



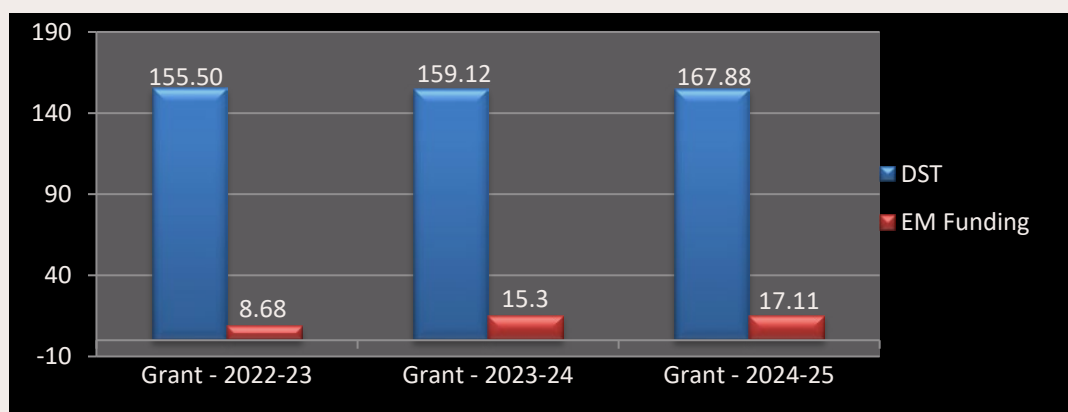
ANNUAL REPORT 2024-25



INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

(A Deemed to be University under
section 3 of UGC Act, 1956)

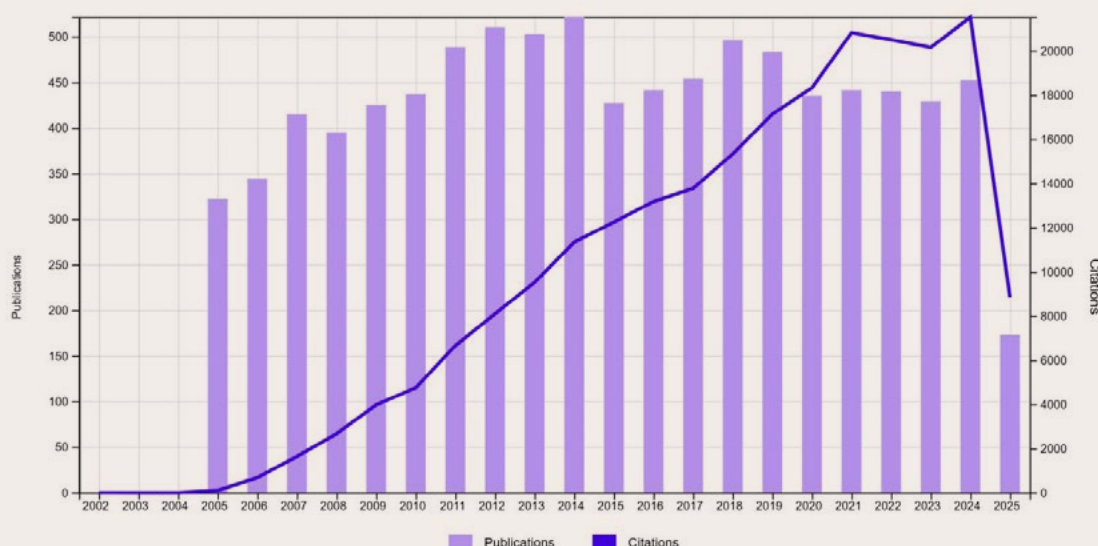
(An Autonomous Institute under
Department of Science & Technology,
Government of India)



Budget in 2024-2025: DST – 167.88 crores

Web of Science

Citation Report (On 11th June, 2025)



Result found 2005-2025

No. of Publications	:	9,031
H Index	:	153
Sum of the times cited	:	231,299
Average citations per item	:	25.61
Average citations per year	:	9637.46

Performance during the year (2024-25)

Publications in Journals	:	429
Publications in Book Chapter	:	06
Average Impact Factor	:	5.82
Ph.D. Degree Awarded	:	78
Patent Granted/Awarded	:	01
Patent Filed	:	01

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FROM THE DIRECTOR'S DESK

It is my great pleasure and privilege to present the Annual Report of the oldest research and teaching institution of the country, Indian Association for the Cultivation of Science (IACS) for the year, 2024-25. IACS continues to be the cradle of Indian Science and is an Autonomous Institute under the Department of Science & Technology, Government of India with unique features for innovations and creativity.

We are close to completing 150 years with a legacy of glorious history and vibrant present. In the year 2018, IACS has received the status of Deemed to be University under the *de novo* category. We are the only DST Institution offering undergraduate teaching in addition to the graduate and PhD programs. We are thankful for excellent support from various funding agencies, specifically DST and the Government of India to take us through difficult circumstances while maintaining high performance at a commendable scale.

In the year, 2024-25, we published 429 high quality research papers in Indexed Journals with an average impact factor of 5.82 and 06 book chapters. About 150 students graduated in various programs including 78 PhD degrees in various science disciplines. One patent filed and one patent was awarded/granted. IACS continues to be the best

performing DST Autonomous Institution and has got a national rank of 13 in Nature index.

The high quality of research has been recognized by various national and international bodies in the form of many laurels and accolades. For example (in alphabetical order), Prof. Abhishek Dey is elected as a Fellow of the Indian National Science Academy of Science (SNA) and an Editorial Advisory Board member in Chemical Reviews, ACS. Prof. Amitava Patra is serving as a senior Editor, Journal of Physical Chemistry Letters; a member of Editorial Advisory Board, Chem. NanoMater., a member of Editorial Advisory Board, Chem. Phys. Chem., chairperson, Scientific Advisory Council, IASST, Guwahati and a member, Academic Council Committee, Chandigarh University. Prof. Anindita Das is elected as an Associate of the West Bengal Academy of Science & Technology (WAST) (2024), an editorial advisory board member of RSC Applied Polymers (since 2024), Royal Society of Chemistry and ACS Polymer Au (since 2024), American Chemical Society and received ACES-CRSI Early Career Award (2024), CRSI. Prof. Benu Brata Das is elected as a Fellow of Indian Academy of Science (FASc), Bengaluru. Prof. Biman Jana received CRSI Bronze Medal, CRSI. Prof. Debashree Ghosh received Pople Medal (APATCC) and serving as a Topic Editor, Journal of Chemical Theory and Computation.



Prof. Indra Dasgupta is elected as a Fellow, Indian Academy of Sciences, Bengaluru (FASc) and Associate Fellow, Asia Pacific Center for Theoretical Physics (2024-2029), APCTP, Pohang, Korea. Prof. Jyotirmayee Dash received Dr. Satyajit Chakrabarti Memorial Award ICCAES 2025, IEM and serving as an editor of Bioorganic & Medicinal Chemistry Letters, Royal Society of Chemistry. Prof. Kalobaran Maiti received Sir, C. V. Raman Memorial Lecture Award, Indian Photobiology Society and Bernard Coqblin Prize 2025. Prof. Pradyut Ghosh is elected as a Fellow of the Royal Society of Chemistry (FRSC), 2025, RSC. Prof. Praveen Kumar is elected as a Member, Global Young Academy 2023-2028 (GYA) and Member, PEC, Materials Science, DST. Prof. Rajib K. Goswami is elected as a Fellow of West Bengal Academy of Science & Technology (FAScT). Prof. Tapan Kr. Paine is serving as an Editorial Advisory Board Member of Transition Metal Chemistry, Springer Nature. Prof. Sumanta Chakraborty received Outstanding Reviewer Award, Institute of Physics, UK, London. About 25 research scholar received best poster prizes in various international conferences.

Several distinguished Scientists from academic institutes and industry delivered Institute Colloquium Lecture Series. To name a few, Prof. Pierre H. Dixneuf, Institute of Chemical Sciences of Rennes, University of Rennes, France spoke on "Catalytic Functionalization of Phosphine C-H bonds and New Reactions of Interrupted Reduction Intermediates"; Prof. Sergey A. Varganov, Department of Chemistry, University of Nevada, Reno, USA talked about "Nonadiabatic molecular dynamics with the crystal field Hamiltonian to study spin dynamics in lanthanide complexes"; Prof. Indrajit Bhattacharya, TCS Research, talked on "Knowledge Based Question Answering in the Age of LLMs"; Prof. Partha Bhowmick, IIT KGP discussed "Curvature Estimation Made Simple - From Real to Digital"; Prof. Prasenjit Mitra, Research Consultant, QCRI talked "About Large Language Models (LLMs)"; Prof. Amitava Das, University of South Carolina, USA talked on "Civilizing AI: Examining Emerging Capabilities and Mitigating Potential Risk of Foundation Models"; Prof. Sandip Trivedi, TIFR Mumbai talked on "Universal themes in physics from black to a grain of grapheme"; Prof. A. Ananthanarayan, IISc, Bangalore talked on the "Joy of Discovery in the Modern Era : Some Reflections and Directions", etc.

IACS took active initiatives in science outreach and encouraging future generation to take up science as their career. For example, third- and fourth-year science students of the five-year Integrated M.Sc. Programme at ISERC, Visva-Bharati, Santiniketan visited IACS on 27th May, 2024. Eighteen Students accompanied by a faculty member, viz. Dr. Mahasweta Nandi (an alumni of IACS) and a staff member attended the programme. Prof. Arindam Banerjee, Prof. Rupa Mukhopadhyay and Prof. T. K. Paine delivered lectures in addition to their visit to the laboratories. Professor Somobrata Acharya has undertaken a project from SEED division to train ST graduate students in science. He along with IACS faculty and staff visit various underprivileged villages and expose them to the wonders of science. Many ST Science Graduate students have been trained with the sophisticated scientific equipment.

We actively participate in inter-Institute collaborations involving academia, industry, and government agencies. Solar Energy Research is being conducted along with the vision of the ministry of new and renewable energy (MNRE). A continuous Ambient Air Quality Monitoring Station (ACAAQMS) is in operation in collaboration with the West Bengal Pollution Control Board at IACS.

IACS remains as Nodal institute for India in Asia Pacific Center for Theoretical Physics (APCTP) based in Seoul, South Korea. There is a Co-Publishing Agreement between Springer Pvt. Ltd. and IACS to run the Indian Journal of Physics. Tripartite water research agreement has been in operation between IACS, University of Roma Tre and University of Cagliari, Italy. There are Japan-India Collaborative Research Projects in Molecular Sciences with the Institute for Molecular Science (IMS), Japan; National Institute of Natural Sciences (NINS), Japan; SERIUS (Solar Energy Research Institute for India and the United States); TWAS-IACS Postdoctoral Fellowship Programme which are currently underway.

To foster industry partnership, we initiated collaboration with GK Machineries and Robotics Pvt. Ltd. for the development of drone assisted pheromone dispersal through nano-sensors for the early detection of pest infestation in cotton farming land. A start-up grant was sanctioned from Biotechnology Industry Research Assistance



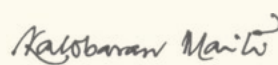
Council (BIRAC), DBT, for the development of point-of-care device for the selective detection of human serum albumin, creatine kinase and kidney injury molecule-I for the accurate determination of acute kidney injury. BIRAC, DBT has funded the formation of a start-up company, GR Agritek Labs through Biotechnology Ignition Grant-13 where the scientists from IACS are part of the team members in this project. A private industry sponsored research program has been initiated with ATGC Biotech Pvt. Ltd. for the development of semiochemical loaded organogelators for the management of certain agricultural pests. Collaborative Research Project is going on with Unilever Research Centre, Bangalore; Research agreement between IACS-TATA Steel Ltd has been signed. Collaborative Research Project with Unilever Industries Pvt. Ltd., Mumbai, between IACS and Dystrophy Annihilation Research Trust, Bangalore between IACS and CSIR-IICB Kolkata are in operation. A joint inter-institutional Integrated MSc-PhD programme in Chemical and Cell Biological Sciences between IACS and IIT-Kharagpur is ongoing, in which several students from various parts of country are inducted.

IACS has been proactive in organizing various national events mandated by the Government of India. Students and staff organize various social and cultural events to keep the IACS a vibrant place.

Being an academic institution of high repute and a national center for innovation and creativity as envisaged by the founder, Dr. Mahendralal Sircar, it will be our mission to continue to do high quality basic research as well as potential translational research and impart good quality education in varied areas of sciences at the undergraduate and postgraduate levels.

My heartiest congratulations to all our faculty, student and staff-members who have been working tirelessly to maintain IACS as a vibrant place and take it forward to a greater height. Thank you for being there in every occasion of joy and handle all types of circumstances with great efficiency. I congratulate and thank the family of all members of the IACS for their passionate support and help to make IACS a wonderful campus to stay in and work peacefully.

Thank you all.



(Kalobaran Maiti)
Director

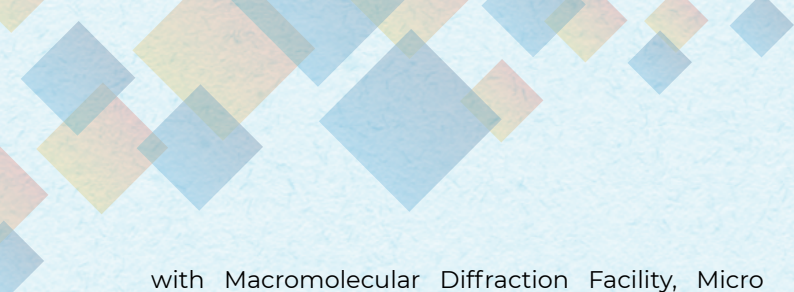


FROM THE DEAN

The office of the Dean R&D oversees the research infrastructures, faculty research grants, collaborations with industries and academic institutions from within the country and abroad, official formalities related to extramural research projects of the faculty members. The Indian Association for the Cultivation of Science (IACS) has an excellent culture of fundamental research, state-of-the art research facility, research synergy between chemistry, physics and biology, confluence of experimental and theoretical research. Presently, IACS nurtures research programs in all core disciplines of Physical, Chemical, Biological, Mathematical and Computational, Materials, and Applied and Interdisciplinary Sciences.

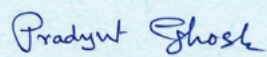
It is my great pleasure to report a productive research activities in the last fiscal year by the highly qualified faculty members, dedicated and motivated students of IACS. At present there are 67 permanent faculty members and ~500 researchers who contributed in the 2024-25 research outputs. This year research activities is impressive as previous year, in terms of publications, obtaining extramural grants, scientific collaborations, hosting national and international conferences, workshops, schools, organizing outreach programmes etc. Our faculty members continued to publish in top quality international journals. In the year 2024-25, the total number of papers published was 435 including 06

in Book Chapters with an average impact factor of 5.82 making IACS best among the DST institutes and 13th among the leading institutions in India as reported in the Nature Index-2025 based on quality publications. In the current year, 23 new extramural projects by various funding agencies including industry were sanctioned in addition to 75 ongoing projects. The Technical Research Centre funded by DST is continuing which not only promoting translational research but also encouraging the academia-industry collaboration. Faculty members of IACS submitted 01 patent application and 01 patent was granted. The faculty members delivered several research lectures/seminars in national and international conferences/schools and also participated in the outreach programs. In particular, in the framework of the Science for Equity, Empowerment & Development (SEED) project several training sessions and outreach activities were organised for the underprivileged ST students in various remote places. Throughout the year, the Institute organized numerous research seminars, colloquiums, workshops and schools. Like every year the six schools of IACS organized focussed research conferences involving speakers with international repute. The research infrastructure was boosted by the procurement of TEM ARM3000F2 (FS), AFM (Oxford), Element Analyzer, Single Crystal X-Ray Diffractometer System



with Macromolecular Diffraction Facility, Micro Volume UV-VIS Spectrophotometer, Pulsed Laser Deposition Chamber with in-situ Rheed facility System, Leica Stellaris STED Super resolution microscope, Rigaku Fully automatic sequential wavelength dispersive X-Ray spectrometer system, Rheometer with Dynamic Mechanical Thermal Analysis System and DNS Sequencer. Needless to say that the upgradation of the research infrastructure has been possible due to the generous funding received from the administrative ministry. I applaud all the faculty members who received various awards and fellowships for their

tireless work in research and sustained effort to take IACS to a newer height. Finally, I congratulate all my colleagues for completing one more successful and productive year in research.



Pradyut Ghosh

(Dean R&D)



It is heartwarming to observe that IACS has completed one more successful year in the domain of academic, administrative, technical, social and cultural activities. In the realm of this excellent journey, the office of the Dean (Administration & Staff Matters) remains involved in various administrative matters, staff related matters, audit issues and any other administrative matters of the Institute as delegated by the Director. A large number of administrative matters are processed through this office. This has been made possible only due to the team work and support of faculties, staffs and students. I am honored to serve the Institute as a Dean, Administration & Staff Matters.

Finally, I take this opportunity to thank and congratulate the Director, Registrar and all my colleagues of the Institute for their tireless efforts towards the growth and development of IACS.

A handwritten signature in black ink, appearing to read 'Somobrata Acharya'.

Somobrata Acharya

Dean (Administration & Staff Matters)



I have great pleasure in reporting an account of a productive academic year steered by the faculty members of the Indian Association for the Cultivation of Science (IACS). The office of the Dean of Faculty Affairs is to facilitate routine service matters of the members of the faculty, recruitment of new faculty members and look after the career advancement of the individual faculty members and to promote their growth as a whole. This includes appointments, reappointments, tenure, promotion, service matters like leave etc. Furthermore, the Dean of Faculty Affairs (DoFA) acts as a bridge between the members of the faculty and the administration. I am happy to share with you that at present we have 67 faculty members distributed in six different schools, who form a vibrant and cohesive group of outstanding academicians. In addition, there are other academic members of great distinction, who add to the vibrant teaching and research program of IACS University.

In the year 2024-25, IACS faculty members have achieved excellence in teaching and research, enabling the institute to realise its aim of providing high quality education in modern sciences, integrated with research. Faculty members have been able to attract large quantum of extramural funding and have published their research in journals of international repute. The institute was involved in several other academic activities such as scientific collaborations, hosting national and international conferences, workshops, schools, organising outreach programmes etc. In the last fiscal year, the total number of publications in journals and in book chapters was 435 with an average impact factor of 5.82 making IACS

best among the DST institutes and 13th among the institutes in India as reported in the Nature Index-2025. Faculty members of IACS filed 01 patent application and 01 patent was granted. The faculty members delivered several lectures/seminars in national and international conferences / schools and also participated in outreach programs.

In the framework of the Science for Equity, Empowerment & Development (SEED) project, several training sessions and outreach activities were organised for the underprivileged ST students in various remote places. The ongoing collaborations with various institutions in India and abroad in terms of academic visits and exchange programs continued. In view of their excellent performance, several faculty members were promoted to the next level.

Faculty members of IACS have been recipient of prestigious awards and recognitions, e.g., Fellowship of the National Academies, West Bengal Academy of Science & Technology and Royal Society of Chemistry, Outstanding Reviewer Award of the Institute of Physics (IoP) publishing, Editorial Advisory Board Membership of several high impact factor journals, Pople Medal (APATCC), CRSI Bronze Medal, Membership of Global Young Academy and PEC, Materials Science, DST. I applaud all the faculty members who received various awards and fellowships for their dedicated work and sustained efforts. Such achievements are commendable and reassuring.

Finally, I take this opportunity to thank and congratulate all my colleagues for their tireless efforts and significant contributions towards the growth and development of IACS.

