2025

31. Manodip Routh, Sayan Ghosh and **Manoranjan Kumar**, *Exploring quantum phases in frustrated spin-1/2 chain and ladders: a detailed review*, Journal of Physics: Condensed Matter, 37, 403001, 2025

32. Manodip Routh, Anutosh Biswas and **Manoranjan Kumar**, *Emergent quasiparticles of the spin – 1 trimer chain*, Physical Review B, 112, 094436, 2025

33. Sambunath Das, Dayasindhu Dey, **Manoranjan Kumar**, S. Ramasesha, *Quadrupolar phases and plateau states in skewed ladders*, Journal of Magnetism and Magnetic Materials, 629, 173262, 2025

34. Prabhakar, Subhajyoti Pal, Umesh Kumar, **Manoranjan Kumar** and Anamitra Mukherjee, *Fractionalized excitations and resonant inelastic x-ray spectra in frustrated spin-1/2 trimer chains*, Physical Review B, 111, 205106, 2025

35. Sk Saniur Rahaman, **Manoranjan Kumar**, Shaon Sahoo, *Magnetic Plateaus and Jumps in a Spin-1/2 Ladder with Alternate Ising–Heisenberg Rungs: A Field-Dependent Study*, Physica Status Solidi B, 262, 2500027, 2025

36. Riju Pal, Kakan Deb, **Nitesh Kumar**, Bernd Büchner, Alexey Alfonsov & Vladislav Kataev, *Ferromagnetic Resonance Spectroscopy on the Kagome Magnet $MgMn_6Sn_6$*, Applied Magnetic Resonance, 56, 1507-1521, 2025

37. S. M. Hossain, B. Rai, P. R. Baral, O. Zaharko, **N. Kumar**, A. K. Bera and M. Majumder, *Evidence for magnetoelastic coupling and chiral magnetic ground state in quasi-van der Waals trigonal $Cr_{1.22}Te_2$*, Physical Review B, 112, 024439, 2025

38. Rahul Pan, Anyesh Saraswati, Amit Mondal, Pujalin Biswal, Debakanta Samal, **Nitesh Kumar** and Partha Pratim Jana, *Unusual magnetic and transport properties of heavily disordered Mn–Zn–M (M = Ga and Sn) alloys with a* b*-Mn-type chiral structure*, Dalton Transactions, 54, 14469-14479, 2025

39. Banik Rai and **Nitesh Kumar**, *Cusplike feature in the Hall resistivity of a uniaxial ferromagnet in nonorthogonal Hall geometry*, Physical Review B, 112, 035110, 2025

40. Rafiqul Alam, Debasis Dutta, Modhumita Sariket, **Nitesh Kumar**, Amit Agarwal, **Atindra Nath Pal**, *Nonlinear and Planar Hall Effects as Probes of Band Geometry in 1T-TaS_2 Driven by CDW Transition*, Advanced Functional Materials, 35, 2418643, 2025

41. Anyesh Saraswati, Sudipta Chatterjee, **Nitesh Kumar**, *Single Crystal Growth and Magnetotransport Properties of 4f Electron Antiferromagnet SmGaSi*, Physica Status Solidi Rapid Research Letters, 20, e202500350, 2026

42. Ritamay Bhunia, Rajesh Jana, Anyesh Saraswati, Kinsuk Giri, **Nitesh Kumar** & **Avijit Chowdhury**, *$MoTe_2$-based synaptic-bridge memristor for brain-inspired computing: neuromorphic performance*

evaluation using MLP-CNN frameworks, npj 2d materials and applications, https://doi.org/10.1038/s41699-026-00682-5

43. Lipika, Shobha Singh, Anyesh Saraswati, Vikas Chahar, Yan Sun, Pascal Manuel, Devashibhai Adroja, Walter Schnelle, **Nitesh Kumar**, Jhuma Sannigrahi and Kaustuv Manna, *Complex spin dynamics induced metamagnetic phase transitions in Dirac semimetal EuAuBi*, Physical Review B, 113, 104406, 2026

44. Dipankar Biswas, Swagata Nandy, Rittwick Mondal, Ardhendu Sekhar Patra, **Premananda Chatterjee**, Saikat Santra & Soumyajyoti Kabi, *Synergistic Effect of Ge Addition on Optical, Thermal, and Mechanical Properties of Se-Te-Pb Chalcogenide Glasses*, Journal of Electronic Materials, 54, 8054-8069, 2025

45. Pratap Pal, Krishnendu Patra, Subhajit Nandy, Sudipta Mahana, Jayjit Kumar Dey, Souvik Chatterjee, C. L. Prajapat, Tapas Paramanik, Dinesh Topwal, Amitabh Das, **Priya Mahadevan** and Debraj Choudhury, *Stability of the collinear up-up-down-down magnetic ordering in Ca_3 $CoMnO_6$*, Physical Review B, 112, 214448, 2025

46. Poulomi Mukherjee, Ranjan Das, Debasmita Pariari, Koushik Das, **Priya Mahadevan** and D. D. Sarma, *Energy-Transfer Pathways That Sensitize Mn^{2+} Emissions Using Mn@CsPbCl$_3$ Nanocrystals as a Generic Platform*, ACS Energy Letters, 10, 6381-6389, 2025

47. Basabendra Roy, Satyaki Kundu, Gaurav Dubey, **Priya Mahadevan**, Bipul Pal, Anamitra Mukherjee, Dhanvir Singh Rana, Bhavtosh Bansal, *Picosecond evolution of an induced metallic state under infinitesimal optical doping in $NdNiO_3$*, Journal of Applied Physics, 138, 065103, 2025

48. Sreyan Raha, Prasun Boyal, Suvadip Masanta, Chumki Nayak, Abhijit Roy, Prabir Pal, **Priya Mahadevan**, Achintya Singha, *Mn-Intercalation-Induced Burstein–Moss Shift and Broadband Emission in $MoSe_2$*, Nano Letters, 25, 14333-14340, 2025

49. Shresth Gupta, Sema Sarisozen, Sanuja Kumar Khuntia, Felix Lang, **Priya Mahadevan**, Sayan Bhattacharyya, *X-Ray Detection with High Dynamic Sensitivity and Ultra-Low Detection Limits by Low-Dimensional Hybrid Bismuth-Iodides*, Advanced Functional Materials, 36, e14126, 2026

50. Debayan Mondal, **Priya Mahadevan**, *Why Do We Have Dual Emission in Two-Dimensional Hybrid Perovskites?*, Journal of Physical Chemistry C, 2026, https://doi.org/10.1021/acs.jpcc.6c00118

51. Banik Rai, Krishnendu Patra, Satyabrata Bera, Sk Kalimuddin, Kakan Deb, Mintu Mondal, **Priya Mahadevan**, **Nitesh Kumar**, *Direction-Dependent Conduction Polarity in Altermagnetic CrSb*, Advanced Science, 12, 2502226, 2025

52. **Ranjini Bhattacharya** and Souvik Roy, *Comparative study between charge and spin thermoelectric figure of merits in molecular junctions with multiple loops*, Journal of Applied Physics, 137, 154301, 2025

53. Susmita Changdar, Oleksandr Suvorov, Andrii Kuibarov, **Setti Thirupathaiah**, Grigory Shipunov, Saicharan Aswartham, Sabine Wurmehl, Iryna Kovalchuk, Klaus Koepernik, Carsten Timm, Bernd Büchner, Ion Cosma Fulga, Sergey Borisenko & Jeroen van den Brink, *Topological nodal i-wave superconductivity in $PtBi_2$*, Nature, 647, 613-618, 2025

54. Susanta Ghosh, Achintya Low, Nayana Devaraj, Susmita Changdar, Awadhesh Narayan, **Setti Thirupathaiah**, *Extremely large and angle-dependent magnetoresistance in kagome Dirac semimetal RFe_6Sn_6 (R = Ho, Dy)*, Journal of Alloys and Compounds, 1040, 183506, 2025

55. Susanta Ghosh, Tushar Kanti Bhowmik, Achintya Low, and **Setti Thirupathaiah**, *Spin-reorientation-driven temperature-dependent intrinsic anomalous Hall conductivity observed in Fe_3 Ge: A ferromagnetic topological metal*, Physical Review Materials, 9, 084201, 2025

56. Anumita Bose, Shubham Purwar, **Setti Thirupathaiah** and Awadhesh Narayan, *Anomalous and parallel Hall effects in ferromagnetic Weyl metal Cr_3Te_4*, Physical Review Materials, 9, 044413, 2025

57. Achintya Low, Tushar Kanti Bhowmik, Susanta Ghosh, Susmita Changdar, and **Setti Thirupathaiah**, *Topological Hall effect in ferromagnetic Weyl semimetal Mn_5 Ge_3 originating in competing dipolar interaction and magnetocrystalline anisotropy*, Physical Review B, 111, 144422, 2025

58. Anjan Kumar N M, Soumya Mukherjee, Abhirup Mukherjee, Ajinkya Punjal, Shubham Purwar, **Thirupathaiah Setti**, Shriganesh Prabhu S., Siddhartha Lal and N. Kamaraju, *Revealing the*

magnetic dimensional crossover in the Heisenberg ferromagnet $CrSiTe_3$ through picosecond strain pulses, Physical Review B, 111, L140414, 2025

59. Anyesh Saraswati, Jyotirmoy Sau, Vera Misheneva, Rui Lou, Sudipta Chatterjee, Sandip Kumar Kuila, Bibhas Ghanta, Anup Kumar Bera, Partha Pratim Jana, Alexander Fedorov, **Setti Thirupathaiah**, **Manoranjan Kumar** and **Nitesh Kumar**, *Accessing quasiflat bands to harvest large Berry curvature in NdGaSi*, Physical Review Materials, 10, L031202, 2026

60. Sk Kalimuddin, Biswajit Das, **Sudipta Chatterjee**, Arnab Bera, Satyabrata Bera, KalyanKumar Chattopadhyay, Mintu Mondal, *Low-Frequency 1/f Noise and Barrier Height Inhomogeneity in Topological Insulator-Based Photodetectors*, ACS Applied Materials & Interfaces, 17, 35781-35789, 2025

61. Sk Kalimuddin, **Sudipta Chatterjee**, Arnab Bera, Satyabrata Bera, Deep Singha Roy, Soham Das, Tuhin Debnath, Ashis K. Nandy, Shishir K. Pandey, Mintu Mondal, *Emergence of a hidden-order phase well below the charge density wave transition in a topological Weyl semimetal $(TaSe_4)_2I$*, Physical Review B, 113, 045114, 2026