Sourov Roy
Dean (Faculty Affairs)



Office of the Dean (Graduate Studies and Students Affairs) looks after academic affairs of the institute, such as students admission (advertisement, interview and all other related task), academic calendar, running courses, communication with course instructors, research progress monitoring and comprehensive examination of PhD students, PhD registration, thesis colloquium, thesis submission, thesis evaluation and viva-voce, issuing provisional degree certificate and different other certificates to the students, Annual Convocation (partial responsibility together with the Office of the Director and Registrar) and other academic matters. Advertisement and appointment of Research Associates are also done by this office. Dean (Graduate Studies and Students Affairs) is assisted by Academic Coordinators for running the academic programs of the institute. Day-to-day work of the academic office is supervised by the In-charge, academic office, who is assisted by other staff members in the office. In the year 2024, students' admission for the Integrated BS-MS and MS/ Integrated MS-PhD program of IACS was conducted in two-steps. A national level written test was conducted for BS-MS (UPST) as well as

MS-Integrated PhD (MPST) admission. Test centers were spread in different major cities across India. In the year 2024, 1601 students appeared for the UPST while 1086 students appeared for the MPST. Students, short listed based on UPST or MPST, were called for interview and based on their performance in both the written test as well as in the interview, the final merit list was prepared. From this batch total 37 and 62 students have been continuing in the BS-MS and MS/ MS-Integrated PhD course, respectively. PhD admission window was opened 2 times in the year. Together 77 students took admission for the PhD program in 2024-25. In the 4th Annual Convocation of IACS, held on 31st July, 2024, 47 students received PhD degree, 49 students received MS degree and 30 students received BS-MS degree.

Suhrit Ghosh

Dean (Graduate Studies and Student Affairs)



FROM THE REGISTRAR'S DESK

It is my privilege to present this note in the Annual Report for the year 2024–25 of the Indian Association for the Cultivation of Science (IACS), Kolkata. This report captures the key developments and achievements across administrative, technical, financial, and infrastructural areas during the past year. As the country's oldest scientific research institution, we continue to uphold our commitment to supporting excellence in science, and this year has been no exception.

Over the course of the year, we have made notable progress in streamlining and strengthening our administrative systems. Efforts have been taken to improve internal processes, adopt digital tools for better coordination, and ensure transparency and accountability in our day-to-day operations. The Registrar's office has worked closely with all departments to maintain smooth functioning and compliance with government and institutional policies. The technical wing has extended their competent and wholehearted services and support in running the state-of-the-art sophisticated instrumental facilities for the seamless and productive research activities of the scientists.

On the financial front, we ensured prudent and effective utilization of resources. Budgetary planning and expenditure have been managed carefully in line with the approved allocations, and all efforts were made to support the research and academic activities of the institute without any hindrance. Timely audits and internal checks have helped us maintain financial discipline, and I

express my gratitude to the Finance and Accounts team for their continuous hard work.

Infrastructure development has remained a key focus area throughout the year. Several renovation and upgradation projects were undertaken to improve laboratories, hostels, office spaces, and campus facilities. Steps were also taken to maintain the overall environment of the campus in a manner that is conducive to both research and academic excellence. We acknowledge the contribution of our engineering and maintenance teams in ensuring that these developments were carried out efficiently.

None of this would have been possible without the dedication and cooperation of all members of the IACS community - faculty, students, staff, and administrators. I extend my sincere thanks to each one of you for your support and active participation in maintaining the standards that IACS is known for. It is this collective effort that has allowed us to bring out such a comprehensive and meaningful Annual Report.

As we move ahead, I urge everyone to continue working together in the same spirit of collaboration and commitment. Let us carry forward the legacy of this great institution with renewed energy and shared responsibility.

With warm regards and sincere thanks to all who contributed to this report.

Sarbani Saha

Sarbani Saha

Registrar

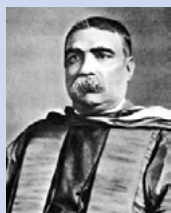
THE PAST GLORY



IACS is the oldest research institute in India. **Dr. M.L. Sircar** (1833-1904), a medical practitioner, founded IACS in 1876 to cultivate science in all departments. In the first 50 years, IACS was run only by donations received from individuals like Vidyasagar, Maharaja of Vijianagram, KalikrishnaTagore and others.



Original research at IACS was started in 1907 by **C.V. Raman**. Raman came to Calcutta as Assistant Auditor General of Government of India and started working at IACS outside office hours and holidays. The Raman Effect was discovered in 1928 for which Raman received the 1930 Nobel Prize in Physics. Raman was a Palit Professor of Physics of Calcutta University from 1917-1933 but he carried out all his research at IACS. Raman discovered the small angle X-ray.



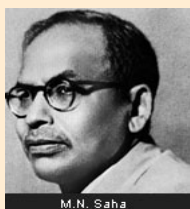
In the initial period Father Lafonte took major steps in teaching and building laboratories. **J.C.**

Bose, FRS (1858-1937, inventor of microwave communication) and **Asutosh Mukherjee** (1864-1924), first Indian to publish a Paper in 1881) were among first lecturers of IACS.



S.N. Bose, FRS (1894 - 1974) (discoverer of the Bose Statics) joined IACS as a National Professor in 1958.

In 1933, Raman left IACS to join IISc, Bangalore as its first Indian Director. Before leaving Calcutta, he appointed **K.S. Krishnan**, FRS (1898-1961), co-discoverer of Raman Effect) as the first MLS Professor.



After Independence, M.N. Saha, FRS (1893-1956, discoverer of Saha Ionization Formula) played a big role in making IACS as a full-fledged research institute. With the help of **Dr. B.C. Ray**, CM/WB and Pandit J.L. Nehru, PM, Saha built the present campus at Jadavpur. Saha was the first Director of IACS (1953-1956).



Professor Kedareshwar Banerjee (1900-1975) was a world renowned X-ray crystallographer and he served as Director of IACS from 1959 until his retirement in 1965. He was the founder of crystallography in India and proposed a new approach to the crystallographic phase problem, which heralded the extremely powerful direct methods of crystallography of the modern era.



Professor Amal Kumar Raychaudhuri (1924-2005)

was an acclaimed theoretical physicist well known for his seminal work on relativity and cosmology. He worked as a research scholar at IACS (during 1940's) and later took a research job at the institute. He is most well known for the Raychaudhuri equation which describes the gravitational attraction for pressure-free matter, showing the repulsive nature of a positive cosmological constant, and underlying the basic singularity theorem.



Professor Phanindra Chandra Dutta (1912-1983)

took over the charge as the Head of the Department of Organic Chemistry at IACS in 1953 and guided the destiny of the Department for more than two decades. He introduced in our country for the first time the stereo controlled synthesis of organic molecules related to terpenoids and variety of other natural products.



Professor Santi Ranjan Palit

(1912-1981) joined IACS in 1947 as a head of the Department of Physical chemistry and got actively engaged himself with all his vigour and enthusiasm in the development plan of the

Association. He made significant contributions in many areas of physical chemistry as well as polymer chemistry. His contributions in the field of polymer chemistry are of lasting importance and he is justifiably regarded as the father of polymer research in India.



Professor Priyada Ranjan Ray (1958)

was a renowned inorganic chemist who served as the Director of IACS. He is particularly well known for his seminal work on rhombic twist mechanism (Ray Dutt Twist), coordination chemistry stabilization of metal ions in unusual oxidation states and so on.



Suri Bhagavantam (1909-1989), impressed by the discoveries of Sir C.V. Raman, relocated to Calcutta and joined him in 1928 at IACS. After the Nobel Prize-winning discovery, Raman chose Bhagavantam as his collaborator to further his research work. Till the early decades of this century the IACS was the only place in India where high level research in Physical Sciences could be carried out. Prof. Bhagavantam was among the many distinguished scientists of modern India who carried out research at IACS to enrich the scientific research culture of India. In 1957, he became the Director of the Indian Institute

of Science in Bangalore. He was then appointed as the scientific adviser to the Government of India under the Ministry of Defence and then joined as the Director of the Defence Research and Development Organisation (DRDO) in 1962 after the Indo-Chinese War. Professor Bhagavantam wrote the well known book titled The Theory of Groups and its Physical Applications along with Venkata Rayudu. This book was published in three editions and was translated into Russian. It is often said that a whole generation of spectroscopists are brought up on this book. He also wrote the book titled Scattering of Light and Raman Effect.

DISTINGUISHED ALUMNI AND ASSOCIATES

NOBEL LAUREATE

- ◆ Sir C.V. Raman(1888–1970,former faculty of IACS)

BHARAT RATNA (HIGHEST CIVIL HONOR IN INDIA)

- ◆ Sir C.V. Raman(1888–1970, former faculty of IACS)
- ◆ Prof. C.N.R. Rao (former Chairman of the Review Committee of IACS and IACS Fellow)

FELLOW OF THE ROYAL SOCIETY (FRS), LONDON:

- ◆ Sir C.V. Raman(1888–1970, former faculty of IACS)
- ◆ Prof .Meghnad Saha (1893-1956, former faculty and Director of IACS)
- ◆ Sir J.C. Bose (1858-1937, former faculty of IACS)
- ◆ Prof. K.S.Krishnan (1898-1961, alumnus former faculty of IACS)
- ◆ Prof. S.N.Bose (1894-1974,former faculty of IACS)
- ◆ Prof. A.P. Mitra (1927-2007, former Chairman of the IACS Council)
- ◆ Prof. C.N.R. Rao (former Chairman of the Review Committee of IACS and IACS Fellow)
- ◆ Prof .M.M. Sharma (former Chairman of the IACS Governing Council and IACS Fellow)
- ◆ Prof. TV Ramakrishnan (IACS Fellow)
- ◆ Prof. Ajay Sood (IACS Fellow)

PADMA VIBHUSHAN (CIVIL HONOR IN INDIA):

- ◆ Prof. C.N.R. Rao (former Chairman of the Review Committee of IACS and IACS Fellow)
- ◆ Prof. M.M. Sharma (Chairman of the IACS Governing Council and IACS Fellow)

PADMA BHUSAN (CIVIL HONOR IN INDIA):

- ◆ Prof. K.S.Krishnan (1898-1961, alumnus and former faculty of IACS)
- ◆ Prof. M.M. Sharma (Former Chairman of the IACS Governing Council and IACS Fellow)
- ◆ Prof. Sisir Kumar Mitra

PADMA SHRI (CIVIL HONOR IN INDIA):

- ◆ Prof. A.K.Barua (former faculty and Director of IACS)
- ◆ Prof. G. Mehta
- ◆ Dr. Srikumar Banerjee

ALEXANDER VON HUMBOLDT RESEARCH AWARD

- ◆ Prof. D. Mukherjee (former student, faculty and Director of IACS)

FELLOW OF THE WORLD ACADEMY OF SCIENCES (FTWAS)

- ◆ Prof. C.N.R. Rao (former Chairman of Review Committee of IACS and IACS Fellow)
- ◆ Prof. D. Mukherjee (former student, faculty and Director of IACS)
- ◆ Prof. D.D. Sarma (former faculty of IACS)
- ◆ Prof. K Bhattacharyya (former student, faculty and Director of IACS)
- ◆ Prof. Santanu Bhattacharya (former Director of IACS)
- ◆ Prof. T. Saha Dasgupta (former faculty of IACS)

TWAS PRIZE

- ◆ Prof. C.N.R. Rao (former Chairman of Review Committee of IACS and IACS Fellow)
- ◆ Prof. Animesh Chakravorty (former faculty of IACS)
- ◆ Prof. D.D. Sarma (former faculty of IACS)
- ◆ Prof. K. Bhattacharyya (former student, faculty and Director of IACS)
- ◆ Prof. Santanu Bhattacharya (former Director of IACS)

SHANTI SWARUP BHATNAGAR (SSB) PRIZE

- ◆ Prof. K.S. Krishnan (1898-1961, received in 1958, former faculty of IACS)
- ◆ Prof. S. Basu (1922-1992, received in 1965, former faculty of IACS)
- ◆ Prof. U.R. Ghatak (1931-2005, received in 1974, former Director and faculty of IACS)
- ◆ Prof. C.K. Majumdar (1938-2000, received in 1975, former faculty of IACS)
- ◆ Prof. C.N.R. Rao (former Chairman of Review Committee of IACS and IACS Fellow)
- ◆ Prof. Animesh Chakravorty (received in 1975, former faculty of IACS)
- ◆ Prof. M. Chowdhury (received in 1977, former faculty of IACS)
- ◆ Prof. D. Mukherjee (received in 1987, former student, faculty and Director of IACS)
- ◆ Prof. M. Ray (received in 1989, former faculty of IACS)
- ◆ Prof. D.D. Sarma (received in 1994, former faculty of IACS)
- ◆ Prof. K. Bhattacharyya (received in 1997, former student, faculty and Director of IACS)
- ◆ Prof. Akhil R. Chakravarty (received in 1998, former student of IACS)
- ◆ Prof. D.S. Ray (received in 1999, former student and faculty of IACS)

- ◆ Prof. Sourav Pal (received in 2000, former student of IACS)
- ◆ Prof. Santanu Bhattacharya (received in 2003, former Director, IACS)
- ◆ Prof. Samaresh Bhattacharya (received in 2005, former student of IACS)
- ◆ Prof. Kalobaran Maiti (received in 2010, present Director of IACS)
- ◆ Prof. Pradyut Ghosh (received in 2015, present faculty of IACS)
- ◆ Prof. Krishnendu Sengupta (received in 2012, present faculty of IACS)
- ◆ Prof. P.S. Mukherjee (received in 2016, former student of IACS)
- ◆ Prof. Tapas Maji (received in 2019, former student of IACS)
- ◆ Prof. Jyotirmayee Dash (received in 2020, present faculty of IACS)

FELLOW OF THE INDIAN NATIONAL SCIENCE ACADEMY (FNA)

- ◆ Sir C.V. Raman (1888-1970, former faculty of IACS)
- ◆ Prof. K.S. Krishnan (1898-1961, former faculty of IACS)
- ◆ Prof. K. Banerjee (1900-1975, former faculty of IACS)
- ◆ Prof. S.D. Chatterjee (1909-1995, former faculty of IACS)
- ◆ Prof. S.R. Palit (1912-1981, former faculty of IACS)
- ◆ Prof. D. Basu (1917-2005, former faculty and Director of IACS)
- ◆ Prof. S. Basu (1922-1992, former faculty of IACS)
- ◆ Prof. P.C. Dutta (1912-1971, former faculty of IACS)
- ◆ Prof. U.R. Ghatak (1931-2005, former faculty and Director of IACS)
- ◆ Prof. Akshayananda Bose (1911-1997, former faculty of IACS)
- ◆ Prof. Amal K. Raychaudhuri (1923-2005, former faculty of IACS)

- ◆ Prof. Sushil K. Mukherjee (1914-2006, former president of IACS)
- ◆ Prof. Priyada Ranjan Ray (1888-1982, former faculty and Director of IACS)
- ◆ Prof. M. Chowdhury (1937-2017, former faculty of IACS)
- ◆ Prof. C.N.R. Rao (former Chairman of Review Committee of IACS and IACS Fellow)
- ◆ Prof. Animesh Chakravorty (former faculty of IACS)
- ◆ Prof. D. Mukherjee (former student, faculty and Director of IACS)
- ◆ Prof. K. Bhattacharyya (former student, faculty and Director of IACS)
- ◆ Prof. Santanu Bhattacharya (former Director of IACS)
- ◆ Prof. B.C.Ranu (former student and faculty of IACS)
- ◆ Prof. A. Ghosh (former faculty of IACS)
- ◆ Prof. .D.S.Ray (former student and faculty of IACS)
- ◆ Prof. D.D. Sarma (former faculty of IACS)
- ◆ Prof. R.N .Mukherjee (former student of IACS)
- ◆ Prof. Akhil R. Chakravarty (former student of IACS)
- ◆ Prof. Sourav Pal (former student of IACS)
- ◆ Prof. A. Samanta (former student of IACS)
- ◆ Prof. K. Nag (former faculty of IACS)
- ◆ Prof. Subrata Ghosh (former faculty of IACS)
- ◆ Prof. S. Goswami (former faculty of IACS)
- ◆ Prof. A.J. Pal (former faculty of IACS)
- ◆ Prof. P. Ghosh (present faculty of IACS)
- ◆ Prof. K. Sengupta (present faculty of IACS)
- ◆ Prof. R. Sen (former Director of IACS)
- ◆ Prof. Kalobaran Maiti (present Director of IACS)

FELLOW OF THE INDIAN ACADEMY OF SCIENCES (FASc)

- ◆ Sir C.V. Raman (1888–1970, former faculty of IACS)
- ◆ Prof. K. Banerjee (1900–1975, former faculty of IACS)
- ◆ Prof. S. Basu (1922–1992, former faculty of IACS)
- ◆ Prof. P.C. Dutta (1912-1971, former faculty of IACS)
- ◆ Prof. U.R. Ghatak (1931-2005, former faculty and Director of IACS)
- ◆ Prof. K.S. Krishnan (1898-1961, former faculty of IACS)
- ◆ Prof. S.R. Palit (1912-1981, former faculty of IACS)
- ◆ Prof. Amal K. Raychaudhuri (1923-2005, former faculty of IACS)
- ◆ Prof. M. Chowdhury (former faculty of IACS)
- ◆ Prof. C.N.R. Rao (former Chairman of Review Committee of IACS and IACS Fellow)
- ◆ Prof. Animesh Chakravorty (former faculty of IACS)
- ◆ Prof. R.N. Mukherjee (1999, former student of IACS)
- ◆ Prof. Akhil R. Chakravarty (1995, former student of IACS)
- ◆ Prof. Sourav Pal (1996, former student of IACS)
- ◆ Prof. A. Samanta (2003, former student of IACS)
- ◆ Prof. Samaresh Bhattacharya (2006, former student of IACS)
- ◆ Prof. M. Durga Prasad (2012, former student of IACS)
- ◆ Prof. .D.D. Sarma (1993, former faculty of IACS)
- ◆ Prof. Surajit Sengupta (2006, former faculty of IACS)
- ◆ Prof. Jayanta K Bhattacharjee (1993, former faculty of IACS)
- ◆ Prof. .A.K. Barua (1987, former faculty and Director of IACS)
- ◆ Prof. G.K .Lahiri (2005, former student of IACS)

- ◆ Prof. S.P. Bhattacharya (1993, former student and faculty of IACS)
- ◆ Prof. D. Mukherjee (1987, former student, faculty and Director of IACS)
- ◆ Prof. Santanu Bhattacharya (2000, former Director of IACS)
- ◆ Prof. K. Bhattacharyya (1997, former student, faculty and Director of IACS)
- ◆ Prof. D.S. Ray (1995, former student and faculty of IACS)
- ◆ Prof. B.C. Ranu (1995, former student and faculty of IACS)
- ◆ Prof. A. Ghosh (2009, former faculty of IACS)
- ◆ Prof. K. Nag (1992, former faculty of IACS)
- ◆ Prof. Subrata Ghosh (1998, former faculty of IACS)
- ◆ Prof. S. Goswami (2004, former faculty of IACS)
- ◆ Prof. A.J. Pal (2010, former faculty of IACS)
- ◆ Prof. A.K. Nandi (2009, former faculty of IACS)
- ◆ Prof. B.N. Dev (2006, former faculty of IACS)
- ◆ Prof. T. Chakraborty (2015, present faculty & Director of IACS)
- ◆ Prof. K. Sengupta (2012, present faculty of IACS)
- ◆ Prof. A. Patra (2016, present faculty of IACS)
- ◆ Prof. A. Banerjee (2015, present faculty of IACS)
- ◆ Prof. Pradyut Ghosh (2016, present faculty of IACS)
- ◆ Prof. P.K. Das (2017, present faculty of IACS)
- ◆ Prof. Tapas K. Maji (2018, former student of IACS)
- ◆ Prof. P.S. Dastidar (2018, present faculty of IACS)
- ◆ Prof. N. Pradhan (2019, present faculty of IACS)
- ◆ Prof. P.S. Mukherjee (former student of IACS)
- ◆ Prof. J. Dash (2021, present faculty of IACS)
- ◆ Prof. R. Sen (former Director of IACS)
- ◆ Prof. S. Acharya (present faculty of IACS)

- ◆ Prof. A. Dey (present faculty of IACS)
- ◆ Prof. Kalobaran Maiti (present Director of IACS)

FELLOW OF THE NATIONAL ACADEMY OF SCIENCES (FNASc)

- ◆ Prof. M.N. Saha (1893-1956, former faculty, Director of IACS)
- ◆ Prof. K.S. Krishnan (1898-1961, former faculty of IACS)
- ◆ Prof. Amal K. Raychaudhuri (1923-2005, former faculty of IACS)
- ◆ Prof. C.N.R. Rao (former Chairman of Review Committee of IACS and IACS Fellow)
- ◆ Prof. B.P. Chatterjee (former faculty of IACS)
- ◆ Prof. Jayanta K Bhattacharjee (former faculty of IACS)
- ◆ Prof. D.D. Sarma (former faculty of IACS)
- ◆ Prof. Sourav Pal (former student of IACS)
- ◆ Prof. A. Samanta (former student of IACS)
- ◆ Prof. D. Mukherjee (former student, faculty and Director of IACS)
- ◆ Prof. K. Bhattacharyya (former student, faculty and Director of IACS)
- ◆ Prof. D.S. Ray (former student and faculty of IACS)
- ◆ Prof. S. SenGupta (present faculty of IACS)
- ◆ Prof. B.N. Dev (former faculty of IACS)
- ◆ Prof. A.J. Pal (former faculty of IACS)
- ◆ Prof. K. Sengupta (present faculty of IACS)
- ◆ Prof. A. Patra (present faculty of IACS)
- ◆ Prof. S. Adhikari (present faculty of IACS)
- ◆ Prof. Benu Brata Das (present faculty of IACS)
- ◆ Prof. D. Basak (present faculty of IACS)
- ◆ Prof. N. Pradhan (present faculty of IACS)
- ◆ Prof. R. Sen (former Director of IACS)
- ◆ Prof. S. Acharya (present faculty of IACS)
- ◆ Prof. D. Basak (present faculty of IACS)

- ◆ Prof. Kalobaran Maiti (present Director of IACS)

G.D. BIRLA AWARD FOR SCIENTIFIC RESEARCH

- ◆ Prof. D.D.Sarma (former faculty of IACS)
- ◆ Prof. Santanu Bhattacharya (former Director of IACS)
- ◆ Prof. N. Pradhan (present faculty of IACS)

JC BOSE FELLOWSHIP, DST

- ◆ Prof. D. Mukherjee (former student, faculty and Director of IACS)
- ◆ Prof. D.D. Sarma (former faculty of IACS)
- ◆ Prof. K. Bhattacharyya (former student, faculty and Director of IACS)
- ◆ Prof. R.N. Mukherjee (former student of IACS)
- ◆ Prof. Santanu Bhattacharya (former Director of IACS)
- ◆ Prof. Sourav Pal (former student of IACS)
- ◆ Prof. A. Samanta (former student of IACS)
- ◆ Prof. B.C.Ranu (former student and faculty of IACS)
- ◆ Prof. S. Goswami (former faculty of IACS)
- ◆ Prof. S. Ghosh (former student and faculty of IACS)
- ◆ Prof. A. Ghosh (former faculty of IACS)
- ◆ Prof. A.J. Pal (former faculty of IACS)
- ◆ Prof. D.S. Ray (former faculty of IACS)
- ◆ Prof. P. Ghosh (present faculty of IACS)
- ◆ Prof. K. Sengupta (present faculty of IACS)
- ◆ Prof. J. Dash (present faculty of IACS)
- ◆ Prof. Kalobaran Maiti (present Director of IACS)

B. M. BIRLA SCIENCE PRIZE

- ◆ Prof. Santanu Bhattacharya (former Director of IACS)
- ◆ Prof. G.K. Lahiri (former student of IACS)
- ◆ Prof. Arindam Banerjee (present faculty of IACS)

- ◆ Prof. P.K. Das (present faculty of IACS)

- ◆ Prof. Pradyut Ghosh (present faculty of IACS)
- ◆ Prof. Suhrit Ghosh (present faculty of IACS)
- ◆ Prof. Ayan Datta (present faculty of IACS)
- ◆ Prof. Kalobaran Maiti (present Director of IACS)

SWARNAJAYANTI FELLOWSHIP, DST

- ◆ Prof. Santanu Bhattacharya (former Director of IACS)
- ◆ Prof. Narayan Pradhan (present faculty of IACS)
- ◆ Prof. Pradyut Ghosh (present faculty of IACS)
- ◆ Prof. S.P. Mukherjee (former student of IACS)
- ◆ Prof. Suhrit Ghosh (present faculty of IACS)
- ◆ Prof. J. Dash (present faculty of IACS)
- ◆ Prof. Kalobaran Maiti (present Director of IACS)

INSA MEDAL FOR YOUNG SCIENTIST

- ◆ Prof. M. Ray (former faculty of IACS)
- ◆ Prof. B.K.Chaudhuri (former faculty of IACS)
- ◆ Prof. Sourav Pal (former student of IACS)
- ◆ Prof. D. Datta (former student and faculty of IACS)
- ◆ Prof. T. Jana (former student of IACS)
- ◆ Prof. T.K. Paine (present faculty of IACS)
- ◆ Dr. Arnab Sen (present faculty of IACS)
- ◆ Dr. Saptarshi Mukherjee (former student of IACS)
- ◆ Dr. Pratik Sen (former student of IACS)

ASSOCIATES OF THE INDIAN ACADEMY OF SCIENCES

- ◆ Prof. T. Jana (former student of IACS)
- ◆ Dr. S. Malik (former student of IACS)
- ◆ Prof. Suhrit Ghosh (present faculty of IACS)
- ◆ Dr. A. Dey (present faculty of IACS)
- ◆ Dr. Anindita Das (present faculty of IACS)



- » **Abhishek Dey** : Fellow, Indian National Academy of Science (INSA); Editorial Advisory Board Chemical Reviews, ACS
- » **Amitava Patra** : Senior Editor, Journal of Physical Chemistry Letters; Member of Editorial Advisory Board, ChemNanoMat; Member of Editorial Advisory Board, ChemPhysChem; Chairperson, Scientific Advisory Council, IASST, Guwahat and Member, Academic Council Committee, Chandigarh University.
- » **Anindita Das** : Associate of the West Bengal Academy of Science & Technology (WAST) (2024); Editorial Advisory Board Member of RSC Applied Polymers (since 2024); Royal Society of Chemistry; Editorial Advisory Board Member of ACS Polymer Au (since 2024), American Chemical Society; ACES-CRSI Early Career Award (2024), CRSI.
- » **Benu Brata Das** : Fellow of Indian Academy of Science (FASc), Bengaluru
- » **Biman Jana** : CRSI Bronze Medal Award, CRSI
- » **Debashree Ghosh** : Pople Medal (APATCC); Topic Editor, Journal of Chemical Theory and Computation.
- » **Indra Dasgupta** : Fellow, Indian Academy of Sciences, Bengaluru; Associate Fellow, Asia Pacific Center for Theoretical Physics (APCTP) (2024-2029), APCTP, Pohang, Korea.
- » **Jyotirmayee Dash** : Dr. Satyajit Chakrabarti Memorial Award ICCAES 2025, IEM, Editor of Bioorganic & Medicinal Chemistry Letters, Royal Society of Chemistry.
- » **Kalobaran Maiti** : Sir, C. V. Raman Memorial Lecture Award, Indian Photobiology Society; Bernard Coqblin Prize 2025
- » **Pradyut Ghosh** : Fellow of the Royal Society of Chemistry (FRSC), 2025, RSC.
- » **Praveen Kumar** : Member : Global Young Academy 2023-2028 (GYA); Member : PEC, Materials Science, DST.
- » **Rajib Kr. Goswami** : Fellow (FAScT, West Bengal Academy of Science & Technology.

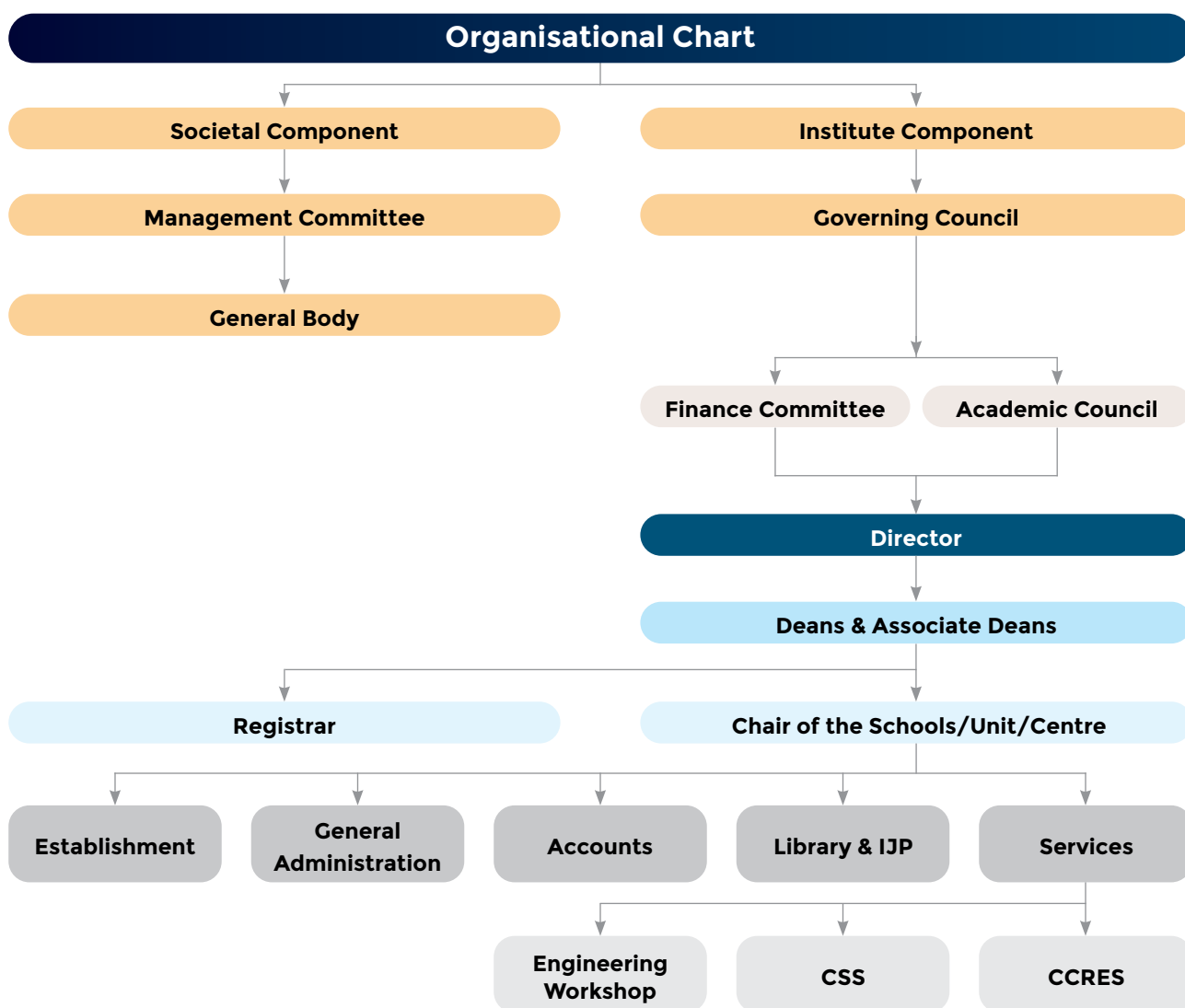


- » **Argha Chakraborty** : Best Poster Award at ISMC, Mumbai
- » **Ambreen Rashid** : Best Poster award, Chem. Communication 60th Aniv., IACS
- » **Atanu Ghosh** : Best Poster Award in IS3NA, Tokyo University of Science, Japan
- » **Bikash Das** : Short term research internship award, University of Warsaw.
- » **Bikash Das** : Best Poster Award (SoPhyc), RSC
- » **Kingshuk Das** : Best Poster Award (SMCB) (Biman)
- » **Sk. Kalimuddin** : Best Poster Award, SBNBCBS, Kolkata; Young Scientist Award, MRSI.
- » **Mandira Dey** : Best Poster Award, PCAMC-2024, IISER, Kolkata
- » **Mohamad Numan** : Best Poster Award : ICMAGMA-2025
- » **Priyanka Dinda** : Best Poster Award, MRSI YSC Kolkata Chapter, Bellur (TKM)
- » **Puja Garai** : Best Poster Presentation, FICS 2024, IIT Guwahati
- » **Payel Khanra** : Best Poster Award, ChemComm 60th year symposium, IACS, Kolkata
- » **Rohon Mitra** : Best Poster award (InAdvances), ACS
- » **Rajkumar Sahoo** : Best Poster Presentation, SMS Symposium, IACS
- » **Sourav Satapathi** : Best Poster Award (CTTC), ACS
- » **Supriyo Santra** : Best Talk (InAdvanCS-2025)
- » **Soumya Mondal** : Best Oral Presentation, InAdvanCS-2025
- » **Suman Paul** : Best Poster Award, ETOMC-2024
- » **Subhro Mandal** : Best Poster Award, Chem. Communication 60th Aniv., IACS
- » **Subrata Mandi** : Best Poster Award, ICCHD-2025, CU
- » **Srijita Paul Chowdhuri** : Third finalist TNQ Inspiring Science Awards, Cell Press TNQ Award, 2024 (BBD)
- » **Saini Basu** : Best Poster Award, JNCASR, Bengaluru
- » **Sudipta Sarkar** : Best Poster Award, Sister Nivedita University
- » **Satyabrata Bera** : Best Poster Award, IACS, Kolkata
- » **Sourav Mukherjee**: Best Poster Award, ICMAC - 2025 Singapore



Key Committees





In accordance with DST guideline (letter no. AI/001/97, dated 01.08.1997) the administrative and financial set up of the institute is as following :

Governing Council

Dr. Renu Swarup, former Secretary, DBT, New Delhi (Chairperson)

(Nominated by the Department of Science & Technology, Government of India)

Prof. Abhay Karandikar, Secretary, DST or his nominee

Professor Kalobaran Maiti, Director, IACS

Ms. Yatinder Prasad, Financial Advisor to the Government of India, DST

Professor Swaminathan Sivaram

Emeritus Scientist and Hon. Prof., IISER Pune, Member *(Nominated by IACS Governing Council for three terms)*

Professor Maitrayee Dasgupta, Univ. of Calcutta *(Nominated by INSA for three terms)*

Professor U Kamachi Mudali, VC, HBNI, Mumbai *(Nominated by DST for three terms)*

Dr. (Mrs.) Suman Kumari Mishra

Ex-Director, CGCRI *(Nominated by DST for three terms)*

Dr. Dinakar Kanjilal Former Director, IUAC New Delhi Inter Univ. Accelerator Centre *(Nominated by the Governing Council of IACS for three terms)*

Smt. Sarbani Saha, Registrar – Non Member Secretary

Secretary, Higher Education

Govt. of West Bengal, Ex-Officio Member

Finance Committee

- » Chairman, Governing Council, IACS
- » Director, IACS
- » One Representative of Ministry of Science of Technology, GOI

- » Professor Bhupati Chakraborty, Trustee, nominated by the Council
- » Principal Accountant General, Govt. of West Bengal
- » Registrar, IACS, Non-member Secretary

Research Advisory Committee (RAC)

- » Professor N. Sathyamurthy (Chairman)
- » Professor Mahan MJ
- » Professor Sandeep Verma
- » Professor Sanghamitra Bandyopadhyay
- » Professor H.R. Krishnamurthy
- » Professor Satishchandra Ogale

- » Professor LS Shashidhara
- » Professor Anunay Samanta
- » Professor Giridhar Kulkarni
- » Dr. Chandrima Shaha
- » Professor G. Ravindran

Management Committee

- » Dr. Renu Swarup, Former Secretary, DBT, New Delhi, (President)
- » Professor Kalobaran Maiti, Director (Vice President, Ex-Officio)
- » Professor Alok K Mukherjee (Vice President)
- » Professor Amitava Dutta (Hony. Secretary)
- » Professor Sanjib Ghosh (Hony. Treasurer)
- » Professor Dhiranjan Roy

- » Professor Indrani Bose
- » Professor Debasish Bhattacharya
- » Professor Kamal Bhattacharyya
- » Professor Subir Ghosh
- » Dr. Bhupati Chakraborty
- » Dr. Chinmoy Kumar Ghosh
- » Sri. Prabir Manna, Executive Secretary

Trustee

- » Professor Milan Sanjal
- » Professor R N Mukherjee
- » Professor Bhupati Chakraborty

Annual Report and Publication Cell

- » Prof. P.K. Das -Chairman
- » Dr. G. Paul - Member
- » Smt. Rimi Chakraborty – Jt. Convener

- » Dr. D. Mukherjee – Member
- » Smt. Sohinee Motilal – Jt. Convener
- » Sri Abhijit Basak – Permanent Invitee

Deans

Prof. Suhrit Ghosh, Dean (Graduate Studies and Student Affairs)

Prof. Pradyut Ghosh, Dean (Infrastructure)

Prof. Durga Basak, Dean (Finance)

Prof. Indra Dasgupta, Dean (Faculty Affairs and Research & Development)

Prof. Somobrata Acharya, Dean (Admn. & Staff matters)

Academic Council

Director – Chairperson

All Chairs of Schools

» Professor Indra Dasgupta

» Prof. Satrajit Adhikari

» Professor Abhijit Kumar Das

» Professor Prasanta Kumar Das

» Professor Sugata Ray

» Prof. Somobrata Acharya

» Dr. Partha Basu choudhuri

» Dr. Sayani Bera

» Professor G.U. Kulkarni, President, JNCASR, Bangalore

» Professor Devajyoti Choudhury, University of Delhi, Delhi

» Professor Kolin Paul, Indian Institute of Technology, Delhi

» Professor Jayashree Saha, University of Calcutta, Kolkata

» Dr. Amit Basak, Indian Institute of Technology, Kharagpur

» Dr. Sreemonti Sarkar, Bose Institute, Kolkata

» Dr. Shuvendra Bhattacharya, Indian Institute of Chemical Biology

» Dr. Neena Gupta, Indian Statistical Institute

» Dr. Sadhna Rana, TCS Innovation Labs, Tata Consultancy Services Ltd. Mumbai

The Registrar (ex-officio) shall be Secretary of the Academic Council.