62. **Suranjana Chakrabarty**, Anup Ghosh, *Interpreting the Solvatochromic Behavior of DMSO: Perceptions into Hydrogen Bond Donor-Acceptor Duality*, Chemistry Select, 10, e05655, 2025

63. Sudipta Saha, **Suranjana Chakrabarty**, Basudha Deb, Shreya Raha, Amit Kumar Paul, Anup Ghosh, *Probing Intramolecular Vibrational Coupling between the C=C Ring and Amide-I Modes in Quinolinone Derivatives: Insights from DFT and Molecular Dynamics Simulations*, Journal of Physical Chemistry A, 129, 8935-8944, 2025

64. **Suranjana Chakrabarty**, Manisha Bhattacharya, Sudipta Saha, Madhurima Chatterjee, Jayanta Mukhopadhyay, Anup Ghosh, *Unusual Hydrations of Amide I: An Insight into Protein Structure and Flexibility*, Journal of Physical Chemistry B, 2026 (https://doi.org/10.1021/acs.jpcb.5c08241)

65. **Suranjana Chakrabarty**, Basudha Deb, Shreya Raha, Sudipta Saha, Amit Kumar Paul, Anup Ghosh, *DNA Base Pair Mediated Vibrational Coupling: An Adenine-Thymine Base Pair Study*, Advanced Theory and Simulations, 9, e01802, 2026

66. Arnab Paul, Samir Rom, Prabuddha Sanyal and **Tanusri Saha Dasgupta**, *Origin of ferromagnetism and trends in Berry curvature driven anomalous Hall conductivity in the metallic rare-earth antimonides $R\ CrSb_3$ (R = La, Ce, Nd)*, Physical Review B, 112, 094427, 2025

67. Bharti Agrawal, Himanshu Sharma, Jayachandran Babu, **Tanusri Saha-Dasgupta**, Aftab Alam and Titas Dasgupta, *Bonding mediated coupling of electron band mass and phonon group velocity: an effective strategy to improve the thermoelectric performance of solid solutions*, Journal of Materials Chemistry A, 13, 25579-25589, 2025

68. Koushik Pradhan, Dipayan Sen, Prabuddha Sanyal and **Tanusri Saha-Dasgupta**, *Two-sublattice double exchange driven magnetism in Cr-based two-dimensional magnets*, Physical Review B, 111, L180404, 2025

69. Shatabda Bhattacharya, Shubhadip Moulick, Chinmoy Das, Shiladitya Karmakar, Hirokazu Tada, **Tanusri Saha-Dasgupta**, Tatsuhiko Ohto, Shinji Kitao, Makoto Seto, Pradip Chakraborty and **Atindra Nath Pal**, *Engineering Fe(II) spin-crossover/2D reduced graphene oxide heterostructures for tunable cooperativity, magnetic coupling, and conductance switching*, Nanotechnology, 36, 455702, 2025

70. Swagata Das, Uttam Pal, **Tanusri Saha-Dasgupta**, Susanna Leong, *Combating Fuel Biocontamination: Tailored Antimicrobial Peptides and an Innovative Delivery Strategy*, ACS Applied Bio Materials, 8, 7672-7683, 2025

71. Rajdeep Biswas, Jyoti Sharma, Aftab Alam and **Tanusri Saha Dasgupta**, *Tuning magnetic ground states of $R\ Mn_6\ Sn_6$ (R = Lu, Mg) kagome metals by dimensionality reduction: Route to ferromagnetism and large anomalous Hall effect*, Physical Review Materials, 9, 104205, 2025

72. Arnab Bera, Riju Pal, Buddhadeb Pal, Samir Rom, Suchanda Mondal, Deepti Rana, Aastha Vasdev, Sandeep Howlader, Manish Jana, Tanmay Maiti, Rafikul Ali Saha, Biswajit Das, **Tanusri Saha-Dasgupta**, **Prabhat Mandal**, **Atindra Nath Pal** and Mintu Mondal, *Observation of superconductivity and weak ferromagnetism in the quasi-one-dimensional chain compound $(TaSe_4)_3I$ at ambient pressure*, Physical Review B, 112, L180502, 2025

73. Prosanta Sarkar and **Tanusri Saha-Dasgupta**, *Interplay of charge transfer, charge disproportionation, and Jahn-Teller distortion, and its implication for the properties of mixed*

$CaFeO_3 – LaMnO_3$ *compounds*, Physical Review B, 113, 094202, 2026

74. Sweta Ghosh, Sudipta Kanungo and **Tanusri Saha Dasgupta**, *Topology, electric field induced Rashba effect and metal-insulator transition: A case study with bulk and nanostructured layered Zintl compound, KCdBi*, Physical Review Materials, 10, 034202, 2026

Department of Physics of Complex Systems

1. Rishik Perugu, **Arijit Haldar** and Sumilan Banerjee, *Universal nonequilibrium dynamics of pure states and density-dependent thermalization in the Sachdev-Ye-Kitaev model*, Physical Review B, 112, 184301, 2025
2. **Asmita Kumari** & Ujjwal Sen, *Local PT-symmetric evolutions on separable states and violation of no-signaling*, European Physical Journal D, 79, 109, 2025
3. Anirban Paul and **Jaydeb Chakrabarti**, *Heterogeneous water dynamics in hyaluronan-DPPC interfaces*, Physical Chemistry Chemical Physics, 28, 841-849, 2026
4. Tamisra Pal, **Jaydeb Chakrabarti**, *Molecular Dynamics Study on Polymer Nanocomposite on a Substrate with Different Nanoparticle Architecture*, Advanced Theory and Simulations, 9, e01243, 2025
5. Srabani Chakrabarty, Arijit Mondal and **J Chakrabarti**, *Splitting of fluid layers in a modulated colloidal fluid film*, Physica Scripta, 101, 5, 2026
6. Kanika Kole and **Jaydeb Chakrabarti**, *Free Energy Landscape between Watson–Crick to Hoogsteen Base Pairing Transitions*, Journal of Physical Chemistry B, 129, 9600-9608, 2025
7. Ananya Chakraborty, Kunika Agarwal, Sahil Gopalkrishna Naik and **Manik Banik**, *Advantage of Greenberger-Horne-Zeilinger correlation in communication complexity: A step beyond the conventional Greenberger-Horne-Zeilinger paradox*, Physical Review A, 112, 012214, 2025
8. Mir Alimuddin, Snehasish Roy Chowdhury, Ram Krishna Patra, Subhendu B. Ghosh, Tommaso Tufarelli, Gerardo Adesso and **Manik Banik**, *Ergodiscord: An operational and distinct notion of quantumness of correlations*, Physical Review Research, 7, 023200, 2025
9. Sahil Gopalkrishna Naik, Mani Zartab, Nicolas Gisin, **Manik Banik**, *No-go theorem for generic simulation of qubit channels with finite classical resources*, Proceedings of the Royal Society A, 482, 2333, 2026
10. Ram Krishna Patra, Kunika Agarwal, Biswajit Paul, Snehasish Roy Chowdhury, Sahil Gopalkrishna Naik and **Manik Banik**, *Quantum Incompatibility in Parallel versus Antiparallel Spins*, Physical Review Letters, 136, 110402, 2026
11. Saheli Mukherjee, Bivas Mallick, Arun Kumar Das, Amit Kundu and **Pratik Ghosal**, *Measurement-device-independent Schmidt number certification of all entangled states*, Physical Review A, 112, 062434, 2025
12. Animesh Hazra, Tanmoy Chakraborty, Anirban Mukherjee and **Punyabrata Pradhan**, *Generic power laws in higher-dimensional lattice models with multidirectional hopping*, Physical Review E, 112, 044130, 2025
13. Tanmoy Chakraborty and **Punyabrata Pradhan**, *Anomalous current fluctuations and mobility-driven clustering*, Journal of Statistical Mechanics: Theory and Experiment, 2025, 093203, 2025
14. **Ritwick Sarkar** and Ion Santra, *Tracer dynamics in an interacting active bath: fluctuations and energy partition*, New Journal of Physics, 27, 094601, 2025
15. Ramesh Pramanik, Ramu K. Yadav & **Sakuntala Chatterjee**, *Dynamics of chemoreceptor activity with time-periodic attractant field*, European Physical Journal E, 48, 60, 2025
16. Shobhan Dev Mandal and **Sakuntala Chatterjee**, *Bacterial chemotaxis in a traveling wave attractant environment*, Journal of Statistical Mechanics: Theory and Experiment, 2025, 063501, 2025
17. Chandradip Khamrai and **Sakuntala Chatterjee**, *A novel mechanism of ordering in a coupled driven system: vacancy induced phase separation*, Journal of Statistical Mechanics: Theory and Experiment, 2026, 023201, 2026 (**DOI:** 10.1088/1742-5468/ae373f)
18. **Samrat Sen**, *Conclusive local state marking: More nonlocality with no entanglement*, Physical Review A, 112, 052225, 2025
19. J. Bharathi Kannan, Sreeram PG, **Sanku Paul**, S. Harshini Tekur and M. S. Santhanam, *Probing the localization effects in Krylov basis*, Physical Review E, 112, 044203, 2025

20. **Soumi Das**, *Decoding the effect of temperatures on conformational stability and order of ligand unbound thermosensing adenine riboswitch using molecular dynamics simulation*, Journal of Biomolecular Structure and Dynamics, 43, 11042-11055, 2025
21. Snehasish Roy Chowdhury, **Subhendu B. Ghosh**, Tathagata Gupta, Anandamay Das Bhowmik, Sutapa Saha, Some Sankar Bhattacharya and Tamal Guha, *Local inaccessibility of random classical information and their implications in the change-point problem*, Physical Review A, 112, 052401, 2025
22. **Suchismita Banerjee**, Abhik Ghosh & Banasri Basu, *Exploring citation diversity in scholarly literature: an entropy-based approach*, Scientometrics, 130, 2673-2704, 2025
23. Ritwick Sarkar, Sreya Chatterjee and **Urna Basu**, *From attraction to repulsion: emergent interactions in harmonically coupled active binary system*, Journal of Physics A: Mathematical and Theoretical, 58, 415001, 2025
24. Ritwick Sarkar and **Urna Basu**, *Emergent short-range repulsion for attractively coupled active particles*, Soft Matter, 21, 3595-3603, 2025
25. Debraj Dutta, Ritwick Sarkar and **Urna Basu**, *Stochastic two-temperature nonequilibrium Ising model*, New Journal of Physics, 28, 034602, 2026
26. Koyena Ghosh, Suchismita Banerjee, **Urna Basu** & Banasri Basu, *Classifying urban regions by aggregated pollutant–weather correlation strength: a spatiotemporal study*, Stochastic Environmental Research and Risk Assessment, 40, 76, 2026