Alumni Affairs

Dean of Student Affairs	Chairman
Prof. Sudip Malik	Member
Prof. Amit Majumdar	Member
Dr. Satyanarayan Mukhopadhyay	Member
Dr. Praveen Kumar	Member
Dr. Sayani Bera	Member
Two student representatives to be nominated by the RSA	Member
Ms. Saswati Bhattacharya	Convener

Anti Ragging Cell

Dean of Student Affairs	Chairman
Warden, Boys' hostel	Member
Warden, Girls' Hostel	Member
Psychological Counsellor	Member
Ms. Saswati Bhattacharya	Member
Student Representative	Member
Mr. Prolay Mondal	Convener

Amenities Committee

Prof. Deepak Kumar Sinha	Chairman
Prof. Somdatta Ghosh Dey	Member
Dr. Sumanta Chakraborty	Member
Dr. Devajyoti Mukherjee	Member
Dr. Anindita Das	Member
Student Representative	Member
Dr. Urmimala Maitra	Member
Prof. Prashant Ch. Singh	Member
Ms. Suhita Neogi	Joint Secretary
Mr. Soumik Mitra	Joint Secretary

Building Advisory Committee

Prof. Somobrata Acharya	Chairman
Dr. Satyanarayan Mukhopadhyay	Member
Dr. Debasis Das	External Expert
Mr. Asim Sinha	External Expert
Mr. Rabindranath Kundu	Member, External Expert
Mr. Soumen Bandyopadhyay	Estate Officer
Mr. Soumen Bandyopadhyay	Convener

Central Scientific Services (CSS)

Prof. Sugata Ray	Head
Prof. Somobrata Acharya	Associate Head
Prof. Rupa Mukhopadhyay	Associate Head
Dr. Mintu Mondal	Co-ordinator
Dr. Anindita Das	Co-ordinator
Dr. Nabanita Deb	Co-ordinator

Canteen Committee

Prof. Amit Majumdar	Chairman
Dr. Shinto Varghese	Member
Mr. Rabindranath Banik	Member
Mr. Arunim Paul	Member
Mr. Soumik Mitra	Convener
Student as nominated by RSA	Member

CCRES Core Committee

Prof. Satrajit Adhikari	Chairman
Prof. Raja Paul	Member
Dr. Partha Basuchowdhuri	Member
Dr. Debashree Ghosh	Member
Ms. Sarbani Saha	Member
Mr. Abhra Paul	Jt. Secretary
Ms. Rimi Chakraborty	Jt. Secretary

CREW Committee

Prof. Siddhartha Sankar Jana	Chairman
Dr. Anindita Das	Member
Prof. Deepak Kr. Sinha	Member
Mr. Amit Kumar Sarkar	Member
Mr. Somnath Bandyopadhyay	Member
Mr. Arka Mukherjee	Member
Mr. Arup Dhar	Member Secretary

Disposal Committee

Dr. Subhadeep Datta	Chairman
Dr. K.D.M. Rao	Member
Mr. Amit Kr. Sarkar	Member
Mr. Rajib Debnath	Member
Mr. Rajesh Mondal	Convener

Equal Opportunity Cell (EOC)

Director	Chairperson
Prof. Indra Das Gupta Senior Professor	Member
Ms. Gayatri Paul	Liaison Officer, Member
Dr. Anindita Das, Associate	Member
Ms. Sarbani Saha, Registrar	Member
President, Research Scholar's Association	Member
Ms. Purbasha Banerjee, Dy. Registrar	Member Secretary

Staff Grievance Redressal Committee

Prof. Suhrit Ghosh	Chairman
Prof. Somobrata Acharya	Member
Ms. Purbasha Banerjee	Member, Liaison Officer for SC, ST
Prof. Benu Brata Das	Member, Liaison Officer for OBC
Mr. Gopal Gond	Jt. Convener
Mr. Tapan Sardar	Jt. Convener

Students' Grievance Redressal Committee

Prof. Suhrit Ghosh : Chairperson (Phone - +91 33 24734971 (Ext. 1563) Email : psusg2@iacs.res.in)

Prof. Ankan Paul : Member (Phone - +91 33 2473 4971 (Ext. 1779) Email : rcap@iacs.res.in)

Prof. Somobroto Acharya : Member (Phone - +91 33 2473 4971 (Ext. 1104) Email : camsa2@iacs.res.in)

Dr. Subhadeep Datta : Member (Phone - +91 33 2473 4971 (Ext. 2141) Email - sspsdd@iacs.res.in)

Dr. Urmimala Maitra : Member (Phone - +91 33 2473 4971 (Ext. 1224) Email - urmimala.maitra@iacs.res.in)

Nominee of the Research Scholars' Association : Special Invitee

Ms. Saswati Bhattacharya : Member Secretary (Phone - +91 33 2473 4971 (Ext: 2236)
Email - aofficesb@iacs.res.in)

Grievance Redressal Committee for SC members

Professor Somobrata Acharya	Chairman
Dr. Anusrita Mandal, Asst. Professor, Surendranath College	Member
Dr. Jhuma Bhadra, Asst. Professor, Sarojini Naidu	Member
Professor S. S. Jana, Senior Professor, SBS, IACS	Member
Professor Jayashree Saha, Professor, Calcutta University	Member

Institutional Animal Ethics Committee

Professor Siddhartha S Jana, SBS, IACS - Chairman
Professor Sib Sankar Roy, IICB, Kolkata
Professor Avik Saha, PU, Kolkata
Professor Kaushik Biswas, Bose Institute, Kolkata
Professor Surajit Sinha, SAIS, IACS
Professor Benu Brata Das, SBS, IACS
Dr. Ritesh Ranjan Pal, SBS, IACS, Convener
Dr. Abhiroop Banerjee (Veterinarian)

Institutional Biosafety Committee

Prof. Prasanta Kr. Das	Chairman
Dr. Krishnanda Chattopadhyay	External Expert
Dr. Parimal Karmakar	External Expert
Prof. Surajit Sinha	Member
Prof. Siddhartha S. Jana	Member
Prof. Benu Brata Das	Member
Prof. Deepak Sinha	Member
Prof. Prosenjit Sen	Convener

Internal Complaints Committee

Prof. Srimonti Sarkar	Chairman and External Expert
Prof. Tanusree Kar	Advisor and Permanent Invitee
Prof. Jyotirmoyee Dash	Member
Prof. Deepak Sinha	Member
Dr. Praveen Kumar	Member
Dr. Anindita Das	Member
Ms. Rita Bhattacharya	Lady NGO Member
Ms. Shweta Mukherjee	Lawyer Member
Ms. Sarbani Saha	Secretary

International Travel Committee

Prof. Indra Dasgupta	Chairman
Prof. Rupa Mukhopadhyay	Member
Prof. Debashree Ghosh	Member
Smt. Purbasha Banerjee	Convener

Institute Colloquium Committee

Dr. Shinto Varghese	
Prof. Deepak Kumar Sinha	
Prof. Jyotirmayee Dash	
Dr. Urmimala Maitra	
Dr. Rajarshi Ray	
Dr. Devajyoti Mukherjee	

IPR Cell, Patenting and Innovation Centre

Prof. Surajit Sinha	Chairman
Prof. Nikhil R. Jana	Member
Ms. Suhita Neogi	Secretary

Library Committee

Prof. Subham Majumdar	Chairman
Prof. Suhrit Ghosh	Member
Prof. Prasanta Kr. Das	Member
Prof. Abhishek Dey	Member
Dr. Partha Basuchowdhuri	Member
Mr. Debajyoti Nath	Secretary
Ms. Suhita Neogi	Nodal person for IACS Media Cell

New Campus at Baruipur

Prof. Pradyut Ghosh	Chairman
Prof. Dilip Ghosh	Member
Prof. Joyram Guin	Member

Qualification Committee

Professor Utpal Chattopadhyay, Senior Professor, SPS	Chairman
Dr. Urmimala Maitra	Member
Dr. Debarshi Kumar Sanyal	Member
Dr. Biplab Bhattacharjee, Jadavpur University	External Expert
Mr. Gopal Gond	Convener

Space Committee

Director	Chairman
Dean of Faculty Affairs	Member
Prof. Indra Dasgupta	Member
Prof. Somobrata Acharya	Member
All the School Chairs	Member
Registrar	Member
Mr. Rajib Debnath	Jt. Convener
Mr. Abhijit Basak	Jt. Convener

Standing Medical Committee

Prof. Satrajit Adhikari	Chairman
Prof. Siddhartha S. Jana	Member
Ms. Sarbani Saha	Member
Representative of the Pensioners	Member
Mr. Amit Kr. Majumdar (Retd.)	Member
Dr. Bebi Chakraborty, PTMO	Member
Dr. Shyamsundar Poddar, CMO	Member
Dr. Bebi Chakraborty, PTMO, IACS	Member
One Student Representative	Member
Mr. Tapan Sardar	Jt. Convener
Ms. Ankeeta Chakraborty	Jt. Convener

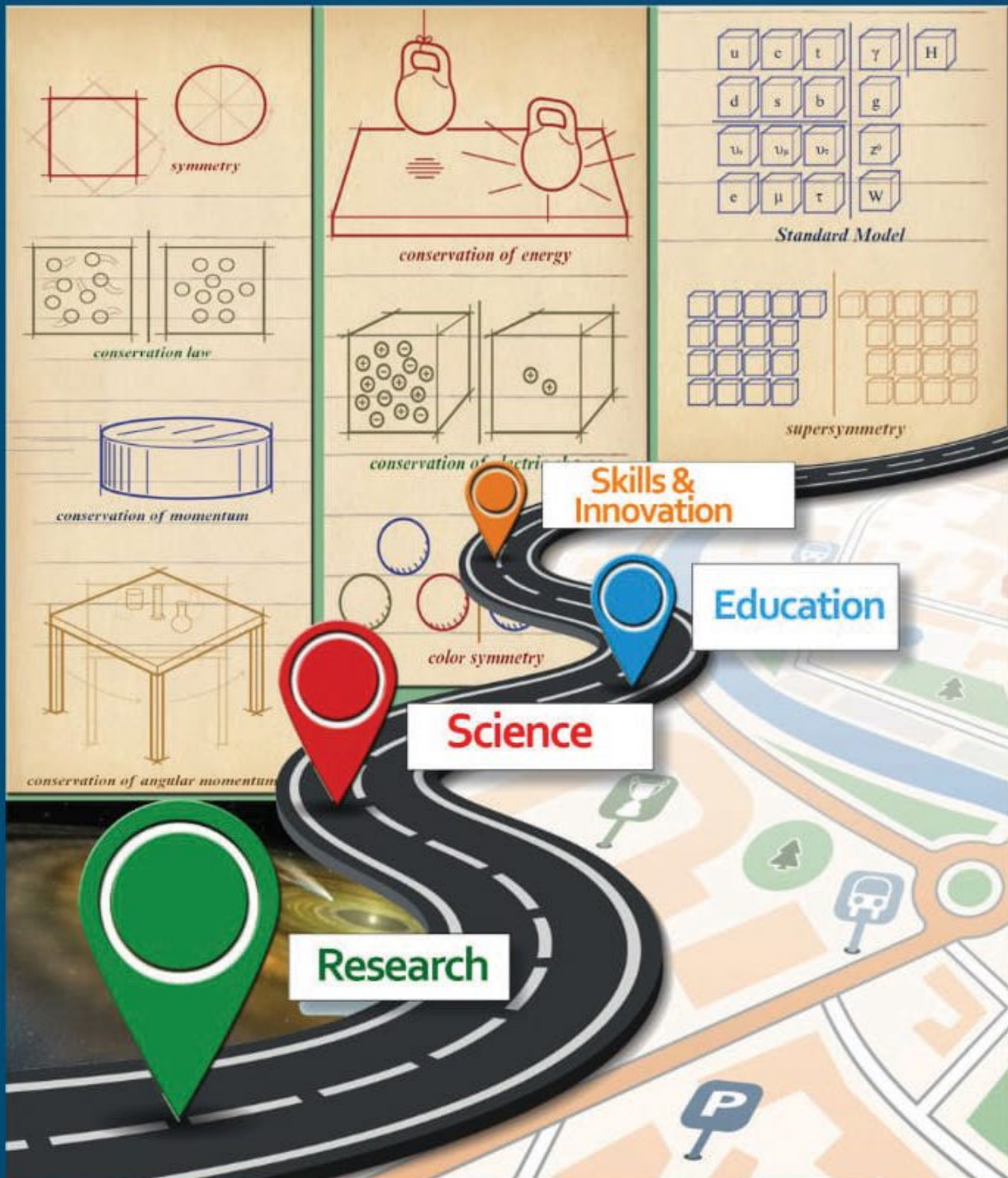
SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) Committee

Prof. Suhrit Ghosh, Dean	(Graduate Studies and Students Affairs)
Dr. Sumanta Chakraborty, Assistant Professor	School of Physical Sciences
Ms. Purbasha Banerjee	Dy.Registrar
Ms. Rimi Chakraborty	Joint Convener
Ms. Sohinee Motilal	Joint Convener

Vigilance Officer

Professor Tapan Kanti Paine

Executive Summary



Executive Summary

To quote the Founder, the great visionary, Dr. Mahendra Lal Sircar “The objective of the Association is to enable the Natives of India to cultivate Science in all its departments with a view to its advancement by original research and with a view to its varied application to the arts and comforts of life.” Even today, IACS is dedicated to the realization of the undying dream of its founder and his compatriots. The institute pursues relentlessly theoretical and experimental research in fundamental and basic sciences with emphasis on translating its discoveries into technology wherever possible and train and prepare the younger generation to

handle the challenges of the future, be it in the emerging areas of science or technology.

IACS has currently 6 Schools (School of Applied and Interdisciplinary Sciences, School of Biological Sciences, School of Chemical Sciences, School of Mathematical and Computational Sciences, School of Materials Science and School of Physical Sciences) apart from Service Units that provide research facilitation (Central Scientific Services, Computer Centre, Library, Workshop etc.).

Highlights of major achievements in the different Schools are as follows:

School of Applied and Interdisciplinary Sciences (SAIS)

- » Hierarchical assembly of foldable polymers and functional materials
- » Supramolecular antiviral materials
- » Piezoelectric/ Pyroelectric donor-acceptor (macro)molecular self-assembled systems
- » Activable photodynamic therapy
- » Development a manufacturing protocol for morpholino oligonucleotides using amidite approach by automated DNA/RNA synthesizer.
- » Process chemistry for the synthesis of rare disease drugs
- » A new morpholino-based approach for immunotherapy for cancers
- » Synthesis and functionalization of nanoparticle
- » Exploring properties of nanomaterials & molecules
- » Complex nanostructures and molecular assemblies
- » Energy related applications
- » Development of solid-state emissive polymeric materials.
- » Polymer based materials for energy storage applications.
- » Rheological investigations of polymer networks under large deformations

- » Synthesizing novel halide perovskite single crystals and elucidating their crystallographic and electronic band structures

School of Biological Sciences (SBS)

- » Self-assembling peptide based nanobiomaterials
- » Peptide attached Naphthalenediimide based gels
- » Biomedical chemistry of self-assembled functional soft nanocomposites
- » Fabrication of soft-nanocomposites from functional molecules with diversified applications
- » Naphthalimide based fluorescent organic nanoparticles in selective sensing
- » Lipase sensing by naphthalene diimide based fluorescent organic nanoparticles
- » Nanoscale Bioengineering
- » Nanoscale Biosensing
- » Nanoscale Bioelectronics
- » To understand the role of nonmuscle myosin II in bleb dynamics in tumor cell lines
- » Functional analysis of Nonmuscle myosin IIs and their mutants found in human patients
- » Functional analysis of the spliced isoforms of nonmuscle myosin II in mouse neuronal cells
- » To probe how the mutation on ORF3a gene of SARS-CoV2 changes its binding ability with host Caveolin protein

- » Biological physics, Lipid droplets in development
- » Impact of cytoplasmic stiffening on the phagocytic ability of the macrophage
- » Switching between blebbing and lamellipodia
- » Coagulation biology and cellular signaling
- » Role of Phospholipid in blood coagulation
- » SARS-CoV-2 main protease, structure-based drug design, molecular docking, ADMET, Drug-likeness, MD simulation
- » Monocyte to Macrophage differentiation
- » Molecular mechanism of DNA damage and repair in cancer
- » Uncovering of stress induced novel post-translational modification of proteins
- » Host-pathogen interactions and infection biology
- » Pathogenesis of communicable diseases
- » Therapeutic strategy development against infectious agents

School of Chemical Sciences (SCS)

- » Co(II) mediated catalytic hydrolysis of C-S bonds for a series of aliphatic and aromatic thiolates.
- » Understanding Reaction Mechanisms of Catalytic and transformative processes relevant to the cause of Environmental Sustainability and (b) Comprehending novel chemical phenomena using excited state theoretical techniques.
- » Designing and developing new strategies for novel organic transformations following the concept of radical chemistry, photocatalysis, organocatalysis and transition metal catalysis.
- » Understand how fundamental molecular interactions control structure, dynamics and ultimately, any macroscopic property of interest in a wide variety of molecular systems at the interfaces of chemistry, molecular biology and soft materials science.
- » Unified understanding of phenomena at various length and time scales using techniques based on ab-initio and extended quantum mechanical methods.
- » Uncovered that the pre-organization environment of the ATP hydrolysis reaction of kinesin-I is critically dependent on having the broken state of the Arg203-Glu236 salt-bridge sufficiently populated. This disruption is responsible for the HSP disease in humans.
- » Development of strategies to understand ground and excited state electronic structure of strongly correlated systems
- » State-of the art synthetic design and isolation of artificial porphyrinoids by swapping pyrrole component(s) with diverse functionalized pyrrolic(heterocyclic)/carbacycle building block(s) to compare the impact on the electronic absorption spectra, aromaticity and anion receptor abilities of the incorporated isomeric/expanded porphyrinoids.
- » Demonstrated the bioorthogonal macrocyclization directed by G-quadruplex DNA as the templates.
- » Application of supramolecular synthons/ coordination chemistry in the context of crystal engineering is being exploited to generate materials having potential for various applications such as topical gels for drug delivery, coordination polymer based metallogels for drug delivery, cell imaging etc.
- » A halogen bond based water soluble tetrapodal iodoimidazolium receptor was developed which exhibited a high degree of efficiency (~ 96%) in extracting ReO_4^- from 100% aqueous medium within the wide range of concentrations and pH range
- » Synthesis and characterization of Metal-Organic Frameworks (MOF) and coordination polymers, coupled with identification of structure-property relationships in these systems.
- » Coupled three-dimensional (3D) time dependent wave packet formalism in hyperspherical coordinates on ab initio calculated ground adiabatic potential energy surface for the $\text{F} + \text{H}_2/\text{D}_2$ ($v = 0, j = 0$) reaction was developed.
- » The reactivity of iron(II)-mandelate and cobalt(II)-mandelate complexes of tetradentate nitrogen donor ligands toward dioxygen has been investigated. The complexes react with dioxygen to afford equimolar amounts of benzaldehyde and benzoic acid.
- » Thermal reactions of selected atmospherically significant volatile organic compounds like hydroxyacetone and formaldehyde with nitrogen dioxide (NO_2) have been studied

with the aim to identify the unknown sources of atmospheric nitrous acid (HONO).

- » Use of different macromolecular engineering tools to synthesize stimuli-responsive smart homo-/block-copolymers, peptide-polymer conjugates, amino acid-based polymers, poly(ionic liquid)s, poly(zwitterions) and functionalized polypeptides.

School of Mathematical and Computational Sciences (SMCS)

- » Research focuses on the design of superalkalis and their potential applications, functionalization of BN fullerenes for hydrogen storage, enhancement of light harvesting in dye-sensitized solar cells, mechanisms of self-healable hydrogels derived from vegetable oil, porphyrin systems for solar cells, and the physicochemical properties, bioactivity, and toxicity of drugs.
- » Physics of living and non-living systems through statistical mechanics, Monte Carlo, and molecular dynamics simulations. Related research covers active matter, biological processes like cell division and intracellular transport, and phase transitions in disordered materials.
- » Deep learning to domains such as natural language processing, biomedical image processing, and crystal property prediction. Related work includes context-relevant information extraction, claim verification, super-resolution of medical images, and generating distributed representations for atoms in crystals.
- » Research investigates the dynamics of automorphisms in C^m , $m \geq 2$, focusing on iterated dynamical systems, non-autonomous families, and Fatou-Bieberbach domains. The group also resolved a longstanding problem related to the existence of these domains by revising techniques for complex Hénon maps.
- » Explainability in AI planning with a focus on unsolvability in hybrid systems. They propose sub-problem identification to analyze unsolvability and present an algorithm to flag the first unreachable waypoint as the explanation.
- » Operator theory, particularly higher-rank numerical ranges of normal operators, dilation

theory, and matricial ranges. This group achieved an affirmative solution to a conjecture posed by Halmos and is currently exploring extensions and generalizations of this work.

- » Natural language processing with an emphasis on scholarly document analysis. Related contributions include advancements in neural topic models, datasets for NER in AI/ML literature, algorithms for extracting entities from agricultural research, and improved text summarization for academic literature.

School of Materials Sciences (SMS)

- » Ultrafast dynamics of two-dimensional (2D) semiconductor nanoplatelets (NPLs)
- » Quantum dots, Metal clusters, Perovskite nanocrystals
- » Water purification
- » Nano-Biotechnology
- » Catalysis, CO₂ fixation
- » Electrochemical/ photoelectrochemical water splitting
- » CO₂ reduction reactions and biomedical applications
- » Understanding role of spin-orbit coupling in deciding the magnetic and electronic ground states of 4d-5d transition metal oxides,
- » Understanding quenching of orbital angular momentum in vacancy ordered systems,
- » Observation of unusual colossal electroresistance in vanadates,
- » Griffiths phase in Swedenborgite systems,
- » Understanding nucleation of metal clusters in water and manipulating the process for the use of water purification.
- » Biomedical application of functional nanoparticle
- » Hybrid Heterostructuring: III-V semiconductors
- » Carbon nanostructures, 2D materials, MXenes, Quasi-2D materials, Spinel oxides
- » Development of self-powered and broadband photodetectors.
- » Understanding 'SPIN-manipulated charge transport in JANUS 2D-Materials'
- » Development of the proof-of-concept for SPIN-dependent H₂ generation."

- » Transition metal oxide-based cathode materials for Na and Li ion battery – electrochemical performance
- » Mechanistic and degradation studies of battery electrodes and electrolytes using in-situ and ex-situ spectroscopic and diffraction methods

School of Physical Sciences (SPS)

Theoretical Physics:

- » Quantum Condensed Matter and Statistical Physics, with an emphasis on Non-Equilibrium Dynamics and Phases of Quantum Matter and related areas in Adiabatic Quantum Computation.
- » Statistical and Condensed Matter physics; spin liquids, phase transitions, entanglement in many-body systems, Monte-Carlo methods, anomalous thermalization in interacting models including lattice gauge theories
- » Theoretical Quantum Optics, Quantum Information Science, Atomic, Molecular and Optical Physics
- » Higgs Physics, Dark Matter Physics, Electroweak Phase Transition and Gravitational Wave, Astro-particle Physics, Standard Model Effective Theory
- » Electronic Structure of Quantum Matter
- » Conformal integrals from Quaternionic Lauricella system and GKZ hypergeometric series.
- » Scattering amplitudes from tilting structures in quotient triangulated categories
- » I and my group members have worked on several aspects of quantum condensed matter and conformal field theory. Our work has focussed on out-of-equilibrium dynamics of these systems. This work has led to several publications whose details are given along with.
- » Quantum condensed matter, conformal field theory, Out-of-equilibrium dynamics
- » Can BBH Merger GW Data Constrain Corrections to Bekenstein-Hawking Entropy ?
- » 1) Cosmology of Particle Dark Matter, (2) Dark Matter Searches using Cosmological, Astrophysical and Laboratory-based Probes, (3) Elementary Particle Physics
- » Black hole shadows
- » Study of regular black holes and naked singularities

- » Non singular bounce in modified gravity theories
- » Nested modulus stabilization in doubly warped braneworld model and moduli stabilization
- » Quasar continuum spectra and magnetic monopole charge
- » Particle, astro-particle and cosmo-particle physics including physics of axions and axion-like particles, neutrinos, dark matter physics and cosmic inflation.
- » Black hole physics, Gravitational waves,
- » Quantum physics in curved spacetime, Cosmology, Theories beyond general relativity, Quantum aspects of gravity.
- » Particle Physics and dark matter analyses with Supersymmetry, Standard Model Effective Theory

Experimental Physics:

- » Carrier dynamics, opto-electronics of 2D van Der Waals and 3D sulfide and oxide thin films.
- » Multiferroic thin films and heterostructures
- » Electrocaloric and magnetocaloric materials
- » Quantum Hall effect in magnetic thin films
- » Resistive switching in artificial synaptic devices
- » Quantum phenomena in low-dimensional and vdW materials
- » Topological phases and emergent long-range orders, including charge and spin density wave physics
- » Dynamic response and critical fluctuations in low-dimensional vdW magnetic systems, including skyrmion-hosting materials, spin liquid candidates
- » Coherent dynamical response and control of quantum state in nanostructured materials and molecules
- » Magnetoelectric coupling in multiferroics
- » Anomalous Hall and Nernst effect in strongly correlated system
- » Our research Group focuses on furthering the science of two-dimensional (2D) magnetism and technology of related micro-/nano-electronic devices by probing elementary spin-dependent interactions, developing circuit prototypes and voltage-control methods necessary for scalable sensor processing. One of the main focuses is

on using the characteristic phonon modes of the 2D lattice to decode the magnon-phonon hybridization. Realizing magnetic atomic layers in the solid-state offers a new pathway to scalable quantum devices: this approach builds on the experience of the electronic circuits and is poised to benefit from the use of novel nanomaterials such as large-area monolayer magnet, magnetic heterostructure, magnetic nanowires and quasi-1D nanoribbons.

- » Manipulation of long-range order in 2D van der Waals (vdW) magnetic materials (e.g., CrI₃, CrSiTe₃, etc.), exfoliated in few-atomic layer, can be achieved via application of electric field, mechanical-constraint, interface engineering, or even by chemical substitution/doping. Usually, active surface oxidation due to the exposure in the ambient condition and hydrolysis in the presence of water/moisture causes degradation in magnetic nanosheets that, in turn, affects the nanoelectronic/spintronic device performance. Counterintuitively, the current study reveals that exposure to the air at ambient atmosphere results in advent of a stable nonlayered secondary ferromagnetic phase in the form of Cr₂Te₃ (T_{C2} ≈ 160 K) in the parent vdW magnetic semiconductor Cr₂Ge₂Te₆ (T_{C1} ≈ 69 K). The coexistence of the two ferromagnetic phases in the time elapsed bulk crystal is confirmed through systematic investigation of crystal structure along with detailed dc/ac magnetic susceptibility, specific heat, and magneto-transport measurement. To capture the concurrence of the two ferromagnetic phases in a single material, Ginzburg-Landau theory with two independent order parameters (as magnetization) with a coupling term can be introduced. In contrast to the rather common poor environmental stability of the vdW magnets, the results open possibilities of finding air-stable novel materials having multiple magnetic phases. (Published in Small, 2023)
- » In the field of semiconductor device physics, we present the electric-field tunable electron and hole transport in a microchannel device consisting of highly air-stable van der Waals (vdW) noble metal dichalcogenide (NMDC), PdSe₂, as an active layer. Pristine bulk PdSe₂ constitutes Se surface vacancy defects created during the growth or exfoliation process and

offers ambipolar transfer characteristics with a slight electron dominance recorded in field-effect transistor (FET) characteristics showing an ON/OFF ratio < 10 and electron mobility ≈ 1 cm²/V-s. However, transfer characteristics of PdSe₂ can be tuned to a hole-dominated transport while using hydrochloric acid (HCl) as a p-type dopant. On the other hand, the chelating agent EDTA, being a strong electron donor, enhances the electron-dominance in PdSe₂ channel. In addition, p-type behavior with a 100 times higher ON/OFF ratio is obtained while cooling the sample down to 10 K. Low-temperature angle-resolved photoemission spectroscopy resembles the p-type band structure of PdSe₂ single crystal. Also, density functional theory calculations justify the tunability observed in PdSe₂ as a result of defect-engineering. Such a defect-sensitive ambipolar vdW architecture may open up new possibilities toward future CMOS (Complementary Metal-Oxide-Semiconductor) device fabrications and high-performance integrated circuits. (Published in Chemistry of Materials, 2023)

- » In case of one-dimensional (1D) van der Waals (vdW) materials, we have reported a new halide based "truly" 1D few-chain atomic thread, PdBr₂, isolable from its bulk which crystallizes in a monoclinic space group C2/c. Liquid phase exfoliated nanowires with mean length (20 ± 1) μm transferred onto SiO₂/Si wafer with a maximum aspect ratio of 5000 confirms the lower cleavage energy perpendicular to chain direction. Moreover, an isolated nanowire can also sustain current density of 200 MA/cm² which is at least one-order higher than typical copper interconnects. However, local transport measurement via conducting atomic force microscopy (CAFM) tip along the cross direction of the single chain records a much lower current density due to the anisotropic electronic band structure. While 1D nature of the nanoobject can be linked with non-trivial collective quantum behavior, vdW nature could be beneficial for the new pathways in interconnect fabrication strategy with better control of placement in an integrated circuit (IC). (Published in Applied Physics Letter, 2023)
- » Magnetism, Strongly correlated electron system



SCHOOL OF APPLIED & INTERDISCIPLINARY SCIENCES



SCHOOL OF APPLIED AND INTERDISCIPLINARY SCIENCES



Professor Surajit Sinha
School Chair

School Profile

People

Faculty	: 07
Post-doctoral Research Associate	: 14
Ph.D. Students	: 58
Non-Academic Staff	: 03

Extra Mural Funding

Projects (ongoing)	: 17
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Research Achievements

Research Papers in Journals	: 44
Ph.D. degree awarded	: 11

Academic Activities

Talks delivered by members	National : 46
of School in conferences/symposia	Intl. : 03



Anindita Das

Associate Professor

Controlled supramolecular polymerization; Functional polyesters; Crystallization driven self-assembly of chromophore-conjugated bio-degradable polymers; Halogen bonding-mediated stimuli-responsive self-assembled systems.

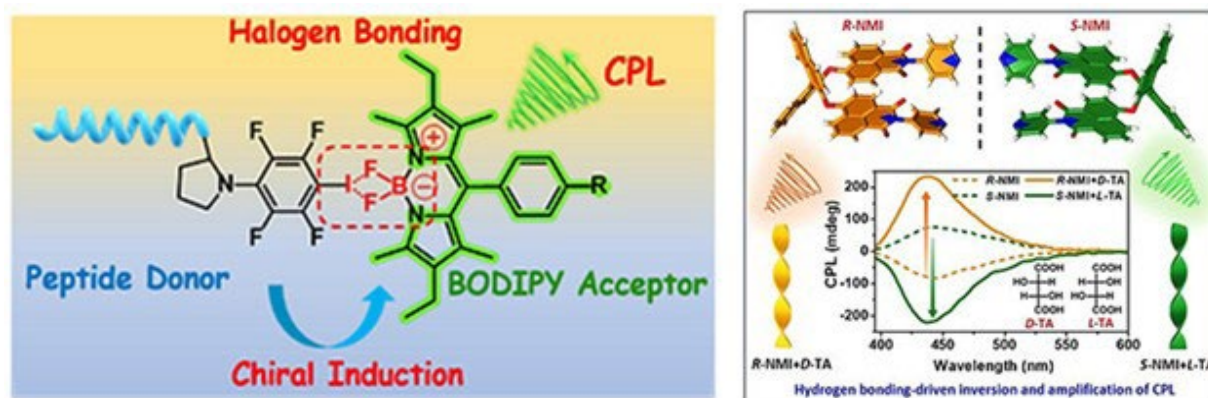
Associates : (1) Dr. Subhendu Biswas (RA-1), (2) Payel Khanra (SRF), (3) Chhandita Chakraborty (SRF), (4) Chandrayee Banerjee (SRF, Integrated-PhD), (5) Yaiswarya Das Karmakar (SRF), (6) Soumyadip Show (SRF), (7) Subhojit Nayak (JRF, Integrated-PhD), (8) Dr. Tirupati Roy (RA-1, TRC), (9) Ankita Banerjee (JRF, Integrated-PhD), (10) Manami Ghosh (JRF) and (11) Soumi Chhanda (Integrated-MS student).

i) Chiral emission from self-assembled systems

: In this field, we are interested in developing highly luminescent responsive supramolecular systems with enriched chiroptical properties in both ground and excited states. In one of the projects, we demonstrated halogen bonding (XB)-induced circularly polarized luminescence (CPL) with a g_{lum} value up to -1.2×10^{-2} from a chiral XB peptide donor to two achiral BODIPY dyes acting as XB acceptors (Scheme 1, left) and investigated their assembly properties and temperature-dependent disassembly. Detailed investigations were performed to understand the combined effect of the hydrogen bonding of the peptide backbone and its orthogonal halogen bonding interaction with the achiral acceptors on the formation of heterostructures BODIPY and their thermal stability (*Chem. Commun.*, 2025,61,1826).

In another project, we studied the self-assembly and chiroptical properties of two axially chiral π -conjugated luminogens, R-NMI and S-NMI, each equipped with two pyridyl moieties for

hydrogen (H)-bonding with chiral diacids (Scheme 1, right). The two enantiomers display aggregation-induced emission enhancement (AIEE) and increased CD and CPL signals in the self-assembled state with a high g_{lum} value of 1.5×10^{-2} . Crystallographic analysis confirmed mirror-image helical structures for R-NMI and S-NMI involving both intra- and intermolecular π - π stacking, leading to elongated hexagonal platelets. Supramolecular co-assembly of R-NMI and S-NMI with D- and L-tartaric acids (D-TA and L-TA) could remarkably modulate and invert their chiroptical properties, which was unachievable with control chiral monoacids. Detailed crystal structure analysis and computation studies revealed the formation of extended H-bonded chains between the pyridyl moiety of R-NMI/S-NMI and the carboxylic acid groups of TA was responsible for such switching in the CPL properties. Thus, H-bonding was found to be an excellent tool to manipulate the chiroptical behaviors in chiral NMI systems (*Angew. Chem. Int. Ed.* 2025, 64, e202500879).



Scheme 1. Left: Schematic representation of halogen bonding-mediated induction of circularly polarized luminescence (CPL) into an achiral BODIPY dye using a peptide scaffold; Right: Hydrogen bonding driven inversion and amplification of CPL signals in axially chiral NMI enantiomers.

ii) Precision 2D assemblies : In this project, we have explored the crystallization-driven self-assembly (CDSA) technique for controlled self-assembly of different chromophore-conjugated poly(L-lactide) (PLLA) homopolymers in iPrOH into precision two-dimensional monolayered assemblies. This strategy resulted in the generation of well-defined diamond-shaped 2D nanoplatelets with very high aspect ratio and the surface of the resultant nanostructures could be decorated with different terminally-attached chromophores that act as soluble corona. Further, by co-assembly of suitable Förster resonance energy transfer donor- (FRET) (Pyrene) and acceptor- (phenothiazine) polymers, efficient energy transfer on the crystalline nanoplatelet surfaces could be achieved, and the efficiency values could be tuned by engineering the spatial proximity of the two chromophores with varying polymer chain lengths. Interestingly, our studies also demonstrated the impact of the chromophore attached at the PLLA chain end on the morphology of the two platelets. A remarkable transition in the morphology from diamond to hexagonal shape could be achieved by increasing the crystal annealing temperature or by varying the chain length of the polymer. Our study reveals that an interplay of the solvation of the surface-anchored chromophores and the crystallization of the core-forming backbone determines the kinetics of the 2D assembly and eventually the shape of the nanoplatelets (*Nanoscale*, 2024, 16, 13019).

iii) Functional polyesters for mitochondria targeting : We recently demonstrated a versatile methodology for functional polyester synthesis by organocatalyzed transesterification from activated pentafluorophenyl diester of adipic acid and functional diols by step-growth polymerization under mild reaction conditions. Next, we explored this methodology for the synthesis of water-dispersible, green-emitting chromophore-conjugated cationic polyesters with enzymatically degradable backbones that exhibit broad-spectrum antibacterial properties as their action shows similarity with the function of host-defense peptides (*Polym. Chem.* 2024, 15, 2753. A systematic variation of the polyester structure was carried out to explore how subtle structural differences

influence antibacterial activity. Additionally, for their very low cytotoxicity, we explored their potential uptake in mammalian cancerous HeLa cell lines and they were found to show greater than 90 % uptake and locate in the mitochondria due to their dual lipophilic and cationic character. Interestingly, another neutral polyester, which displayed acidic pH-triggered cationic properties in only cancerous microenvironment, could selectively stain the mitochondria of the cancerous cells, where it acquired the positive charge, while in noncancerous cells, being neutral was found to locate in the cytosol. Thus, our newly developed strategy for water-dispersible polyesters demonstrates promising potential for targeted delivery (*Nanoscale*, 2025, 17, 5732).

Awards/Recognitions :

- » Associate of the West Bengal Academy of Science & Technology (WAST-2024)
- » Kabita Maiti Memorial Award, 2024, Professor Sukumar Maiti Polymer Award Foundation
- » Editorial Advisory Board Member of RSC Applied Polymers, Royal Society of Chemistry
- » Editorial Advisory Board Member of ACS Polymer Au, American Chemical Society
- » ACES-CRSI Early Career Award-2024, CRSI, India

Publications in Journals

1. Hydrogen Bonding-Induced Inversion and Amplification of Circularly Polarized Luminescence (CPL) in Supramolecular Assemblies of Axially Chiral Luminogens - S. Ghorai, S. Show, A. Das,**Angew. Chem. Int. Ed.*, **64**, e202500879 (2025). [IF:16.6]
2. Mitochondria-targeting nanostructures from enzymatically degradable fluorescent amphiphilic polyesters - S. Biswas, P. Rajdev, A. Banerjee, A. Das,**Nanoscale*, **17**, 5732-5742 (2025). [IF:5.8]
3. Peptide-induced chirality transfer and circularly polarized luminescence in achiral BODIPY emitters via halogen bonding - S. Show, A. Jamadar, S. Gorai, S. Mula, A. Das,**Chem. Commun.*, **61**, 1826-1829 (selected for cover page) (2025). [IF:4.3]

4. Polymer Science and Engineering in India-A. Das,* T. K. Patra,* *ACS Polymer Au*, **4**, 460–462 (Editorial) (2024).[IF:4.8]
5. Shape-tunable two-dimensional assemblies from chromophore-conjugated crystallizable poly(l-lactides) with chain-length-dependent photophysical properties - C. Chakraborty, A. Rajak, A. Das,**Nanoscale*,**16**, 13019-13028 (2024). [IF:5.8]
6. Synthesis of amphiphilic cationic polyesters and their antibacterial activity - S. Biswas, R. Barman, M. Biswas, A. Banerjee, A. Das,**Polym. Chem.***15**, 2753 (2024).[IF:4.1]

Ph.D. Degree Awarded :

(1) Aritra Rajak (IACS Deemed to be University) and (2) Subhendu Biswas (IACS Deemed to be University).

Lectures Delivered :

- » Invited talk at (1) Kathmandu, Nepal, (2) MAM Tamil Nadu, (3) ICCHD-2025, CU, (4) Prof. Sukumar Maiti Polymer Award Foundation, Salt Lake, (5) POLYSOLVAT 15, IACS, Kolkata, (6) Lotus Eco Beach Resort, Konark, Odisha, (7) INST Mohali, (8) IEST, Shibpur, (9) KaSAM-2024, Kathmandu, Nepal, (10) FORCE-IICS 2024, Alappuzha, Kerala, (11) GRSI National Symposium, Dr. Reddy's Laboratories Hyderabad, (12) SARC 2024, IIT Mandi

Sponsored Project

- » Halogen-Bonded Organic Materials (DAE-BRNS)
- » Structural Impact on the Pathway Conjugated-Systems (SERB Women Excellence Research Grant)
- » A Versatile Methodology Self-Assemblies (SERB)
- » Supramolecular Dipole Ferroelectricity



K.D. Mallikarjuna Rao

Assistant Professor

Design and fabrication of nanoelectronic device.