Technical Research Centre

1. Snehanka Bose, Samya Sen, Taniya Mariyam, Aniket Jana, Nabanita Mukherjee, **Uttam Pal**, Batakrishna Jana, Surajit Ghosh, Amitava Das, *Gelatinase-Responsive Short Peptide Conjugate as a Precision Therapy Against Methicillin-Resistant Staphylococcus aureus*, Journal of the American Chemical Society, 147, 37398-37413, 2025
2. Sandip Dolui, Anupam Maity, Shubham Kundu, Banadipa Nanda, Anupam Roy, Animesh Mondal, Ananya Adhikary, Achintya Saha, **Uttam Pal**, Anirban Bhunia, Nakul C. Maiti, *Stabilization of* a-*Helical Folded Structures Retards Hydrophobic Zipping and Fibrillation of Bovine Insulin: A Key Signature from Raman Spectroscopic Analysis*, Journal of Physical Chemistry B, 129, 4320-4334, 2025
3. Sougata Mondal, Upasana Das, Oyendrila Ghosh, Bidisha Maiti, Shuvam Halder, **Uttam Pal**, Kalyan Kusum Mukherjee, Supratim Ghosh, *Mercury Can Bond to -Carbon of Curcumin Increasing Stability in Aqueous Medium and Demonstrated Selective Cytotoxicity against Acute Leukemia*, ACS Omega, 10, 17416-17434, 2025
4. Banadipa Nanda, Anupam Maity, Rajendra Prasad Nandi, Sandip Dolui, Rajdip Misra, **Uttam Pal**, Nakul C. Maiti, *Conformational Heterogeneity and Redox Switching of the Cysteine Residues in SARS-CoV-2 Main Protease: A Raman Molecular Fingerprint*, Journal of Physical Chemistry B, 2026, (https://doi.org/10.1021/acs.jpcb.5c06195)

Inter-Departmental

1. Bidhan Kumbhakar, **Uttam Pal**, Avanti Chakraborty, Pekham Chakrabortty, **Tanusri Saha-Dasgupta** and **Pradip Pachfule**, *Engineering donor-functionalized covalent organic frameworks to promote photocatalytic hydrogen peroxide generation*, Chemical Communications, 61, 15425-15428, 2025
2. Avanti Chakraborty, Uttam Pal, Sonali Priyadarshini Swain, Sudipa Mondal, Akhtar Alam, **Tanusri Saha-Dasgupta** and **Pradip Pachfule**, *Engineering intermolecular charge transfer in covalent organic frameworks for photocatalytic hydrogen peroxide generation*, Journal of Materials Chemistry A, 2026, DOI: 10.1039/d5ta09118g
3. Bikash Mishra, Supriti Dutta, Uttam Pal, Subhajit Rana, Sandeep Kumar Mishra, **Tanusri Saha-Dasgupta**, **Pradip Pachfule**, *Diketopyrrolopyrrole-based Donor–Acceptor Covalent Organic Frameworks for Iodine Capture*, Small, 21, 2411199, 2025
4. Bidhan Kumbhakar, Avanti Chakraborty, Uttam Pal, Gaurav Jhaa, Sukanta Mondal, Abhik Banerjee, **Tanusri Saha-Dasgupta**, **Pradip Pachfule**, *A Dimolybdenum Paddlewheel Embedded Covalent Organic Framework for Photocatalytic Hydrogen Peroxide Generation*, Small, 21, 2501823, 2025

Total number of Journal Publications: 218

Other Publications

Department of Astrophysics and High Energy Physics

1. Amitabha Lahiri, Parity Nonconsevation Induced by Spacetime Geometry (with A. Chakraborty) in the Proceedings of the 26th DAE-BRNS High Energy Physics Symposium, Varanasi, India, Published in Springer Proc. Phys. 432 (2026) 413-416
2. Amitabha Lahiri, Exploring the Effect of Chiral Torsion on Neutrino Oscillation in Long Baseline Experiments (with R. Barick) in the Proceedings of the 26th DAE-BRNS High Energy Physics Symposium, Varanasi, India, Published in Springer Proc. Phys. 432 (2026) 1170-1173
3. Amitabha lahiri, Neutrino Oscillation in Core Collapse Supernova: The Impact of Spacetime Geometry (with I. Ghose) in the Proceedings of the 26th DAE-BRNS High Energy Physics Symposium, Varanasi, India, Published in Springer Proc. Phys. 432 (2026) 1268-1271
4. Sukanta Bhattacharyya, Soham Sen, Sunandan Gangopadhyay, Resonant Bar Gravitational Wave Detectors in the Generalized Uncertainty Principle Framework, Springer Proceedings in Physics, 432, 518, (2026)
5. Sunandan Gangopadhyay, Noise of Gravitons and the Uncertainty Principle, Springer Proceedings in Physics, 432, 463, (2026)
6. Manjari Dutta, Soham Sen, Sunandan Gangopadhyay, Berry Phase for a Harmonic Oscillator Interacting with a Gravitational Wave, Springer Proceedings in Physics, 432, 490, (2026)
7. Anirban Roy Chowdhury, Ashis Saha, Sunandan Gangopadhyay, Mutual Information and the Page Curve, Springer Proceedings in Physics, 432, 472, (2026)
8. Soham Sen, Sunandan Gangopadhyay, Bose-Einstein Condensate as a Graviton Detector, Springer Proceedings in Physics, 432, 467, (2026)
9. Arnab Mukherjee, Sunandan Gangopadhyay, A.S. Majumdar, Fulling-Davies-Unruh Effect Through Atom-Field Interactions, Springer Proceedings in Physics, 432, 476, (2026)
10. Ashis Saha, Sunandan Gangopadhyay, Chaos, Nonconformality and Holography, Springer Proceedings in Physics, 432, 459, (2026)
11. Souvik Paul, Sunandan Gangopadhyay, Ashis Saha, Gauss-Bonnet AdS Black Hole Thermodynamics and Holography, Springer Proceedings in Physics, 432, 514, (2026)
12. Arijit Manna, Sabyasachi Pal, Tapas Baug, "Detection of comet 3I/ATLAS in radio wavelength during closest approach to Earth using uGMRT", The Astronomer's Telegram, No. 17571, 2026

Department of Condensed Matter and Materials Physics

1. APS Global Physics Summit 2025: Vineet Pandey, Prasenjit Ghosh, Riju Pal, Kenji Watanabe and Takashi Taniguchi, Atindra Nath Pal, Vidya Kochat,, "Broken Symmetry Quantum Hall States, Layer Hybridization and Screening Effects in Twisted Bilayer Graphene at Intermediate Angles." Presented at the APS Global Physics Summit 2025, March 17, 2025
2. S. Sarkar, P.Saha and K. Mandal, “Geometry mediated interconvertibility between spin glass and superparamagnetism relaxation in ZnFe2O4 nanostructures”, Proceedings of the 5th International Conference on Condensed Matter & Applied Physics (ICC 2025) jointly organized by the Condensed Matter Research Society and Bikaner Technical University, Bikaner, India
3. **Tanusri Saha-Dasgupta** and Rupamanjari Ghosh, *India's women of quantum*, Physics World, 38, 8, 2025

Department of Physics of Complex Systems

1. J. C. A. Casapao, A. G. Maity, N. Benchasattabuse, M. Hajdusek, A. Soeda, R. Van Meter, and D. Elkouss; A Double Selection Entanglement Distillation-Based State Estimator, 2025 IEEE International Conference on Quantum Computing and Engineering (QCE), Albuquerque, NM, USA, 2025, pp. 1089-1097, doi: 10.1109/QCE65121.2025.00122

Total number of Other Publications: 16

Impact Factor for publications in the Financial Year 2025-26

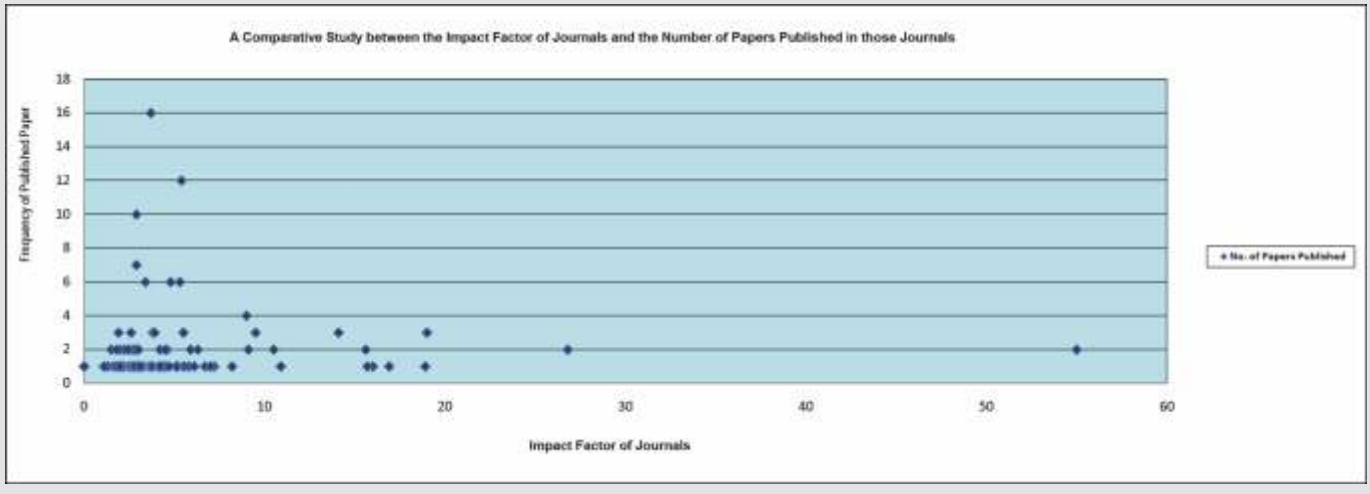
Sl No.	Name of Journal	Journal Impact Factor	No. of Papers Published	Total of Impact Factor in the Journal
1	ACS Applied Bio Materials	5.6	1	5.6
2	ACS Applied Electronic Materials	4.7	1	4.7
3	ACS Applied Energy Materials	5.5	1	5.5
4	ACS Applied Materials & Interfaces	7.8	1	7.8
5	ACS Applied Nano Materials	5.8	3	17.4
6	ACS Energy Letters	17.5	1	17.5
7	ACS Nano	17.3	1	17.3
8	ACS Omega	5.2	1	5.2
9	Advanced Functional Materials	19.9	3	59.7
10	Advanced Materials	29.1	2	58.2
11	Advanced Optical Materials	7.2	1	7.2
12	Advanced Quantum Technologies	4.3	1	4.3
13	Advanced Science	14.1	3	42.3
14	Advanced Theory and Simulations	3.2	2	6.4
15	Analytical Chemistry	7.3	1	7.3
16	Annals of Physics	3	1	3
17	Angewandte Chemie	17.6	1	17.6
18	Antimicrobial Agents and Chemotherapy	4.2	1	4.2
19	Applied Magnetic Resonance	1.3	1	1.3
20	Applied Physics Letters	3.8	1	3.8
21	Astronomical Journal	5.8	1	5.8
22	Astronomy & Astrophysics	6.1	1	6.1
23	Astrophysical Journal	5.7	12	68.4
24	Biochemistry	2.7	1	2.7
25	Biophysical Chemistry	2.3	2	4.6
26	Chemical Communications	4.3	2	8.6
27	Chemistry Europe	NA	1	NA
28	Chemistry of Materials	7.1	1	7.1
29	ChemistrySelect	2	1	2