Design and fabrication of nanoelectronic devices, Optoelectronics, Halide Perovskites, 2D- Heterostructures, Plasmonics, Transparent Electrodes, Neuromorphic Devices, Strain Sensors, Solar Cells, Photodetectors, Nanofabrication, Light-Matter Interaction Energy Harvesting.

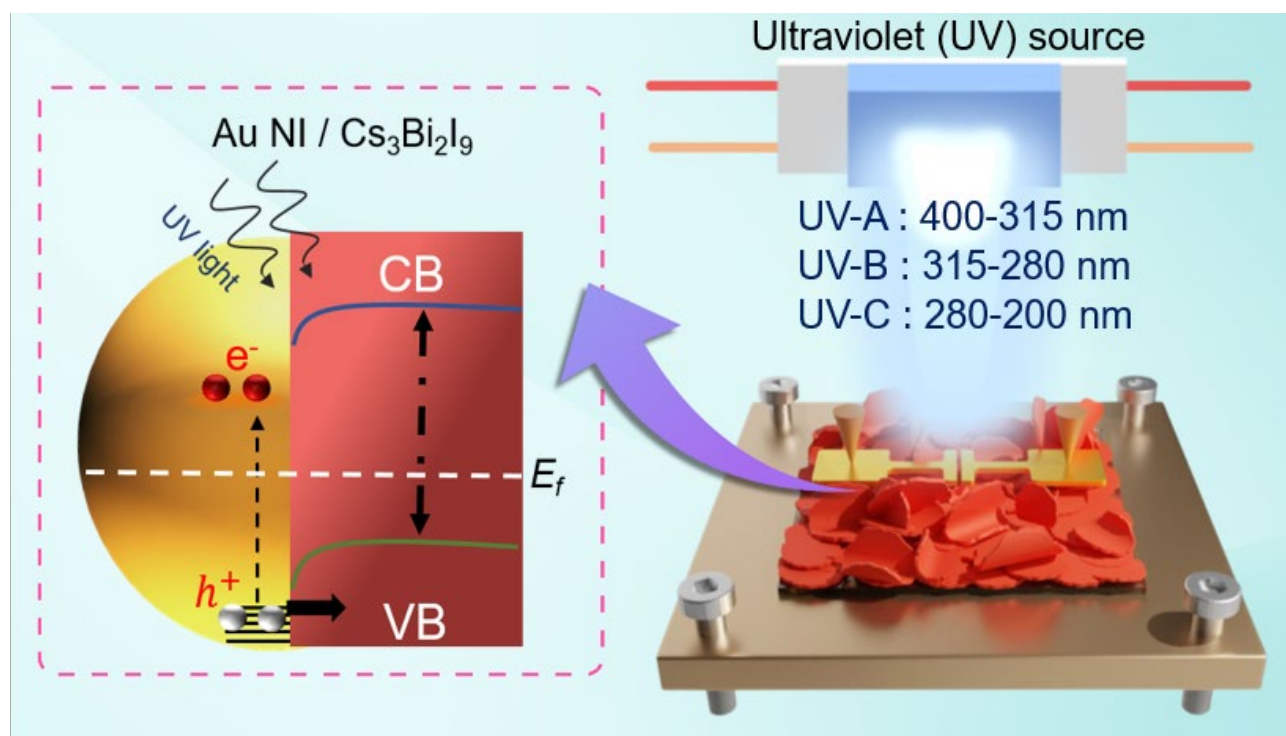
Associates : (1) Prakash Sarkar (Ph.D. student), (2) Kuntal Singh (Ph.D. student), (3) Sougata Karmakar (Ph.D. student), (4) Soham (Ph.D. student), (5) Gopal (Ph.D. student), (6) Harihar (Ph.D. student), (7) Debojjal (Ph.D. student) and (8) Manoj (PDF).

Achieving on-chip, full-UV-band photodetection across UV-A (315–400 nm), UV-B (280–315 nm), and UV-C (100–280 nm) bands remains challenging due to the limitations in traditional materials, which often have narrow detection ranges and require high operating voltages. In this study, we introduce a self-driven, on-chip photodetector based on a heterostructure of hybrid gold nanoislands (Au NIs) embedded in H-glass and cesium bismuth iodide ($\text{Cs}_3\text{Bi}_2\text{I}_9$). The Au NIs act as catalytic nucleation sites, enhancing crystallinity and facilitating the vertical alignment of the interconnected $\text{Cs}_3\text{Bi}_2\text{I}_9$ petal-like thin film. A built-in electric field developed at

the heterojunction efficiently separates hot holes generated in the Au NIs under UV illumination, transferring them to the valence band of $\text{Cs}_3\text{Bi}_2\text{I}_9$ and minimizing recombination losses. The device demonstrates an ultra-high open-circuit voltage of 0.6 V, exceptional responsivity of 0.884 A/W, and a detection threshold of 90 nW/cm², outperforming the existing thin film-based UV photodetectors under self-driven mode. Long-term stability tests confirmed robust operational reliability under ambient conditions for up to eight months. This novel architecture, driven by efficient hot hole dynamics, represents a significant advancement

for full-UV-band optoelectronics with promising applications in environmental monitoring, flame

detection, biomedical diagnostics, and secure communication systems.



On-Chip Full-UV-Band Photodetectors Enabled by Hot Hole Extraction

Publications in Journals :

1. Benign mid-gap halide vacancy states in 2D-bismuth-based halide perovskite microcrystals for enhanced broadband photodetectors - Kuntal Singh, Mozakkar Hossain, Pabitra Kumar Nayak, Sougata Karmakar, Akash Tripathi, Prakash Sarkar, Pratyasha Rudra, A. V. Muhammed Ali, G. Krishnamurthy Grandhi, Paola Vivo, Swastik Mondal, K. V. Adarsh, Dibyajyoti Ghosh, and K. D. M. Rao, *Mater. Horiz.*, <https://doi.org/10.1039/D4MH01532K> (2025).[IF:14.3]
2. On-Chip Full-UV-Band Photodetectors Enabled by Hot Hole Extraction - Sougata Karmakar, Soham Ash, Sinorul Haque, N. K. Murugasenapathi, M. Sridevi, Indrajeet Mandal, Gurupada Ghorai, A. V. Muhammed Ali, Nitya Nand Gosvami, N. M. Anoop Krishnan, Sayan Kanungo, Manohar Chirumamilla, Tamilarasan Palanisamy, Rajiv K. Singh, Amarnath R. Allu*, and K. D. M. Rao, *ACS Nano*, **19**, 6, 6309–6319. (2025).[IF:15.8]
3. Perovskite-Inspired $\text{Cs}_2\text{AgBi}_2\text{I}_9$: A Promising Photovoltaic Absorber for Diverse Indoor Environments - Mokurala Krishnaiah, Kuntal Singh, Sanchi Monga, Akash Tripathi, Sougata Karmakar, Ramesh Kumar, Christos Tyrpenou, George Volonakis, Debjit Manna, Paavo Mäkinen, K. V. Adarsh, Saswata Bhattacharya, G. Krishnamurthy Grandhi, K. D. M. Rao*, and Paola Vivo*, *Adv. Energy Mater.*, 2404547 (2024). [IF:27.8]
4. Unveiling Double A-Site Cation Perovskite-Inspired Materials: From 0D- $\text{Cs}_3\text{Bi}_2\text{I}_9$ to 2D- $\text{Cs}_2\text{AgBi}_2\text{I}_9$ with Enhanced Charge Transport - Mozakkar Hossain, Kuntal Singh, Ankita Narwal, Md Sariful Sheikh, Sandeep K Reddy, Kiran Vankayala, Asha Singh, Saleem Khan, Salahuddin Khan, Praveen Kumar Velpula, Manohar Chirumamilla, Sharma S. R. K. C. Yamijala, G. Krishnamurthy Grandhi, Paola Vivo, and K. D. M. Rao*, *Chem. Mater.*, **36**, 16, 7781–779 (2024).[IF:7.2]
5. H-Glass Supported Hybrid Gold Nano-Islands for Visible-Light-Driven Hydrogen

Evolution - Indrajeet Mandal, Jagannath Gangareddy, AbimannanSethurajaperumal, Murugasenapathi NK, Manikanta Majji, Susmita Bera, Pratyasha Rudra, Vanmathi Ravichandran, Sandip Bysakh, Noah Jacob, K. D. M. Rao, Rajiv K. Singh, N. M. Anoop Krishnan, Manohar Chirumamilla, Tamilarasan Palanisamy, M. Motapothula, EswaraiahVarrla, Srabanti Ghosh, and Amarnath R. Allu, *Small*, **20**, 2401131. (2024). [IF:13.0]

6. Nature-Inspired Halide Perovskite Breath Figures: Unleashing Enhanced Light-Matter Interaction - P Sarkar, T Maitra, M Hossain, NK Murugasenapathi, M Chirumamilla, T Palanisamy, K. D. M. Rao*, *Advanced Optical Materials*, **12**, 9, 2400353, (2024). [IF:9.1]

7. On the grain boundary charge transport in p-type polycrystalline nanoribbon transistors - Prakash Sarkar, AV Muhammed Ali, Gurupada Chorai, Prabhanjan Pradhan, Biplob K Patra, Abhay A Sagade, K. D. M. Rao*, *Nanoscale*, **16**, 35, 16611-16621, (2024).[IF:5.2]

8. Identification of Environmentally Friendly Solvents to Exfoliate and Stabilize the Dispersions of Antimony Sulfide Nanosheets for Optoelectronic Applications - P Sahoo, VK Gangaiah, K Singh, A Narwal, SK Reddy, SRKC Yamijala, K. D. M. Rao, HSS Ramakrishna, *ACS Applied Nano Materials*, **11**, 13447–13456, (2024). [IF:5.2]

Ph.D. Degree Awarded :

(1) Mozakkar Hossain (IACS Deemed to be University)

Sponsored Project

Solution-processed synthesis Field effect transistors (SERB)

Fabrication and development optoelectronic devices (UGC-DAE)

Lectures Delivered :

» Invited talk at (1) HYPE-24, NISER Bhubaneswar, (2) IUMRS-ICA 2024, UGC DAE Indore and (3) SPARC-24, IIT Kharagpur.



Shinto Varghese

Faculty Fellow

Organic Optoelectronics: Synthesis of Organic Semiconductors and Emitters, Flexible Molecular Crystals, Control over Molecular Organization for Tailored Material Properties, Light Emitting Transistors and Memory Devices.

Associates : Dr. Madhubrata Ghoar, RA, (2) Dr. S. K. Bahadur, RA, (3) Ranjit Kumar Manna, SRF (Integrated-PhD), (4) Subhayan Sarkar, SRF, (5) Pralay Chanda, JRF (INSPIRE Fellow) and (6) Debajyoti Jana, SRF (Inspire Fellow).

Organic semiconductors are driving a transformative change in optoelectronic devices, offering advantages such as mechanical flexibility, lightweight and the potential for low-cost, large-area production. These characteristics make organic electronics particularly suitable for innovative applications, including flexible displays, wearable sensors, and biodegradable devices. The field encompasses various devices such as organic light-

emitting diodes (OLEDs), organic photovoltaics (OPVs), and organic field-effect transistors (OFETs), each leveraging the unique properties of organic materials to achieve functionalities that are challenging with conventional inorganic components. As research progresses, organic electronics hold promise for revolutionizing the design and functionality of electronic devices across multiple applications.

Optimizing organic semiconductors for optoelectronic devices demands a deep understanding of fundamental device physics, including charge transport, photophysical behavior, mechanical characteristics, and film formation processes. Charge transport in these materials typically proceeds via thermally activated hopping between localized states, which is strongly influenced by molecular packing, energetic disorder, and the microstructure of the active layer. Enhancing charge carrier mobility is a key performance factor and can be achieved through strategic molecular design and optimized processing conditions. Photophysical properties such as exciton generation, diffusion, and dissociation critically impact the efficiency of devices like organic photovoltaics (OPVs) and organic light-emitting diodes (OLEDs). Due to the inherently high exciton binding energies in organic semiconductors, effective donor-acceptor interfaces are essential to promote charge separation. Mechanical properties, including flexibility and stretchability, are particularly important for wearable and flexible electronics; these can be tailored by introducing flexible side chains or engineering the molecular arrangement to maintain charge transport under mechanical deformation. Film formation techniques—such as spin-coating, physical vapour transport methods is employed for developing thin films. Intermolecular interactions play a crucial role in dictating film morphology and, subsequently, device performance. Controlling parameters like substituent groups in the molecular backbone, solvent selection, additives, drying kinetics, and thermal annealing is vital to achieving optimal

phase separation, crystallinity, and interface quality. By systematically addressing these factors, the research aims to develop robust, high-performance, and scalable organic optoelectronic devices.

Crystalline π -conjugated materials offer high performance as active materials compared to their amorphous counterpart, but they are typically brittle. This poses a significant challenge that needs to be overcome to unfold their potential in optoelectronic devices. Unveiling the molecular packing topology and identifying interaction descriptors that can accommodate strain offers essential guiding principles for developing conjugated materials as active components in flexible optoelectronics. (Figure 1) The molecular packing and interaction topology of eight crystal systems of dicyano-distyrylbenzene derivatives are investigated. Face-to-face π -stacks in an inclined orientation relative to the bending surface can accommodate expansion and compression with minimal molecular motion from their equilibrium positions. This configuration exhibits good compliance towards mechanical strain, while a similar structure with a criss-cross arrangement capable of distributing applied strain equally in opposite directions enhances the flexibility. Molecular arrangements that cannot reversibly undergo expansion and compression exhibit brittleness. In the isometric CT crystals, the disproportionate strength of the interactions along the bending plane and orthogonal directions makes these materials sustain a moderate bending strain. These results provide an updated explanation for the elastic bending in semiconducting π -conjugated crystals.

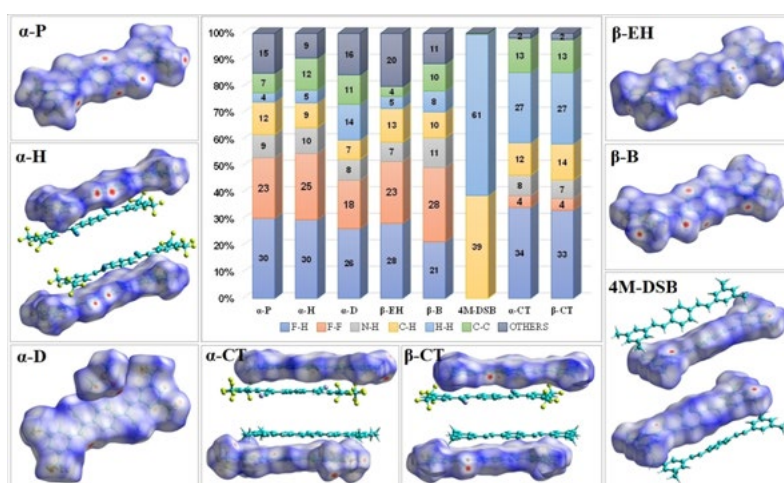


Figure 1. Hirschfeld isosurface representations of the systems under investigation; the percentage-wise contribution of the interactions in the crystals is given, considering all unsymmetrical molecules separately, and weighted to the number of atoms in the molecules.

Ph.D. Degree Awarded :

(1) Madhubrata Ghora (IACS Deemed to be University)

List of Publications :

- » Molecular Packing Topology and Interactions to Decipher Mechanical Compliances in Dicyano-Distyrylbenzene Derivatives - M. Ghora, R. K.

Manna, S. K. Park, S. Oh, S.-I. Kim, S. Y. Park, J. Gierschner, S. Varghese, *Chem. Eur. J.*, **30**, 202401023 (2024).[IF:]

Sponsored Project :

Exploring Single Crystals, Doped Crystals and Crystalline Thin Films of Conjugated Molecular Materials for Organic Light-Emitting Field-Effect Transistors. (SC-OLET)/SERB."



Somobrata Acharya, FASc, FNASc

Senior Professor & Dean (Admin & Staff Affairs)

Area of Research: Molecular assemblies, Perovskite nanocrystals, Supramolecular assemblies, Heterostructures, and Energy related applications.

Associates : (1) Md. Yousuf Sk (Institute), (2) Shramana Guha (Integrated MS-Ph.D.), (3) Anusmita Ghosh (DST Inspire), (4) Mr. Riddhi Mitra (Integrated MS-Ph.D.), (5) Shubhraj Chowdhury (DST Inspire), (6) Debadyuti Mahapatra (Institute Fellow), (7) Soumita Pal (Institute) (8) Mohammad Rahil, RA (TRC) and (9) Deeparati Basu, RA (TRC).

The prime motivation of Acharya group is to explore the structure-properties relationship of a variety of nanomaterials. The group expertise in synthesis a variety of nanomaterials, to characterize structures, properties and depending on that, to fabricate a suitable device. Superfine nanocrystals with a target to reach atomic scale dimension are prepared. Complex heterojunctions and planar materials are the major subject of interest of Acharya's group. Creating multi-dimensional assemblies of nanocrystals and molecules are of interests. The research of Acharya's group is directed towards energy generation and savings using nanomaterials and functional molecules. Supramolecular assemblies of AIE-gens towards energy related applications are of intense interest of Acharya group.

Publications in Journals

1. Molecular Propeller Tethering on a Dipeptide Induces a One-Step Conversion of Its Secondary Structure on Water Surface Promoted by Chiral Supramolecular Assembly - Sandip Biswas,

Umesh, Bidisa Das, Pradyot Koley, Somobrata Acharya* and Santanu Bhattacharya*, *Small*, 2408634 (2024).[IF:13.0]

2. Deriving Chiroptical Properties from Intrinsically Achiral Building Blocks of One-Dimensional CsPbBr₃ Perovskite Nanowires - Shramana Guha, Suman Bera, Arghyadeep Garai, DD Sarma, Narayan Pradhan and Somobrata Acharya*, *J. Am. Chem. Soc.* **146** (49), 33883-33892 (2024).[IF:14.5]
3. Interfacial Assembly of Peptide Carbon Dot Hybrids Enables Photoinduced Electron Transfer with Improved Photoresponse - Pramita Mondal, Umesh, Niladri Hazra, Joydeep Datta, Sharmistha De Dalui, Anashmita Ghosh, Somobrata Acharya* and Santanu Bhattacharya*, *Langmuir*, **40**, 47, 25262-25274 (2024).[IF:3.9]
4. Switchable Bulk Photovoltaic Effect in Intrinsically Ferroelectric 3D All-Inorganic CsPbBr₃ Perovskite Nanocrystals - Anashmita Ghosh, Susmita Paul, Mrinmay Das, Piyush

Kanti Sarkar, Pooja Bhardwaj, Goutam Sheet, Surajit Das, Sk. Kalimuddin, Anuja Datta and Somobrata Acharya*, *ACS Nano*, **18**, 23310–23319 (2024).[IF:15.8]

5. Self-assembled two-dimensional sheets of an amphiphilic sexiphenyl exhibit intense polarized blue emission in the solid state - Pramita Mondal, Jonathan P. Hill*, Gouranga Manna, Sharmistha De Dalui, Edward A. Neal, Gary. J. Richards, Katsuhiko Ariga, Yusuke Yamauchi, Lok Kumar Shrestha and Somobrata Acharya* *Advanced Optical Materials*, 2400177 (2024).[IF:9.0]

Ph.D. Degree Awarded :

- (1) Pramita Mondal (IACS Deemed to be University)

Sponsored Project

- » Fabrication of Perovskite Phototherapy Devices
- » Stimulating scientific self-sustainable empowerment

Lectures Delivered :

- » Invited talk at (1) ICAFM -2025, Kathmandu, Nepal, (2) IIT BHU, (3) CSIR-CGCRI, Kolkata, (4) MAM, Tamil Nadu, (5) NISER, (6) Chemistry Meet 2024, Konarak, (7) NISER & IIT Bhubaneswar, (8) MTMM/SIMS, IISc, Bengaluru, (9) Jadavpur University, Kolkata, (10) IACS, Kolkata, (11) University of Hyderabad, (12) SmartNano, Bali, Indonesia and (13) IISER-Tirupati.



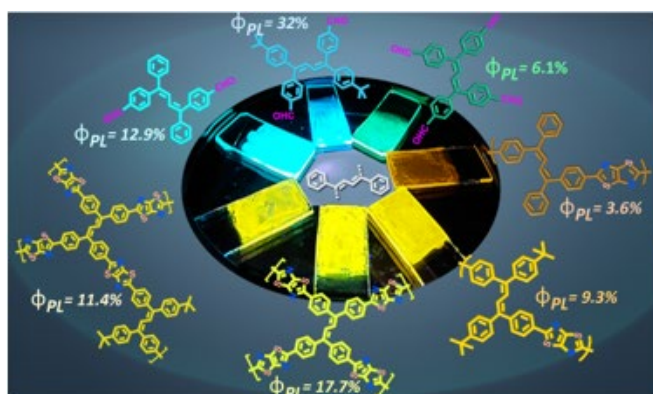
Sudip Malik

Senior Professor

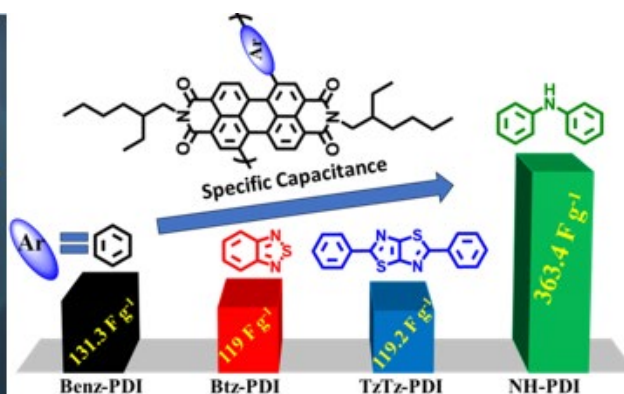
Physical properties of polymer, luminescent oligomers or polymers, polymer for energy storage; electro-chromic polymers and supramolecular aggregates.

Dr. Tanmay Kar : Design and Development of Small Molecule Gelators for Deep Eutectic Solvents and Their Applications in Diversified Fields

Associates : (1) Dr. Tanmay Kar (DST-TARE), (2) Dr. Bayazeed Alam, RA (SERB Project), (3) Ayan Dutta, SRF (UGC), (4) Gopal Lal Dhakar, SRF (Institute), (5) Saily Sriwastav, JRF (Inspire DST), (6) Lalmohan Das, JRF (CSIR), (7) Mustak Ahamed, SRF (CSIR), (8) Praduman K Gupta, SRF (CSIR), (9) Runa Mondal, SRF (CSIR) (10) Bankim Paul, JRF (UGC) and (11) Antara Panja, JRF (Institute).



By taking advantage of twisted and substituted *buta-1,3-diene* moiety, the design and synthesis of various aryl-substituted *buta-1,3-diene* based solid-



state emissive small molecules as well as linear and porous polymers, were developed in the previous year. Prepared small molecular derivatives were also

applied subsequently like organic light emitting diodes (OLEDs) through the efficient triplet harvesting via hot exciton utilization. By considering the enhancement of working potential due to the combined effect of reductive charge storage (n-type counterpart) and oxidative charge storage (p-type counterpart), several perylene diimide (PDI) based n-type polymers were developed and those were utilized as electrode materials for supercapacitors. Additionally, aggregation behaviors of poly(3-hexylthiophene) (P3HT), one of the important conducting polymers, were investigated by varying the temperature at various concentrations, solvents, and molecular weights a) to distinguish the nature of aggregation and b) to optimize the parameter of network formation. Systematic as well as extensive rheological investigations were performed, including frequency sweep, strain sweep, thixotropy studies, and large amplitude oscillatory shear (LAOS) studies to explore the structural response of polymer networks under large deformation.

Publications in Journals :

1. Bay-substituted Perylene diimide-based Donor-Acceptor type Copolymers: Design, Synthesis, Optical and Energy Storage Behaviours - Lalmohan Das, P. Das, Sk. M. Ahamed, A. Datta, A. K. Pal, A. Datta and Sudip Malik*, *J. Mater. Chem. A*, **11**, 16594-16604 (2025). [IF:10.70]
2. Luminescent Mesoporous Squaraine Copolymers: Probing the Structural, Optical, and Sensing Behaviors - S. Sriwastav and Sudip Malik*, *J. Polym. Sci.*, **63**, 1398- 1406 (2025). [IF:3.90]
3. Polyaniline/G-quadruplex Hybrid Gel Networks: Rheological Studies and Supercapacitor Applications - P. Das, Sk. M. Ahamed, G. L. Dhakar, B. Lala, R. Chatterjee, J. Dash* and Sudip Malik*, *J. Energy Storage*, **114**, 115739 (2025). [IF: 8.90]
- 4) Efficient Triplet Harvesting via Hot Exciton Utilization in Solution Processed OLEDs Employing Tetraphenyl Buta-1,3-diene Based AIE Emitters - A. Datta, S. Mukherjee, P. Pal, A. K. Pal, A. Perumal*, A. Datta* and Sudip Malik*, *Advanced Optical Mater.*, **13**, 2401977 (2025). [IF:8.00]
5. Linear and Nonlinear Rheological Investigations of Poly(3-hexylthiophene) H- Aggregated Gel Networks - G. L. Dhakar and Sudip Malik*, *J. Phys. Chem. B*, **128**, 12292-12309-7583 (2024). [IF:2.80]
6. Thiazolothiazole linked solid-state emissive linear and Porous Organic Polymers utilizing Tetraphenyl Buta-1,3-diene based AIE active building blocks - A. Datta, P. Pal, R. Mondal and Sudip Malik*, *Polymer Chemistry*, **15**, 4699-4709 (Appeared in Front cover page) (2024). [IF:4.10]
7. Northiosquaraine Based Nanoparticles for Red-Light Induced Photodynamic Therapy via Singlet Oxygen Generation - S. Sriwastav, Abu R Sarkar, A Datta, N R Jana and Sudip Malik*, *ACS Appl. Nano Mater*, **7**, 21674-21684 (2024). [IF:5.3]
8. Amplifying Reactivity of Bio-inspired [FeFe]-hydrogenase Mimics by Organic Nanotubes - Md E. Ahmed, P Das, Sk M. Ahamed, S. Chattopadhyay, A. Nayek, M. Mondal, Sudip Malik* and A. Dey*, *Chem. Euro. J.*, **30**, e202403011 (2024). [IF: 3.90]
9. Aryl-substituted Buta-1,3-diene and Phenothiazine based Solid-state Emissive Copolymers: Photophysical Properties and Electrochromic Behaviors, P. Pal, A. Datta, B. Paul and Sudip Malik*, *ACS Appl. Polym. Mater.*, **6**, 10882-10890 (2024). [IF:4.50]

Ph.D. Degree Awarded :

(1) Puspendu Das (IACS Deemed to be University).

Lectures Delivered :

Invited talk at (1) IUPAC Conference POLYSOLVAT-15.

Sponsored Project :

- » Design and Development Diversified Fileds (DST-TARE)
- » Wearable Bioelectronic Circuit..... Glucose
- » Buta-1,3-Diene Emitting Diodes (SERB)
- » Microneedle based Glucose Monitoring (DBT BME)

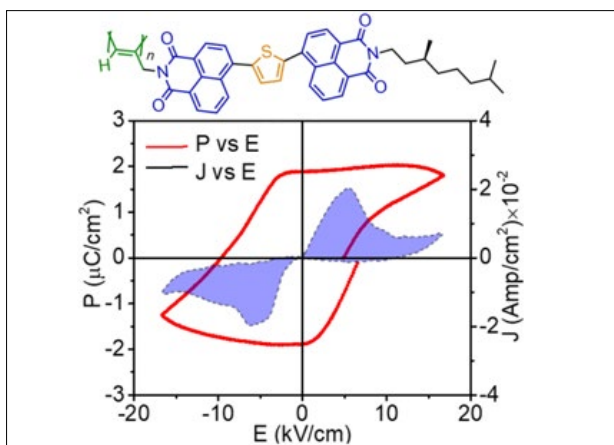


Suhrit Ghosh

Senior Professor & Dean (Graduate Studies and Student Affairs)
Polymer Chemistry, Supramolecular Chemistry, Functional Materials

Associates : Dr. Priya Rajdev (RA-III), (2) Dr. Krishna Dan (DST Woman Scientist), (3) Dr. Sukanya Bera (RA-1), (4) Dr. Atish Nag (RA-1), (5) Aritri Pal (SRF), (6) Tanushri Banerjee (SRF), (7) Supriya Bandyopadhyay (SRF), (8) Mr. Soumya Koner (SRF), (9) Mr. Soumik Sarkar (JRF), (10) Ms Soumili Chakraborti (JRF) and (11) Pritam Sadhukhan (DST Inspire fellow)

In the recent past we have been working on chain-folding regulated assembly of polyurethanes and explored them as functional materials for biological and energy harvesting applications. We continue to work on exploring structural diversity in bio-reducible poly(disulfides) and in the recent past we have demonstrated impact of monomer sequence in aqueous self-assembly of these polymers. We have developed suitable chromophore-appended polymers that exhibit remarkable ferroelectric property. We have demonstrated topochemical polymerization of supramolecular polymers for generating donor/acceptor heterojunctions with ambipolar charge carrier mobility. We continue to work on self-assembly of ambipolar conjugated chromophores with an effort to understand structural nuances on piezoelectric and pyroelectric energy harvesting. We have developed in the recent past polymer-photosensitizer conjugate and new chromophoric systems with outstanding reactive oxygen species (ROS) generation ability. We have developed new supramolecular and polymeric materials those exhibit excellent antiviral activity.



Publications in Journals :

1. Low-Power Piezoelectric Energy from Chiral Supramolecular Polymer of a Donor–Acceptor–Donor Conjugated π -System - S. Paul, A. Pal, S. Ghosh and A. Datta, *Chem. Eur. J.*, doi.org/10.1002/chem.202500540www.chemeurj.org (2025).[IF:3.9]
2. Morphology Control in Supramolecular Assemblies of Sulfated π -Amphiphiles and Impact on the Antiviral Activity - R. Khamrui, A. Mukherjee, S. S. Jana and S. Ghosh *Langmuir*, **41**, 9027–9032 (2025).[IF:3.7]
3. Electronic pyroelectricity in a supramolecular assembly of acceptor-donor-acceptor type ambipolar p-system - P. Sadhukhan, Sk Kalimuddin, A. Pal, T. Debnath, S. Paul, S. Barman, S. Ghosh, M. Mondal and A. Datta, *Chem. Commun.*, **61**, 5289–5292. (2025).[IF:4.3]
4. A ferroelectric helical polymer - S. Bandyopadhyay, S. Barman, S. Paul, A. Datta and S. Ghosh *Chem. Commun.*, **61**, 937–940 (2025).[IF:4.3]
5. Topochemical Polymerization of a Supramolecular Polymer and Prominent Ambipolar Charge-Carrier Mobility - A. Nag, R. Paitandi, S. Seki and S. Ghosh *Macromolecules*, **58**, 697–703 (2025).[F:5.1]
6. pH-Responsive Self-assembled Polymer-Photosensitizer Conjugate for Activable Photodynamic Therapy - T. Banerjee, K. Dan and S. Ghosh, *Nanoscale*, **16**, 19756–19762 (2024). [IF:5.8]

7. S. Bera and S. Ghosh, "Alternating vs Random Amphiphilic Polydisulfides: Aggregation, Enzyme Activity Inhibition and Redox-responsive Guest Release - *Nanoscale*, **16**, 17886–17892 (2024).[IF:5.8]
8. Hydrogen-Bonding-Regulated Morphology Control and the Impact on the Antibacterial Activity of Cationic π -Amphiphiles - R. Khamrui, A. Mukherjee and S. Ghosh, *Langmuir*, **40**, 13870–13878 (2024).[IF:3.7]

Ph.D. Degree Awarded :

- (1) Rajesh Khamrui (IACS Deemed to be University),
 (2) Sukanya Bera (IACS Deemed to be University)
 and (3) Atish Nag (IACS Deemed to be University).

Lectures Delivered :

Invited talk at (1) RGU, Arunachal Pradesh, (2) POLYSOLVAT 15, IACS, Kolkata, (3) KaSAM-2024, Kathmandu, Nepal, (4) SMST-2024, INST, Mohali, (5) RACS, IEST Shibpur, (6) BBMI 2024, IIT Delhi, (7) BBMI 2024, IIT Delhi, (8) Chem 24, IACS, Kolkata, (9) Guangzhou, China, (10) IISER Mohali, (11) ICCHD-2025, (12) ASNM-2025, CeNS, Bangalore MAM Meeting, Mahalalipuram, (13) NSRP25, NISER Bhubaneswar and (14) ACS Meeting Global Virtual Symposia 2025.

Sponsored Project:

- » Hydrogen-Bonding Regulated Antiviral Activity
- » Custom Designed antiadhesion agent

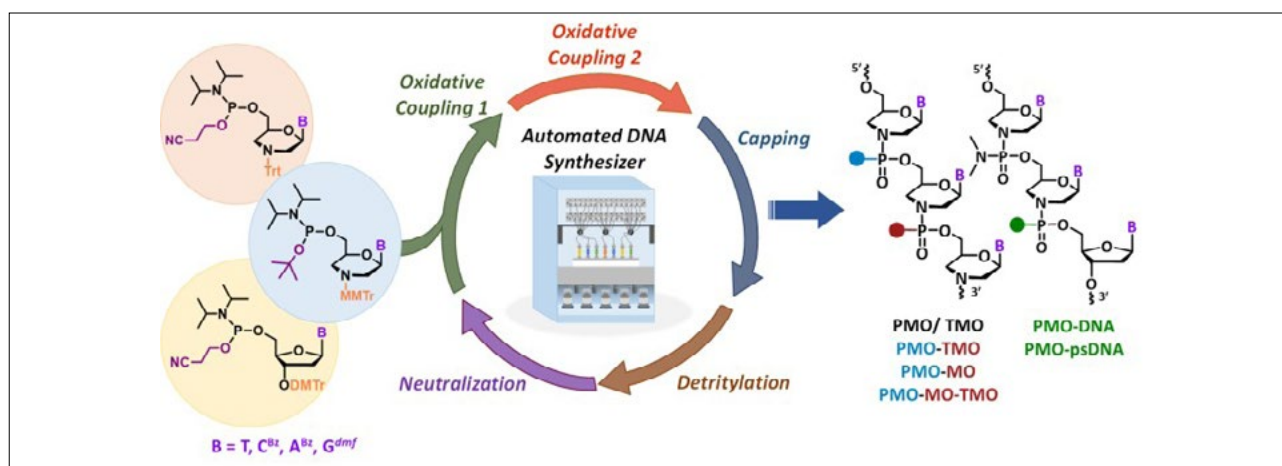


Surajit Sinha

Senior Professor & School Chair

- » Synthesis of biologically important natural products and their analogues. **Recently, an analogue of ibogaine has been identified which can substitute "morphine"**.
- » Small molecule modulation of Hedgehog signaling pathway which plays a critical role in embryogenesis, tissue regeneration, stem cell differentiation and in the development of cancer and studies of Hedgehog dependent physiology using zebrafish as a model organism.
- » Synthesis of artificial amino acids and nucleic acids and morpholino oligonucleotides for biological applications.
- » Non-peptide-based cellular transporter for the delivery of antisense reagents.
- » Morpholino antisense-based therapy for the treatment of Duchenne muscular dystrophy, rare diseases.

Associates : (1) Mr. Arnab Das, SRF (CSIR), (2) Dr. Atanu Ghosh, RA-1 (Institute), (3) Dr. Shalini Gupta, RA-1 (Institute), (4) Swrajit Nath Sharma, SRF (Institute), (5) Ms. Sudipta Sarkar, SRF (CSIR), (6) Subhamoy Pratihari, JRF (Institute), (7) MD Qasim, SRF (IntPhD, CSIR), (8) Sharmeen Naaz, JRF (CSIR), (9) Debajyoti Kuliya, JRF (DST funded) (10) Ms. Mariya Mukherjee, JRF (CSIR Biochemistry), (11) Dr. Abhishek Gupta, RA-1 (TRC), (12) Dr. Senjuti Sen, RA-1 (TRC), (13) Daves Shukla (IntPhD M.Sc SAIS Chemistry Project scholar), (14) Avigyan Bose (IntPhD M.Sc Biology SAIS Project scholar), (15) Sagnik Majumdar (IntPhD M.Sc Biology SAIS Project scholar) and (16) Anwit Bankura Integrated BS-MS (Project)



Phosphorodiamidate Morpholino Oligonucleotides (PMOs) have been well established in the manufacturing of FDA approved DMD drugs

in the last decade. Given their importance in antisense therapeutics, a DNA/ RNA synthesizer compatible modular synthesis protocol of PMOs

is long-awaited to explore next-generation PMO and its chimeras with other therapeutically approved oligonucleotide backbones. We demonstrate a 5' to 3' phosphoramidite approach for the synthesis of PMOs using 5'-*t*Bu-morpholino phosphoramidites which in turn were synthesized from commercially available 5'-OH morpholino monomers. 2-Cyanoethyl (CE) protected 5'-CE-morpholino phosphoramidites were also synthesized to generate thiophosphoramidate (TMO) and phosphoramidate (MO) morpholino oligonucleotides. Full-length PMOs and TMOs were obtained in excellent yield where automated DNA/RNA synthesizer utilizing controlled pore glass (CPG) as the solid support and CH₃CN were used as a solvent. It is important to mention that this method has opened the possibility of various biologically relevant antisense design modalities, such as PMO-TMO and PMO-MO, which were inaccessible otherwise. Furthermore, DNA nucleotides were also incorporated to generate PMO-psDNA and PMO-DNA using commercially available 5'-DNA amidites. Biophysical properties of the synthesized oligonucleotides were analyzed using UV melting and CD studies. Serum interaction profile and innate immune response of the PS-modified poly-T oligonucleotides were analyzed. Interestingly, it was found that the mixed backbone oligonucleotides had a balanced immune response profile as compared to fully charged or neutral oligos. Overall, the synthesis is amenable for the rapid generation of various types of PMO chimeras for biological screening of RNA-targeted sequences, which will expedite their therapeutic development.