Sl No.	Name of Journal	Journal Impact Factor	No. of Papers Published	Total of Impact Factor in the Journal
30	ChemCatChem	4.1	3	12.3
31	Classical and Quantum Gravity	3.9	1	3.9
32	Communications Biology	5.8	1	5.8
33	Communications physics	5.5	1	5.5
34	Current Microbiology	2.8	1	2.8
35	Dalton Transactions	3.3	1	3.3
36	European Physical Journal C	4.9	6	29.4
37	European Physical Journal D	1.8	2	3.6
38	European Physical Journal E	2.6	1	2.6
39	European Physical Journal Plus	2.9	2	5.8
40	Europhysics Letters	2.1	1	2.1
41	Galaxies	3.8	1	3.8
42	IEEE Transactions on Dielectrics and Electrical Insulation	4.38	1	4.38
43	IEEE Transactions on Nanotechnology	2.75	1	2.75
44	International Journal of Electrical and Electronics Engineering	NA	1	NA
45	Journal of Alloys and Compounds	6.7	2	13.4
46	Journal of the American Chemical Society	16.6	2	33.2
47	Journal of Applied Physics	2.7	2	5.4
48	Journal of Astrophysics and Astronomy	1.6	1	1.6
49	Journal of Biomolecular Structure and Dynamics	2.5	1	2.5
50	Journal of Chemical Physics	3.7	3	11.1
51	Journal of Chemical Sciences	1.8	2	3.6
52	Journal of Chemical Theory and Computation	5.8	1	5.8
53	Journal of Cosmology and Astroparticle Physics	6.4	2	12.8
54	Journal of Electronic Materials	2.8	1	2.8
55	Journal of Fluorescence	3.4	1	3.4
56	Journal of High Energy Astrophysics	6.1	2	12.2
57	Journal of High Energy Physics	5.375	3	16.125
58	Journal of Magnetism and Magnetic Materials	3	2	6
59	Journal of Materials Chemistry A	9.2	3	27.6
60	Journal of Materials Chemistry C	5.1	1	5.1
61	Journal of Materials Science: Materials in Electronics	3.2	1	3.2
62	Journal of Molecular Biology	4.7	1	4.7

Sl No.	Name of Journal	Journal Impact Factor	No. of Papers Published	Total of Impact Factor in the Journal
63	Journal of Molecular Liquids	10.3	1	10.3
64	Journal of Molecular Spectroscopy	1.2	1	1.2
65	Journal of the American Chemical Society	16.6	1	16.6
66	Journal of the Optical Society of America B	1.9	2	3.8
67	Journal of Optics	2.2	1	2.2
68	Journal of Physical Chemistry A	3	1	3
69	Journal of Physical Chemistry B	3.2	7	22.4
70	Journal of Physical Chemistry C	3.4	1	3.4
71	Journal of Physical Chemistry Letters	4.5	2	9
72	Journal of Physics: Condensed Matter	2.9	2	5.8
73	Journal of Physics A: Mathematical and Theoretical	1.9	1	1.9
74	Journal of Statistical Mechanics: Theory and Experiment	1.9	3	5.7
75	Langmuir	4.4	3	13.2
76	Laser Physics	1.1	1	1.1
77	Microchemical Journal	5.2	1	5.2
78	Nano Letters	9.1	2	18.2
79	Nanoscale	5.2	1	5.2
80	Nanoscale Advances	6.3	1	6.3
81	Nanotechnology	2.9	1	2.9
82	Nature	56.1	2	112.2
83	New Astronomy	2.4	1	2.4
84	New Journal of Physics	2.8	2	5.6
85	npj 2D Materials and Applications	9.2	1	9.2
86	Optical Materials	4.3	1	4.3
87	Optical Materials Express	2.6	1	2.6
88	Physica Scripta	2.6	3	7.8
89	Physica Status Solidi A	2	1	2
90	Physica Status Solidi B: Basic Solid State Physics	1.7	1	1.7
91	Physica Status Solidi Rapid Research Letters	2	1	2
92	Physical Chemistry Chemical Physics	3	2	6
93	Physical Review A	3	10	30
94	Physical Review B	3.9	16	62.4
95	Physical Review D	5.3	6	31.8
96	Physical Review E	2.5	2	5

Sl No.	Name of Journal	Journal Impact Factor	No. of Papers Published	Total of Impact Factor in the Journal
97	Physical Review Letters	9.4	4	37.6
98	Physical Review Materials	3.6	6	21.6
99	Physical Review Research	4	1	4
100	Physics Letters B	5	2	10
101	Plant Biology Journal	3.4	1	3.4
102	Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences	2.7	2	5.4
103	Protein Science	5.6	2	11.2
104	Publications of the Astronomical Society of Australia	4.6	1	4.6
105	Quantum	NA	1	NA
106	Quantum Information Processing	2.2	1	2.2
107	Science Advances	13.9	1	13.9
108	Scientometrics	3.8	1	3.8
109	SciPost Physics	5.33	1	5.33
110	Small	11.8	3	35.4
111	Soft Matter	2.9	1	2.9
112	Stochastic Environmental Research and Risk Assessment	3.8	1	3.8
113	Surface and Coatings Technology	6.9	1	6.9
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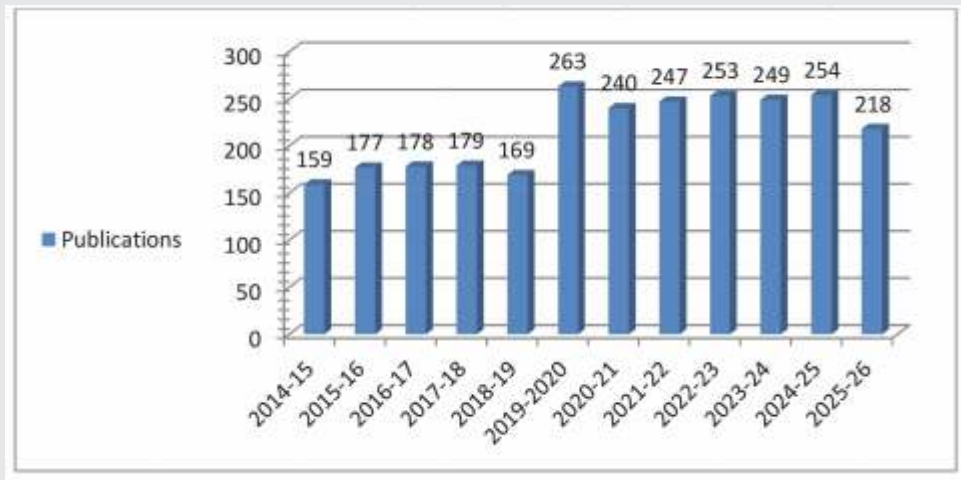
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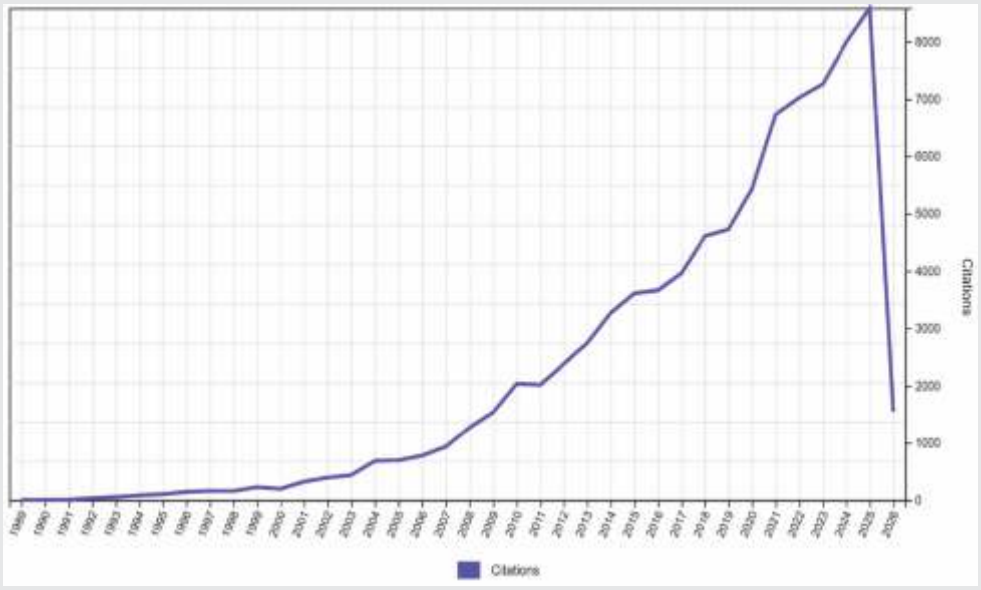


Research Publication Status

Citation Report (On 20th March, 2026)

Database =SCI-EXPANDED, CPCI-S, CPCI-SSH, CCR-EXPANDED, IC.





No. of Publications	:	4622
Sum of the Times Cited	:	85801
Sum of Times Cited without self-citations	:	73054
Citing Articles	:	58524
Citing Articles without self-citations	:	55252

Total no. of Papers published	Total no. of Citation received	Citations per paper	Citations per year*	h-index
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* Year of establishment of the Centre is 1986. Citations received after 1987 to 2026 = 39 years

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Accounts



Satyendra Nath Bose National Centre for Basic Sciences

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BUDGET SUMMARY 2025-2026

The funds come from Department of Sciences and Technology, New Delhi. The following is the summary of budget estimates for the year 2025-2026

(Figure in Lakhs)

	Actuals 2024-2025	Budget Estimate 2025-2026	Revised Estimate 2025-2026
Plan	4911.65	6191.04	6169.45

Plan

Sl no.	Sanction Letter No.	Dated	Amount (Rs. in Lakh)
1	AI/SNBNCBS/SAL/003/2025/1	07.04.2025	₹ 480.00
2	AI/SNBNCBS/SAL/003/2025/2	26.06.2025	₹ 400.00
3	AI/SNBNCBS/SAL/003/2025/3	09.10.2025	₹ 450.00
4	AI/SNBNCBS/SAL/003/2025/4	13.01.2026	₹ 250.00
5	AI/SNBNCBS/SAL/003/2025/5	12.02.2026	₹ 100.00
6	AI/SNBNCBS/GEN/003/2025/1	07.04.2025	₹ 680.00
7	AI/SNBNCBS/GEN/003/2025/2	26.06.2025	₹ 600.00
8	AI/SNBNCBS/GEN/003/2025/3	09.10.2025	₹ 500.00
9	AI/SNBNCBS/GEN/003/2025/4	13.01.2026	₹ 250.00
10	AI/SNBNCBS/GEN/003/2025/5	25.03.2026	₹ 360.00
11	AI/SNBNCBS/CAP/003/2025/1	07.04.2025	₹ 170.00
12	AI/SNBNCBS/CAP/003/2025/2	28.05.2025	₹ 320.00
13	AI/SNBNCBS/CAP/003/2025/2	26.06.2025	₹ 200.00
14	AI/SNBNCBS/CAP/003/2025/4	09.10.2025	₹ 450.00
	Total		**5210.00**

INDEPENDENT AUDITOR'S REPORT

To the Members of

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

Opinion

We have audited the financial statements of **SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES ("the Centre"),** which comprise the Balance Sheet as at 31st March, 2026, the statement of Income & Expenditure, Receipts and Payments Account for the year ended and notes to the financial statements, including a summary of significant accounting policies and other explanatory information.

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid financial statements give a true and fair view in conformity with the accounting principles generally accepted in India, of the state of affairs of the Centre as at 31st March, 2026, **Surplus** for the year ended on that date

Basis for Opinion

We conducted our audit in accordance with the Standards on Auditing (SAs) issued by the Institute of Chartered Accountants of India. Our responsibilities under those Standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the Society in accordance with the Code of Ethics issued by the Institute of Chartered Accountants of India together with the ethical requirements that are relevant to our audit of the financial statements under the Act, and the Rules there-under, and we have fulfilled our other ethical responsibilities in accordance with these requirements and the Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Responsibilities of the Members for the Financial Statements

The Members are responsible with respect to the preparation of these financial statements that give a true and fair view of the financial position, financial performance of the firm in accordance with the accounting principles generally accepted in India, including the Accounting Standards specified under the relevant Act. This responsibility also includes maintenance of adequate accounting records in accordance with the provisions of the Act for safeguarding of the assets of the business and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance of adequate internal financial controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

The Members are also responsible for overseeing the Centre's financial reporting process.

Auditor's Responsibility for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with SAs, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

INDEPENDENT AUDITOR'S REPORT (Contd...)

- Obtained an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances. We are also responsible for expressing our opinion on whether the firm has internal financial controls with reference to financial statements system in place and the operating effectiveness of such controls.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the partners.
- Conclude on the appropriateness of use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Firm's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Firm to cease to continue as a going concern.
- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

Report on Other Legal and Regulatory Requirements

1. We further report, that:

   a) We have sought and obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purposes of our audit.

   b) In our opinion, proper books of account as required by law have been kept by the Centre so far as it appears from our examination of those Books;

   c) The Balance Sheet and the Statement of Income and Expenditure dealt with by this Report are in agreement with the Books of Account;

   d) In our opinion, the aforesaid Financial Statements comply with the Accounting Standards issued by the Institute of Chartered Accountants of India.

   e) The Centre has pending litigations which will have no impact on its financial position.

   f) The Centre did not have any Long-Term contracts including derivative contracts for which there were any material foreseeable losses.

For Roy & Bagchi
Chartered Accountants
FRN No. 301053E

(CA AMIT MITRA)
Partner
Membership No 060694
UDIN: 26060694BBOQNK6113

Place: Kolkata
Date: 28.08.2026

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

BLOCK JD, SECTOR-III, SALT LAKE, KOLKATA - 700 106

BALANCE SHEET AS AT 31ST MARCH 2026 — **Amount (Rs.)**

	Schedule	Current Year (2025-26)	Previous Year (2024-25)
FUNDS AND LIABILITIES			
Capital / Corpus Fund	**1**	149,82,02,222.21	145,82,61,893.77
Reserves And Surplus	**2**	-	-
Earmarked/Endowment Funds	**3**	34,74,91,089.71	34,68,03,696.63
Secured Loans And Borrowings	**4**	-	-
Unsecured Loans And Borrowings	**5**	-	-
Deferred Credit Liabilities	**6**	-	-
Current Liabilities And Provisions	**7**	5,15,19,285.82	5,30,08,349.33
TOTAL		**189,72,12,597.74**	**185,80,73,939.73**
ASSETS			
Fixed Assets	**8**	77,22,47,534.47	77,08,71,085.30
Investments-From Earmarked/Endowment Funds	**9**	25,03,93,056.00	24,18,83,613.00
Investments - Others	**10**	55,86,55,095.00	45,78,85,726.00
Current Assets, Loans, Advances Etc.	**11**	31,59,16,912.27	38,74,33,515.43
Miscellaneous Expenditure			
TOTAL		**189,72,12,597.74**	**185,80,73,939.73**
Significant Accounting Policies	**24**		
Contingent Liabilities And Notes On Accounts	**25**		

As Per our report of even date

Date: 28.08.2026
Place: Kolkata

For **Roy & Bagchi**
Chartered Accountants
FRN: 301053E

(**CA Amit Mitra**)
Partner
Membership no:060694
UDIN: 26060694BBOQNK6113

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES
BLOCK JD, SECTOR-III, SALT LAKE, KOLKATA - 700 106

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2026 **Amount (Rs.)**

	Schedule	Current Year (2025-26)	Previous Year (2024-25)
INCOME			
Income from Services	12	1,91,66,925.77	1,63,30,039.03
Grants/Subsidies	13	40,70,00,000.00	39,54,99,984.00
Fees/Subscriptions(Student Admission & Semester Fees)	14	26,99,273.00	16,52,550.00
Income from Investments (Income on Investment/ Earmarked/ Endowment Funds transferred to Funds)	15	-	-
Income from Technology Transfer & Contract Project	16	-	-
Interest Earned on Term Deposits (including in on HBA)	17	20,802.22	4,35,465.00
Other Income	18	24,75,245.96	21,79,393.96
Increase/(decrease) in stock of finished goods and works-in-progress	19	-	-
TOTAL (A)		**43,13,62,246.95**	**41,60,97,431.99**
EXPENDITURE			
Establishment Expenses	20	16,84,77,315.00	17,49,57,272.00
Other Administrative Expenses etc.	21	23,90,70,799.25	23,99,95,677.44
Expenditure on Grants, Subsidies etc.	22	-	-
Interest Expenses	23	-	-
TOTAL (B)		**40,75,48,114.25**	**41,49,52,949.44**
Balance being excess of Income over Expenditure(A-B)		2,38,14,132.70	11,44,482.55
(Refer to Note of Accounts Schedule 25 - Sub head : 2.6)			
Prior period adjustments (Credit) Transfer to/from Capital Fund		29,14,965.00	
BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CORPUS/CAPITAL FUND		**2,67,29,097.70**	**11,44,482.55**
Significant Accounting Policies	24		
Contingent Liabilities And Notes On Accounts	25		

As Per our report of even date

Date: 28.08.2026
Place: Kolkata

For **Roy & Bagchi**
Chartered Accountants
FRN: 301053E

(**CA Amit Mitra**)
Partner
Membership no:060694
UDIN: 26060694BBOQNK6113

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

RECEIPTS AND PAYMENTS ACCOUNTS

For the year ended 31st March 2026

Amount (Rs.)

RECEIPTS	Current Year (2025-26)	Previous Year (2024-25)	PAYMENTS	Current Year (2025-26)	Previous Year (2024-25)
I. Opening Balances			**I. Expenses :**		
a) Cash in hand	0.00	0.00	a) Establishment Expenses	17,15,19,700.00	18,44,19,278.00
b) Bank Balances :			b) Administrative Expenses	24,45,20,570.79	24,01,06,106.00
i. In current accounts(Schd 11A)	3,70,19,594.85	2,77,70,569.94	c) Maintenance	0.00	0.00
ii. In deposit accounts			**II. Payments made against funds for**		
Schedule - 10	45,78,85,726.00	43,23,14,479.00	**various Projects**		
Schedule - 11A	3,98,62,789.00	7,15,12,546.00			
iii. Savings accounts (Schd 11A)	3,75,06,635.63	6,01,80,153.49	**III. Investments and deposits made**		
iv. Remittance-in-Transit			a) Out of Earmarked/Endowment	0.00	0.00
II. Grants Received			b) CPWD Deposit and NBCC Deposit		
a) From Government of India			c) Bank Gurantee & LC A/C	0.00	3,98,62,789.00
-For the year	57,01,82,220.96	53,70,80,065.64	d) Out of Own Fund	6,94,16,023.00	7,69,68,194.58
-For the previous year					
b) From State Government			**IV. Expenditure on Fixed Assets &**		
c) From Other sources (details)			**Capital Work-in-Progress**		
(Grants for capital & revenue exp.			a) Purchase of Fixed Assets	11,43,21,890.84	11,69,42,483.65
To be shown separately)			b) Expenditure on Capital Work-in-Progress	81,65,313.50	1,63,18,488.00
			V. Refund of Interest		
III. Interest Received			a) To the Government of India		
a) On Bank deposits	4,52,87,680.37	4,48,58,524.00	b) To the State Government		
			c) To other providers of funds		
IV. Other Income	2,43,41,774.73	2,02,74,690.96	**VI. Finance Charges (Interest)**		
V. Amount Borrowed			**VII. Other Payments**	4,12,08,206.09	2,81,62,773.32
VI. Any other receipts	0.00	0.00	**VIII. Closing Balances**		
			a) Cash in hand	0.00	0.00
VII. Amount transferred from Current Account/			b) Bank Balances :		
Savings Account to Deposit Account.		1,11,56,176.00	i. In current accounts(Schd 11A)	64,99,217.00	3,70,19,594.85
			ii. In deposit accounts		
VIII. Amount transferred from Deposit Account			Schedule - 10	55,86,55,095.00	45,78,85,726.00
to Savings Account & Currect Account.	4,39,94,281.92	6,99,07,653.00	Schedule - 11A	0.00	3,98,62,789.00
			iii. Savings accounts(Schd.11A)	4,17,74,687.24	3,75,06,635.63
			iv. Remittance-in-Transit		
	125,60,80,703.46	**127,50,54,858.03**		**125,60,80,703.46**	**127,50,54,858.03**

Per our report of even date
For Roy & Bagchi
Chartered Accountants
FRN: 301053E

(Amit Mitra)
Partner
Membership no: 060694

Date : 05.09.2025
Place: Kolkata

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

BLOCK-JD, SECTOR III, SALT LAKE CITY, KOLKATA 700 106

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31.03.2026 — **Amount (Rs.)**

	Current Year (2025-26)		Previous Year (2024-25)	
SCHEDULE 1 -CAPITAL FUND:				
Balance as at the beginning of the year	145,82,61,893.77		141,89,73,973.93	
Add : Contributions towards Corpus/ Capital Fund	11,40,00,000.00		9,56,64,865.00	
Less: Depreciation for the year	9,94,70,106.66		6,05,82,464.39	
Less: Adjustment during the year	-		30,61,036.68	
Add : Surplus / Deficit during the year	2,54,10,435.10		11,44,482.55	
		149,82,02,222.21		145,82,61,893.77
BALANCE AS AT THE YEAR - END		**149,82,02,222.21**		**145,82,61,893.77**

	Current Year (2025-26)		Previous Year (2024-25)	
SCHEDULE 2 - RESERVES AND SURPLUS:				
1. **Capital Reserve:**				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deductions during the year	-	-	-	-
2. **Revaluation Reserve:**				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deductions during the year	-	-	-	-
3. **Special Reserves:**				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deductions during the year	-	-	-	-
4. **General Reserve:**				
As per last Account	-		-	
Add : Surplus during the year	-	-	-	-
TOTAL		**-**		**-**

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

BLOCK-JD, SECTOR III, SALT LAKE CITY, KOLKATA 700 106

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31.03.2026

SCHEDULE 3 - EARMARKED/ENDOWMENT FUNDS

Amount (Rs.)

	FUND-WISE BREAK UP					TOTAL	
	Technical Research Centre	Project Fund	Retirement Benefits Fund	Staff Medical Fund	Corpus Fund	Current Year (2025-26)	Prev. Year (2024-25)
a) Opening balance of the funds		10,56,96,143.13	13,18,50,983.00	1,40,23,352.00	9,52,33,218.50	34,68,03,696.63	31,16,19,114.79
b) Additions to the Funds							
i) Donations/grants/ Contributions		10,25,61,343.82	8,38,279.00	11,97,115.00	7,77,564.50	10,53,74,302.32	6,12,05,360.84
ii) Income from investments made on account of funds	-	1,08,872.15	14,12,626.00			15,21,498.15	72,06,644.00
iii) Total Interest on Earmarked/ Endowment Fund during the year	-	50,11,614.00			- 3,87,34,096.00	4,37,45,710.00	4,45,35,767.00
iv) Part of surplus as per requirement of corpus guidelines transferred from I/E					13,18,662.60	13,18,662.60	
c) Less : adjustment during the year			46,27,557.98	11,81,750.00	4,75,69,814.88	5,33,79,122.86	
TOTAL (a + b)	**-**	**21,33,77,973.10**	**12,94,74,330.02**	**1,40,38,717.00**	**8,84,93,726.72**	44,53,84,746.84	**42,45,66,886.63**
c) Utilisation/Expenditure towards objectives of funds							
i) Capital Expenditure							
Fixed Assets		47,228,794.50	-	-	-	4,72,28,794.50	4,00,27,981.00
Others- Capital Work in Progress	-	964,500.00	-	-	-	9,64,500.00	
ii) Revenue Expenditure							
Salaries, Stipend and allowances etc.		3,042,385.00				30,42,385.00	94,62,006.00
Rent-	-	-	-	-	-		
Other Administrative expenses	-	5,449,771.54				54,49,771.54	1,10,429.00
Other Payments	-	41,208,206.09	-	-	-	4,12,08,206.09	2,81,62,774.00
iii) Adjustment	-	-	-	-	-	-	
Interest Refunded to DST	-	-	-	-	-	-	
Unspent balance refunded to DST	-	-	-	-	-	-	
TOTAL (c)	**-**	**97,893,657.13**	**-**	**-**	**-**	9,78,93,657.13	**7,77,63,190.00**
NET BALANCE AS AT THE YEAR-END (a+b-c)	**-**	**11,54,84,315.97**	**12,94,74,330.02**	**1,40,38,717.00**	**8,84,93,726.72**	**34,74,91,089.71**	**34,68,03,696.63**

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

BLOCK-JD, SECTOR III, SALT LAKE CITY, KOLKATA 700 106

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31.03.2026 **Amount (Rs.)**

Particulars	Current Year (2025-26)		Previous Year (2024-25)	
SCHEDULE 4 - SECURED LOANS AND BORROWINGS:				
1. Central Government				
2. State Government (Specify)				
3. Financial institutions				
a) Term Loans b) Interest accrued and due				
4. Banks:				
a) Term Loans Interest accrued and due b) Other Loans (Specify) Interest accrued and due				
5. Other Institutions and Agencies				
6. Debentures and Bonds				
7. Others (Specify)				
TOTAL	**Nil**	**Nil**	**Nil**	**Nil**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31.03.2026 **Amount (Rs.)**

Particulars	Current Year (2025-26)		Previous Year (2024-25)	
SCHEDULE 5 - UNSECURED LOANS AND BORROWINGS				
1. Central Government				
2. State Government (Specify)				
3. Financial Institutions				
4. Banks:				
a) Term Loans b) Other Loans (Specify)				
5. Other Institutions and Agencies				
6. Debentures and Bonds				
7. Fixed Deposits				
8. Others (Specify)				
TOTAL	Nil	Nil	Nil	Nil

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

BLOCK-JD, SECTOR III, SALT LAKE CITY, KOLKATA 700 106

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31.03.2026 — **Amount (Rs.)**

	Current Year (2025-26)		Previous Year (2024-25)	
SCHEDULE 6 - DEFERRED CREDIT LIABILITIES:				
a) Acceptances secured by hypothecation of capital equipment and other assets				
b) Others				
TOTAL	Nil	Nil	Nil	Nil

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31.03.2026 — **Amount (Rs.)**

	Current Year (2025-26)		Previous Year (2024-25)	
SCHEDULE 7 - CURRENT LIABILITIES AND PROVISIONS				
A. CURRENT LIABILITIES				
1. Acceptances				
2. Sundry Creditors:				
a) For Capital expenditure		-		-
b) Others - Revenue expenditure (including TRC & Project)		1,07,78,672.82		69,080.97
3. Other Liabilities		67,02,597.41		2,26,55,907.02
4. Deposit from Contractors (including Project & TRC)		1,08,52,698.97		1,08,40,024.50
5. Deposit from Students and other		51,90,750.88		26,71,500.00
6. Deposit from Contractual Employees		14,32,247.00		14,58,486.00
7. Provident Fund Account (Payable)		45,32,444.80		47,25,014.80
8. Project Overhead Fund		78,69,231.43		75,07,693.53
9. Refundable to DST		10,80,000.00		-
10. Employees Welfare Fund		2,21,394.00		2,21,394.00
11. EVLP Overhead Fund		28,59,248.51		28,59,248.51
TOTAL (A)		**5,15,19,285.82**		**5,30,08,349.33**
B. PROVISIONS				
1. For Taxation		-		-
2. Gratuity		-		-
3. Superannuation/Pension		-		-
4. Accumulated Leave Encashment		-		-
5. Trade Warranties/Claims		-		-
6. Others - Ad hoc Bonus		-		-
TOTAL (B)		**-**		**-**
TOTAL (A + B)		**5,15,19,285.82**		**5,30,08,349.33**

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

BLOCK-JD, SECTOR III, SALT LAKE CITY, KOLKATA 700 106

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31.03.2026

Amount (Rs.)

SCHEDULE 8 -FIXED ASSETS

DESCRIPTION	GROSS BLOCK				DEPRECIATION				NET BLOCK	
	Cost/valuation As at begin. of the year 1-4-25	Additions during the year	Adjustment during the year	Cost/valuation at the year end 31-03-26	As at the beginning of the year 1-4-26	Additions during the year	Adjustment during the year	Total up to theYear-end 31-03-26	Current year (2025-26)	Previous year (2024-25)
A. FIXED ASSETS:										
1. LAND:										
a) Freehold										
b) Leasehold	1,09,50,654.60	-	-	1,09,50,654.60	-	-		-	1,09,50,654.60	1,09,50,654.60
2. BUILDINGS:										
a) On Leasehold Land	46,31,59,778.86	67,17,572.00	-	46,98,77,350.86	10,24,14,498.93	74,96,851.26		10,99,11,350.19	35,99,66,000.67	36,07,45,279.93
b) On Freehold Land	-	-	-	-	-	-		-	-	-
c) Ownership Flats/Premises	-	-	-	-	-	-		-	-	-
d) Superstructures on Land not belonging to the entity	-	-	-	-	-	-		-	-	-
3. PLANT MACHIENRY & EQUIPMENT	83,39,06,022.27	8,23,66,780.45	-	91,62,72,802.72	54,47,76,448.78	7,42,96,490.89		61,90,72,939.67	29,71,99,863.05	28,91,29,573.49
4. VEHICLES	7,21,186.00	-	-	7,21,186.00	5,67,106.60	85,640.84		6,52,747.44	68,438.56	1,54,079.40
5. FURNITURE, FIXTURES	4,55,93,835.71	59,728.20	-	4,56,53,563.91	3,41,12,580.79	13,62,400.53		3,54,74,981.32	1,01,78,582.59	1,14,81,254.92
6. OFFICE EQUIPMENT	55,70,436.08	-	-	55,70,436.08	48,81,326.53	1,46,949.38		50,28,275.91	5,42,160.17	6,89,109.55
7. COMPUTER & LAN INSTALLATION	13,64,68,729.20	2,51,77,810.19	-	16,16,46,539.39	6,53,62,093.45	1,58,65,174.52	-	8,12,27,267.97	8,04,19,271.42	7,11,06,635.75
8. ELECTRIC INSTALLATIONS	1,27,86,567.00	-	-	1,27,86,567.00	1,12,18,122.77	2,16,599.24		1,14,34,722.01	13,51,844.99	15,68,444.23
9. LIBRARY BOOKS	-	-	-	-	-	-		-	-	-
10. TUBEWELLS & W.SUPPLY	-							-	-	-
11. OTHER FIXED ASSETS	10,000.00	-	-	10,000.00	9,500.00	-		9,500.00	500.00	500.00
TOTAL OF CURRENT YEAR	15091,67,209.72	11,43,21,890.84	-	162,34,89,100.56	76,33,41,677.85	9,94,70,106.66	-	86,28,11,784.51	76,06,77,316.05	74,58,25,531.87
PREVIOUS YEAR	139,65,44,455.72	15,20,93,466.98	3,94,70,712.98	150,91,67,209.72	70,27,59,213.46	6,07,09,447.79	126,983.40	76,33,41,677.85	74,58,25,531.87	
B. CAPITAL WORK IN PROGRESS	2,07,25,823.78		1,34,75,335.01	72,50,488.77	-	-	-	-	72,50,488.77	2,07,25,823.78
C. Intangable Assest under Development	43,19,729.65	-	-	43,19,729.65	-	-	-	-	43,19,729.65	43,19,729.65
TOTAL (A + B)	153,42,12,763.15	11,43,21,890.84	1,34,75,335.01	163,50,59,318.98	76,33,41,677.85	9,94,70,106.66	-	86,28,11,784.51	77,22,47,534.47	77,08,71,085.30

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

BLOCK-JD, SECTOR III, SALT LAKE CITY, KOLKATA 700 106

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31.03.2026 **Amount (Rs.)**

SCHEDULE 9 - INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS

		Current Year (2025-26)	Previous Year (2024-25)
1.	In Government Securities		
2.	Other approved Securities		
3.	Shares		
4.	Debentures and Bonds		
5.	Subsidiaries and Joint Ventures		
6.	Project Fund Investment	8,03,91,624.00	7,18,82,181.00
7.	Retirement Benefit Fund Investment	14,14,58,192.00	14,14,58,192.00
8.	Staff Medical Fund Investment	1,21,66,085.00	1,21,66,085.00
9.	Corpus Fund Investment (Project Overhead)	1,63,77,155.00	1,63,77,155.00
10.	TRC Fund Investment	-	-
	TOTAL	**25,03,93,056.00**	**24,18,83,613.00**

SCHEDULE 10 - INVESTMENTS - OTHERS

		Current Year (2025-26)	Previous Year (2024-25)
1.	In Government Securities		
2.	Other approved Securities		
3.	Shares		
4.	Debentures and Bonds		
5.	Subsidiaries and Joint Ventures		
6.	Others - Fixed Deposit with Indian Overseas Bank (including Project Overhead Investment)	33,82,61,646.00	28,70,93,848.00
	Fixed Deposit with Union Bank of India	16,63,93,449.00	16,07,91,878.00
	Fixed Deposit with HDFC	5,40,00,000.00	1,00,00,000.00
	TOTAL	**55,86,55,095.00**	**45,78,85,726.00**

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

BLOCK-JD, SECTOR III, SALT LAKE CITY, KOLKATA 700 106

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31.03.2026 Amount (Rs.)

SCHEDULE 11 - CURRENT ASSETS, LOANS, ADVANCES ETC.

	Current Year (2025-26)		Previous Year (2024-25)	
A. CURRENT ASSETS:				
1. Inventories:				
a) Stores and Spares		32,615.57		44,203.53
2. Cash balances in hand				
3. Bank Balances:				
a) With Scheduled Banks:				
On Current Accounts:		64,99,217.00		3,70,19,594.85
On Deposit Accounts for LC&BG:		-		3,98,62,789.00
On Savings Accounts:		4,17,74,687.24		3,75,06,636.63
5. Remittance - in - Transit				
6. Post Office-Savings Accounts				
TOTAL (A)		**4,83,06,519.81**		**11,44,33,223.01**

SCHEDULE 11 - CURRENT ASSETS, LOANS, ADVANCES ETC. (Contd.)

	Current Year (2025-26)		Previous Year (2024-25)	
B. LOANS, ADVACNES AND OTHER ASSETS				
1. Loans:				
a) Staff including HBA ,Vehicle &PC Advance		7,50,986.00		7,00,852.00
b) Project Account		1,28,43,923.00		26,93,926.54
c) Technical Research Centre		3,054,200.58		
2. Advances and other amounts recoverable in cash or in kind or for value to be received:				
a) On Capital Account - CPWD Deposit Account	4,38,840.00		4,38,840.00	
b) Advance Salary Recoverable	23,77,650.00		-	
c) Others	35,84,943.54		39,18,549.54	
d) Contractors & Suppliers	2,04,24,362.00	2,68,25,795.54	1,71,03,562.00	2,14,60,951.54
3. Income Accrued:				
a) On Investments from Earmarked/Endowment Funds (Including Project)	-		1,63,12,735.00	
b) On investments - Others	-		76,01,081.00	
c) Income tax (TDS) Refundable	-			2,39,13,816.00
4. Sundry Debtors		2,10,932.00		3,06,191.00
5. Security Deposit (including Project)		-		-
6. Non Current Assets (Library books)		22,33,02,199.06		22,33,02,199.06
7. Other Non current Assets (Assets held for disposal)		6,22,356.28		6,22,356.28
TOTAL (B)		**26,76,10,392.46**		**27,30,00,292.42**
TOTAL (A + B)		**31,59,16,912.27**		**38,74,33,515.43**

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

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SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31.03.2026

SCHEDULE 12 - INCOME FROM SALES/SERVICES

Amount (Rs.)

	Current Year (2025-26)	Previous Year (2024-25)
1. Income from Sales		
a) Sale of Finished Goods	-	-
b) Sale of Raw Material	-	-
c) Sale of Scraps	-	5,60,160.80
2) Income from Services		
a) Guest House Rent	15,87,856.86	12,94,063.23
b) Hostel Charges (Recovery of HRA)	52,81,666.04	40,97,439.00
c) Equipment Utilisation Fees	4,26,600.00	6,75,500.00
d) Hostel Maintenance Fees	17,82,549.00	15,80,586.00
e) Project Overhead	2,71,026.60	15,02,185.00
f) Income from BSNL	2,95,448.00	1,82,850.00
g) Course fees	1,41,000.00	53,500.00
h) Dining Hall Rent	-	-
i) Reimbursement of Infrastructural Maintenance (NSM)	89,00,743.27	45,99,390.00
j) Conference Registration Fee	4,80,036.00	17,58,942.00
k) Sale of assets	-	25,423.00
TOTAL	**1,91,66,925.77**	**1,63,30,039.03**

SCHEDULE 13 - GRANTS/SUBSIDIES

(Irrevocable Grants & Subsidies Received)

	Current Year (2025-26)	Previous Year (2024-25)
1. Central Government	40,70,00,000.00	39,54,99,984.00
2. State Government(s)		
3. Government Agencies		
4. Institutions/Welfare Bodies		
5. International Organsations		
6. Others		
TOTAL	**40,70,00,000.00**	**39,54,99,984.00**

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

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SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31.03.2016

SCHEDULE 14 - FEES/SUBSCRIPTIONS

Amount (Rs.)

			Current Year (2025-26)	Previous Year (2024-25)
1)	Student Admission Fee	80404	42,253.00	95,800.00
2)	Annual Fees/Subscriptions			
3)	Student Semester Fee	80301	21,20,020.00	14,45,500.00
4)	Consultancy Fees	-	-	
5)	Conference fees	80579	5,37,000.00	1,11,250.00
	TOTAL		**26,99,273.00**	**16,52,550.00**

Amount (Rs.)

SCHEDULE 15 - INCOME FROM INVESTMENTS

(Income on Invest. From Earmarked/ Endowment Funds transferred to Funds)	Investment from Earmarked Fund		Investment - Others	
	Current Year (2025-26)	Previous Year (2024-25)	Currnet Year (2025-26)	Previous Year (2024-25)
1) Interest				
a) On Govt. Securities	-	-	-	-
b) Other Bonds/Debentures	-	-	-	-
2) Dividents:				
a) On Shares	-	-	-	-
b) On Mutual Fund Securities	-	-	-	-
3) Rents	-	-	-	-
4) Others	-	-	-	-
a) Interest on Fixed Deposits with Banks	-	-	-	-
b) Interest on SB Accounts	-	-	-	-
TOTAL	**Nil**	**Nil**	**Nil**	**Nil**
TRANSFERRED TO EARMARKED/ ENDOWMENT FUNDS	**Nil**	**Nil**	**Nil**	**Nil**

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

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SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31.03.2026

SCHEDULE 16 - INCOME FROM TECHNOLOGY TRANSFER & CONTRACT PROJECT

Amount (Rs.)

		Current Year (2025-26)	Previous Year (2024-25)
1.	Income from Technology Transfer	-	-
2.	Income from Contract Project		
3.	Others		
	TOTAL	-	-

SCHEDULE 17 - INTEREST EARNED

		Current Year (2025-26)	Previous year (2024-25)
1)	On Term Deposits:		
	a) With Scheduled Banks	-	-
	b) With Institutions	-	-
	c) Others	-	-
2)	On Savings Accounts:		
	a) With Scheduled Banks	-	-
	b) Post Office Savings Accounts	20,472.22	3,22,757.00
	c) Others	-	-
3)	On Loans:		
	a) Employees/Staff (Interest on HBA etc.)	-	-
	b) Others	-	-
4)	Interest on Debtors and Other Receivables	330.00	1,12,708.00
	TOTAL	**20,802.22**	**4,35,465.00**

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

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SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31.03.2026

SCHEDULE 18 - OTHER INCOME

Amount (Rs.)

		Current Year (2025-26)	Previous Year (2024-25)
1)	Profit on Sale/disposal of Assets:		
	a) Owned assets		
	b) Assets acquired out of grants, or received free of cost		
3)	Fees for Miscellaneous Services		
4)	Miscellaneous Income	24,75,245.96	21,79,393.96
	TOTAL	**24,75,245.96**	**21,79,393.96**

SCHEDULE 19 - INCREASE/(DECREASE) IN STOCK OF FINISHED GOODS & WORK IN PROGRESS

		Current Year (2025-26)	Previous Year (2024-25)
a)	Closing stock		
	Finished Goods		
	Work-in-progress		
b)	Less: Opening Stock		
	Finished Goods		
	Work-in-progress		
	NET INCREASE/(DECREASE) [a-b]	**Nil**	**Nil**

SCHEDULE 20 - ESTABLISHMENT EXPENSES

		Current Year (2025-26)	Previous Year (2024-25)
a)	Salaries and Wages	14,60,91,568.00	15,26,21,933.00
b)	Other Allowances and Bonus	-	-
c)	Employer's Contribution to Provident Fund	23,32,100.00	27,99,227.00
d)	Contribution to Retirement Benefits Fund	-	-
e)	Staff Welfare Expenses (Medical)	52,52,992.98	57,44,213.00
f)	Employer's Contribution to NPS	104,52,075.00	1,21,33,267.00
g)	Others (including Retirement Benefits Expeneses)	43,48,579.02	16,58,632.00
h)	LTC (Plan)	-	
	TOTAL	**16,84,77,315.00**	**17,49,57,272.00**

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

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SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31.03.2026

SCHEDULE 21 - OTHER ADMINISTRATIVE EXPENSES ETC.

Amount (Rs.)

	Current Year (2025-26)	Previous Year (2024-25)
a) Extended Visitors Programme.(Including Seminars & Workshops)	2,29,50,262.06	3,11,71,745.63
b) Meeting Expenses	19,57,504.45	15,34,402.06
c) Library General Expenses	3,04,938.84	63,031.12
d) Electricity and Power	3,69,77,973.00	3,77,61,516.00
e) Laboratory Expenses	93,83,532.25	1,47,21,591.64
f) Insurance	34,225.00	23,338.00
g) Repairs and Maintenance	7,44,53,153.26	7,69,32,226.09
h) TPSC Programme	2,84,000.00	40,000.00
j) Vehicles Hire Charges	17,33,686.00	18,83,476.00
k) Postage, Telephone and Communication Charges	17,11,927.60	11,01,196.00
l) Printing and Stationary	9,65,838.85	13,55,922.00
m) Travelling and Conveyance Expenses	55,79,530.00	21,56,857.00
n) Contingency to Faculty	3,090.00	35,739.00
o) Auditors' Remuneration	4,56,660.00	1,46,910.00
p) Bank Charges	4,21,220.30	75,635.85
q) Professional Charges (Legal Charges)	4,93,210.00	3,00,130.00
r) Staff Training & Welfare	8,53,285.00	8,17,268.00
s) Patent & Trademark		25,500.00
t) Integrated Ph.D.	18,06,902.22	18,20,787.25
u) Hindi Programme	96,660.00	79,168.00
v) Advertisement and Publicity	3,85,493.00	3,31,600.00
w) Others	62,53,147.85	39,70,776.46
x) Municipal Tax	1,81,780.00	1,41,388.00
y) Contract Services	2,02,49,144.85	2,16,25,728.34
z) Stipend (Post BSc. & Post MSc.)	5,09,15,058.00	4,18,79,745.00
1) Expenses for Panchet Observatory	6,18,576.72	
TOTAL	**23,90,70,799.25**	**23,99,95,677.44**

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SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31.03.2026

SCHEDULE 22 - EXPENDITURE ON GRANTS, SUBSIDIES

Amount (Rs.)

	Current Year (2025-26)	Previous Year (2024-25)
a) Grants given to Institutions/Organisations		
b) Subsidies given to Institutions/Organisations		
TOTAL	**Nil**	**Nil**

SCHEDULE 23 - INTEREST

	Current Year (2025-26)	Previous Year (2024-25)
a) On Fixed Loans		
b) On Other Loans (including Bank Charges)		
c) Others		
TOTAL	**Nil**	**Nil**

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

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SCHEDULE 24 - SIGNIFICANT ACCOUNTING POLICIES

1. ACCOUNTING CONVENTION

The Financial Statements are prepared on the basis of Historical Cost Convention, unless otherwise stated and on accrual method of accounting. Interest on Interest bearing Loans and Advances granted to the Staff are accounted for on cash basis and Guest House Rent are accounted for on accrual basis. For Capitalization of Fixed Assets under Project is accounted for in line with applicable provisions of GFR Rule 2017.

2. INVENTORY VALUATION

Stores, Spares and Consumables are valued at Cost.

3. INVESTMENTS

Investments are valued at Cost.

4. FIXED ASSETS

4.1. Fixed Assets are stated at Cost of Acquisition inclusive of Inward Freight, Duties and Taxes and Incidental and Direct Expenses related to Acquisition as well as Custom Duty and Clearing & Forwarding Charges on Imported Equipment are also capitalised.

4.2. Fixed Assets Purchased by way of Non- Monetary Grants (other than towards the Capital Fund) are capitalised at value agreed/ stated by corresponding Credit to Capital Fund. Incomplete Work is shown as Capital Work in Progress and to be capitalised on completion.

5. CAPITAL WORK IN PROGRES

Capital work-in-progress includes Intangible Asset under development which includes associated tangible components, specifically hardware procured for and utilized exclusively during the development phase. Tangible component is capitalised as it is installed and ready for use. Depreciation is charged on a straight-line basis over a useful life. Amortization of Intangible Asset under development will commence upon their readiness for intended use with the successful completion and operationalization.

6. NON-CURRENT ASSETS

6.1. Library Books have been shown under Non-Current Assets.

6.2. No Depreciation /Amortization are provided on Assets held for disposal. Short/Excess over book value on disposal of such assets is provided in the year of sale.

7. DEPRECIATION

7.1. Depreciation on Capitalization has been charged on the value determined /estimated at the time of takeover and as and when on further items were added subsequently to Assets.

7.2. Depreciation is provided on Straight Line Method as per rates specified in the Companies Act,2013

7.3. In respect of Addition to Fixed Assets/ Deletion from Fixed Assets during the Financial Year, Depreciation is considered on Pro-rata basis. Depreciation is provided from the date of Acquisition of the Assets.

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7.4. Depreciation arising on Fixed Assets is deducted from Fixed Assets and also from Capital Fund out of which Fixed Assets are created and not passed through the Income and Expenditure and directly debited to Capital Fund.

7.5. Depreciation on Part of Office Building funded by TRC Fund is not provided but Depreciation on part of the Building funded by Centre Fund is provided.

7.6. No Depreciation has been charged on Fixed Assets procured out of Project Fund.

8. FOREIGN CURRENCY TRANSACTIONS

Transactions denominated in Foreign Currency are accounted for at the exchange rate prevailing at the date of transactions.

9. RETIREMENT BENEFITS

9.1. Investments are valued at cost.

9.2. Retirement benefit Expenditure arising due to super superannuation are accounted for at the time of Retirement.

10. INTEREST ON TERM DEPOSIT

10.1. Interest accrued on Term Deposit credited to Corpus Fund of the Centre.

10.2. Interest on Term Deposit for the F.Y.2025-2026 had been reclassified to Corpus Fund as per applicable accounting policy stated in 10.1.

11. Corresponding figures for the previous year have been re-grouped/re-arranged/ re-classified wherever necessary.

Kolkata

Dated: 22.08.2026

SATYENDRA NATH BOSE NATIONAL CENTRE FOR BASIC SCIENCES

BLOCK-JD, SECTOR III, SALT LAKE CITY, KOLKATA 700 106

SCHEDULE 25 : CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS

1. CONTINGENT LIABILITIES

1.1. Claims against the Centre not acknowledged as Debts are NIL (Previous Year was also NIL).

1.2. Bank Guarantee given by /on behalf of the Centre's to WBSEDCL is Rs.1, 05, 00,000.00 against 100% margin money by way of Fixed Deposit (Previous Year amount was Rs.1, 05, 00,000.00).

Letter of Credit opened by the Bank on behalf of the Centre and Project and balance pending as on 31-03-2026 is Rs. 2,46,45,566.00 (Previous Year amount was NIL).

1.3. Bill Discounted with Banks is NIL (Previous Year was also NIL).

1.4. Disputed Demands in respect Income Tax and GST are Nil (Previous Year amount ware also NIL).

1.5. In respect of Claims from Parties for non-execution of Orders but contested by the Centre is NIL (Previous Year amount was also NIL).

1.6. Subjudice matters involving employee benefit expenses have not been considered in the books of accounts for the F.Y. 2025-26 as the same is not determinable.

2. NOTES ON ACCOUNTS

2.1. Capital Commitments: -Estimated value of Contracts remaining to be executed on Capital Account for NIL (Previous Year Rs. 1, 60, 91,395.00).

2.2. The Unadjusted Travelling Advances of Rs.63, 000.00 paid to Mr. Amartya Sarkar during FY 2012-13 and this amount has been lying unadjusted since FY 2012-13.

2.3. In view of there being no taxable income under the Income Tax Act 1961, no provision for Income Tax has been considered necessary.

2.4. Foreign Currency Transactions

(i) Value of Imports calculated on C.I.F. basis:

	Current Year	Previous Year
Capital Goods:	Rs. 5, 31, 48,975.45	Rs. 4, 39, 85,827.00
Consumables:	Rs. 88,557.94.00	Rs. 3, 63,113.00

(ii) Other Expenditure in Foreign Currency: NIL

(iii) Earnings: Value of Exports on FOB basis: NIL

2.5 The Centre had incurred during FY 2022-2023 Rs. 286.33 Lakhs under following budget head out of its own source, which is yet to be disbursed by DST:

Budget Head	Amount
SALARY	Rs. 79.06 Lakhs
GENERAL	Rs. 207.27 Lakhs

2.6 Net profit amounting to Rs. 2,67,29,097.70 is re-appropriated to Centre's Corpus Fund to the tune of Rs. 13,18,662.60 (as per requirement of Corpus Fund Guidelines) and rest amount of Rs. 2,54,10,435.10 is transferred to Centre's Capital Fund.





CENTRE FOR
S. N. BOSE NATIONAL
BASIC SCIENCES 1986
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