Publications in Journals :

1. A Unified Phosphoramidite Platform for the Synthesis of Morpholino Oligonucleotides and Diverse Chimeric Backbones – A. Ghosh, A. Banerjee, S. Gupta and S. Sinha, *J. Am. Chem. Soc.*, **146**, 32989–33001 (2024).[IF:14.5]
2. Selective Recognition of the Dimeric NG16 Parallel G-Quadruplex Structure Using Synthetic Turn-On Red Fluorescent Protein Chromophore – NK Choudhary, S. Gupta, G. Das, A. Sahoo, S. Harikrishna, S. Sinha and K.R. Gore, *Biochemistry*, <https://doi.org/10.1021/acs.biochem.4c00407> (2024).[IF:2.9]
3. Synthesis of Phosphorodiamidate Morpholino Oligonucleotides (PMOs) Using Staudinger Reduction as a Deblocking Condition and its Usefulness for Orthogonal Conjugation in Bi- and Tri-functionalized PMOs – S. Pratihari, Md. Qasim, and S. Sinha, *Synlett*, **35**(20): 2435-2440 (2024).[IF:1.7]
4. Total Synthesis of Lipopeptide Bacilotetrin C: Discovery of Potent Anticancer Congeners Promoting Autophagy – SS Auddy, S. Gupta, S. Mandi, H. Sharma, S. Sinha and R.K. Goswami, *ACS Med. Chem. Lett.*, **15**, 1340–1350 (2024).[IF:3.5]
5. 2'-O-Alkyl-N3-Methyluridine Functionalized Passenger Strand Improves RNAi Activity by Modulating the Thermal Stability. – A. Sahoo, S. Gupta, G. Das, A. Ghosh, SS Bagale, S. Sinha and K.R. Gore, *ACS Med. Chem. Lett.*, **15**, 1250–1259 (2024).[IF:3.5]
6. Benzofuran Iboga-analogs Modulate Nociception in an Acute Mouse Pain Model – T. Bhattacharya, A. Gupta, S. Gupta, S. Saha, S. Ghosh, Z. Shireen, S. Dey and S. Sinha, *ChemBioChem*, 1-14 DOI:10.1002/cbic.202400162 (2024).[IF:3.2]
7. Evaluation of Transiently O-6 Protected Guanosine Morpholino Nucleosides in PMO Synthesis – M. Qasim, A. Ghosh, A. Das and S. Sinha, *Synlett*, **35**, 1315–1320 (2024).[IF:1.7]

Special Achievement :

A protocol has been developed for the manufacturing of morpholino-based DMD drugs. We are now attempting to scale up the technology with an expectation to manufacture the drug in India so that it would be available in affordable price, in accordance with our Honorable Prime Minister's encouragement for the “Make in India” model.

Ph.D. Degree Awarded :

(1) Abhishek Gupta (IACS Deemed to be University) and (2) Atanu Ghosh (IACS Deemed to be University).

Sponsored Project :

- » Exploration of GMO-siRNA Technology
- » Efficient process Disease drugs (DST)

Lectures Delivered :

Invited talk at (1) NIPER Kolkata, (2) IIT Guwahati, (3) Sheraton Grand, Bengaluru, (4) Chemistry Meet, Konark, (5) Jadavpur University, Kolkata, (6) JNCASR Bengaluru.



SBS

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SCHOOL OF BIOLOGICAL SCIENCES



Professor Siddhartha S. Jana
School Chair

School Profile

People

Faculty	: 08
Post-doctoral Research Associate	: 12
Ph.D. Students	: 53
Non-Academic Staff	: 05

Extra Mural Funding

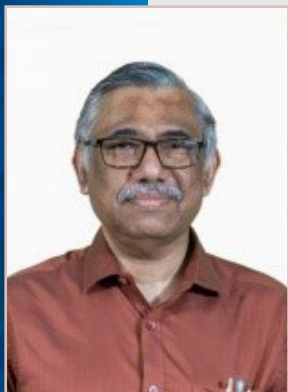
Projects (ongoing)	: 13
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Research Achievements

Research Papers in Journals	: 36
Ph.D. degree awarded	: 07

Academic Activities

Colloquium Lecture/Conference organized	: 01
Talks delivered by members	Intl. National : 04
of department in conferences/symposia	National : 20



Arindam Banerjee, FASc

Senior Professor

Self-assembling peptide and amino acid based functional nanobiomaterials

Associates : (1) Nilardi Hazra (RA I upto Dec. 2024), (2) Biplab Mondal SRF (RA I upto Feb. 3rd week, 2025), (3) Purnadas Ghosh, RA-I, (4) Tanushree Mondal SRF(CSIR), (5) Swapnendu Deb SRF (INSPIRE), (6) Supratim Basu, SRF (UGC), (7) Sagnik Banerjee, JRF (CSIR), (8) Bikram Das, JRF (MS-Int. Ph.D. Institute) and (9) Sherya Ghosh, JRF (Institute).

Peptide based gels as new potential antimicrobials

: Due to the emergence of superbugs that are untreatable with the conventional antibiotics, the discovery and development of new antibacterials against antimicrobial resistance has become a prime need in our society. Nucleobase containing cationic peptides with amphiphilic character have been designed, synthesised, purified, characterised and studied for combating against several drug resistant strains. Interestingly, these new molecules are self-assembled to form anti-parallel betasheet-like structures in their hydrogel phase. Noteworthily, these self-assembled peptides based soft biomaterials exhibit potential antimicrobial activities against both Gram-positive and Gram-negative bacteria including methicillin-resistance staphylococcus aureus (MRSA), Klebsiella pneumonia and Pseudomonas aeruginosa. Moreover, these antibacterial peptide-based compounds have interestingly shown non-significant toxicity towards normal mammalian cell lines including HEK 293 indicating their highly biocompatible behaviour.

Mitochondria targeting and bioimaging by carbon dots using amino acid based amphiphiles

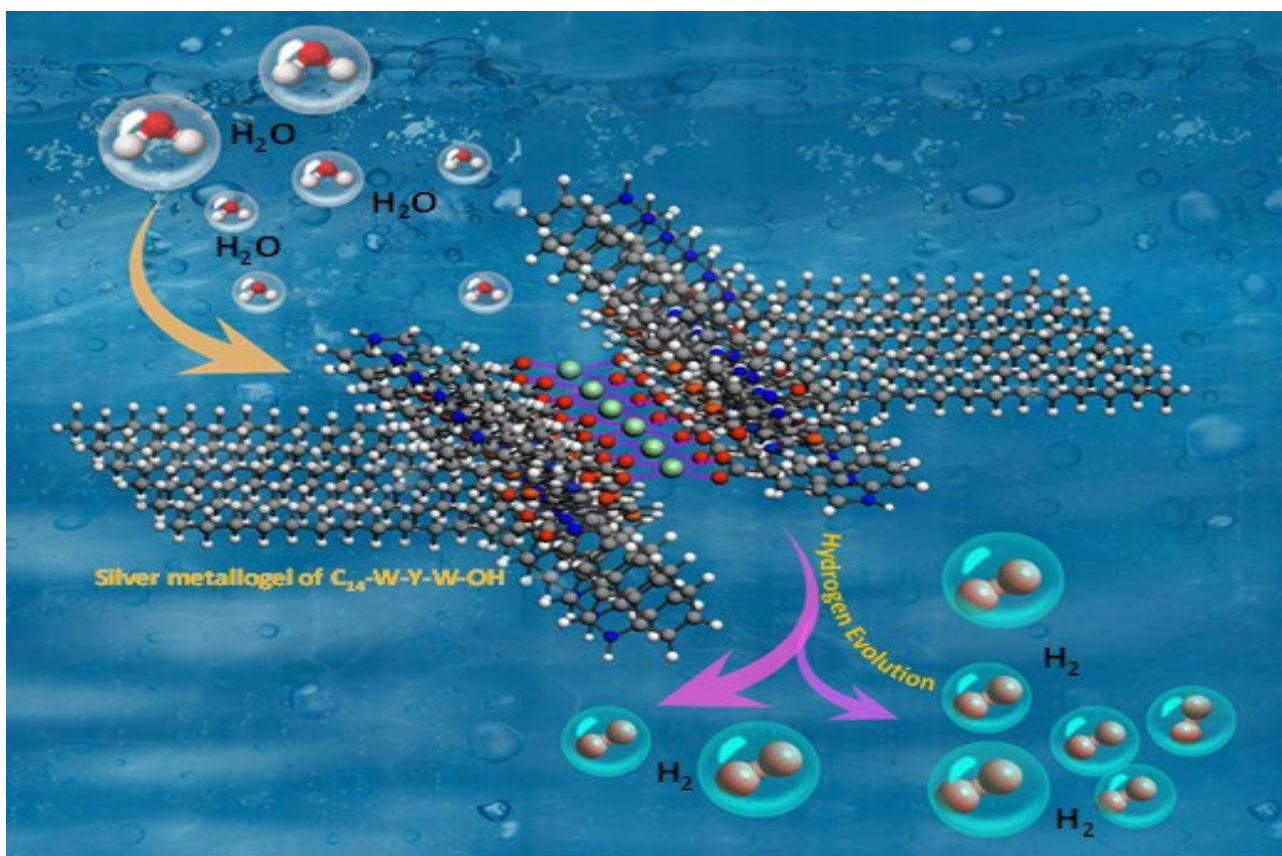
: Mitochondria dysfunction has been correlated with a series of metabolic diseases and neuro degenerative disorders including Parkinson's and Alzheimer disease. So rapid mitochondria targeting is necessary. An amino acid (phenyl alanine) based compounds containing triphenyl phosphine head group and a hydrophobic aliphatic tail has been designed, synthesised, purified, characterised and studied. These amphiphiles form spherical micelle-

type structures in aqueous media and they can able to interact with negatively charged fluorescent carbon nanodots. In both cancerous and non-cancerous cells they are able to do rapid targeting and imaging of mitochondria of the respective cells indicating the advent of new mito-tracker based on amino acid based amphiphiles.

Peptide Based Metallogels as a Nano catalyst for Hydrogen Evolution

: In realm of the production of green and sustainable energy, hydrogen evolution through water splitting by using an electrocatalyst is of prime importance in today's world. A tripeptide based amphiphilic peptide gelator has been found to form metallogels in presence of Ag^+ , Ni^{2+} , Co^{2+} in phosphate buffer at pH 7.46. Morphological studies of these metallohydro-gels have revealed the formation of nanofibrillar network structure. Interestingly, the metallo-hydrogel with Ag^+ ions can be photo reduced to form a new hydrogel infused with silver nanoparticles (Ag^0). It is noteworthy to mention that Ag^+ ion and silver nanoparticle containing metallogels can effectively catalyse hydrogen production through water splitting with an overpotential of 480 mV at a current density of 10 mAcm^{-2} . This indicates the discovery of a peptide based new metallohydro-gels as elctrocatalyst for the sustainable and clean production of H_2 gas via water splitting.

Silver containing peptide based metallo-hydrogel as an efficient nano catalyst for hydrogen evolution reaction.



ACS Appl. Polym. Mater. **2024**, 6, 11383-11391.

Publications in Journals :

1. Stabilization of a Photo Radiated Naphthalene Di-Imide-Based Organic Radical Anion Inside a Peptide-Based Gel Matrix with an Improvement of Optoelectronic Properties - Niladri, Hazra; Kousik Gayen, Purnadas Ghosh; Biswanath Hansda; Arindam Banerjee *Langmuir*, **40**, 18, 9462–9470 (2024).[IF:4.33]
2. Rapid Targeting and Imaging of Mitochondria by Carbon Dots Using an Amino Acid-Based Amphiphile as the Carrier - Niladri Hazra, Reedddhi Ray and Arindam Banerjee* *Nanoscale*, **16**, 9827–9835 (2024).[IF:6.7]
3. Peptide appended perylene bisimide containing silver nanoparticle-based trihybrid system with GO: improvement of photocatalytic and photo-switching behavior -Purnadas Ghosh, Soumyajit Hazra, Kousik Gayen, Niladri Hazra, Arun K. Nandi, Arindam Banerjee. *New J. Chem.*, **48**, 9805–9813 (2024).[IF:3.3]
4. Bicomponent Fluorescent System Composed of Peptide Substituted Naphthalenediimide and Carbon Dots as Nanothermometer - Kousik Gayen, Subir Paul, Soumyajit Hazra, Niladri Hazra and Arindam Banerjee. *ACS Appl. Nano Mater.*, **7**, 17278–17286 (2024).[IF:5.3]
5. Chemically Engineered Water-Soluble Block Copolymer for Redox Responsive SO₂ Release in Antibacterial Therapy - Anushree Mondal, Tanushree Mondal, Sayan Chattopadhyay, Subhamoy Jana, Arindam Banerjee and Priyadarsi De. *J. Mater. Chem. B*, **12**, 8454–8464 (2024).[IF:6.1]
6. Silver Containing Metallo Hydrogel as a Nanocatalyst for Hydrogen Evolution - Tanushree Mondal, Suman Patra, Biplab Mondal, Purnadas Ghosh, Ian W. Hamley, Arindam Banerjee. *ACS Appl. Polym. Mater.*, **6**, 11383–11391 (2024).[IF:4.4]
7. Long Stability of Atomically Precise Red Emissive Copper Nanoclusters within the Gel and Their Use as a Potential catalyst and Fluorescent Ink - Biplab Mondal, Biswanath Hansda, Tanushree

Mondal; Poulami Pal, Kingshuk Basu, Arindam Banerjee. *Langmuir*, **40**, 21876–21883 (2024) [IF:4.33]

8. Development of Organic Mixed Ion-Electron Conductive and Photo-responsive Property in a Peptide Linked Boronic Acid Conjugated Naphthalimide Derivative - Purnadas Ghosh, Niladri Hazra, Kousik Gayen, Biswanath Hansda, Gouranga Mahapatra, Soumik Das, Shovan Das, Arun K. Nandi and Arindam Banerjee. *ACS Appl. Electron. Mater.*, **6**, 9154-9164 (2024). [IF:4.4]
9. Polythiophene Derived Nickel Cobaltite Nanocomposite Showing Excellent Photo-

switching and Photo-assisted Enhanced Supercapacitor Properties - U. Basak, P. Ghosh, D.P Chatterjee, G. Mahapatra, A. Banerjee, A. K. Nandi. *J. Mater. Chem. A*, **13**, 7813–7833 (2025). [IF:10.7]

Ph.D. Degree Awarded :

(1) Niladri Hazra (IACS Deemed to be University), (2) Purnadas Ghosh (IACS Deemed to be University).

Lectures Delivered:

(1) Adichuchanagiri University, Karnataka, (2) IISER-Kolkata, (3) NIPER-Kolkata, (4) IIT-Roorkee, (5) IACS, Kolkata and (6) Indo-French Seminar – Tamil Nadu



Benu Brata Das, FNASc

Professor & Wellcome-Trust/DBT India alliance Intermediate fellow
Molecular mechanism of DNA damage and repair in cancer

Associates : (1) Dr. Sarita Das (DBT-RA), (2) Srijita Paulchowdhuri, RA, (3) Sangheeta Bhattacharjee, RA, (4) Saini Basu, SRF, (5) Sayan Das, SRF (CSIR), (6) Arpan Bhattacharyya, SRF (UGC), (7) Abhik Sengupta, SRF (CSIR), (8) Asmit Banerjee, JRF (UGC) and (9) Anushmita Paul, JRF (UGC).

Molecular mechanism of DNA damage and repair in cancer : Our laboratory primarily focuses on DNA topoisomerases, Top1 is essential in higher eukaryotes as it relaxes positive DNA supercoiling in advance of replication forks and transcription complexes as well as negative supercoiling behind such complexes. Supercoiling relaxation requires the production of transient Top1 cleavage complexes (Top1cc), which are Top1-linked DNA single-strand breaks. Top1cc catalytic intermediates can be converted into irreversible Top1-DNA cleavage complexes by colliding replication and transcription complexes. It is those DNA lesions that trigger cell death and the antitumor activity of camptothecin (CPT) and its clinical derivatives irinotecan and topotecan after the drugs selectively trap Top1cc. Despite the clinical successes of Top1

inhibitors, inherent resistance has been reported with significant limitation. CPT and its derivatives bind reversibly to the Top1 cleavage complexes. The drug-DNA-Top1-complexes are destabilized in the serum or when CPT is diluted out or removed from cell culture, leading to rapid reversal of Top1cc that limits the efficacy of Top1-poisons. Thus, our group at IACS is focused to understand how new genes and novel post-translational modifications coordinate the DSBs repair signaling in cells, which can eventually pave the pathway into therapeutic benefit.

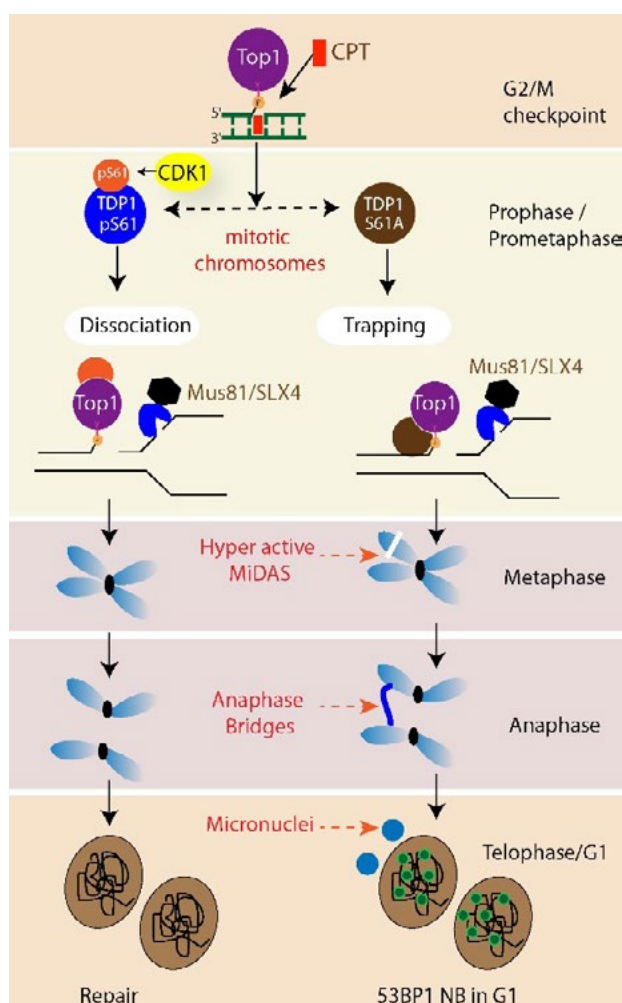


Figure: Model depicting how TDP1S61A trapping on mitotic chromosomes leads to hyperactivation of mitotic DNA synthesis (MiDAS), causing excessive MUS81-Eme1 endonuclease-mediated DNA resection and breaks on the mitotic DNA. These breaks manifest as bulky anaphase bridges followed by chromosomal segregation defects leading to the formation of micronuclei and the accumulation of 53BP1 nuclear bodies in G1 daughter cells. CDK1-mediated phosphorylation of TDP1 at the S61 residue promotes its exclusion from the mitotic chromosome to safeguard genomic stability.

- » Genomic instability leads to cancer, premature aging, neurodegeneration and several human diseases. Other than the nuclear genome, mitochondria also harbor the small, circular DNA (mtDNA) that is essential for life. Mitochondrial reactive oxygen species (ROS) is the source for the endogenous DNA damage. Thus, DNA repair enzymes provide a critical defense mechanism against endogenous and exogenous DNA damage.

- » DNA topoisomerases are essential enzymes involved in maintaining the topology of both the nuclear and mitochondrial DNA. However, topoisomerase I (Top1) is detrimental to the cell when Top1 gets irreversibly trapped on the DNA (Top1cc) that generates DNA double-strand breaks.
- » The key enzyme for the repair of Top1cc is tyrosyl-DNA phosphodiesterase (TDP1). Active site mutation of TDP1 causes the severe neurodegenerative syndrome spinocerebellar ataxia with axonal neuropathy (SCAN1).
- » Research in our lab is focused on understanding the molecular mechanism of DNA damage response pathways both in the nucleus and mitochondria. We are especially interested to uncover stress induced novel post-translational modification of proteins and evaluate their role in genome maintenance. We will also explore the cellular stress response network with potent anti-cancer agents in preclinical development.
- » Topoisomerase 1 (Top1) controls DNA topology, relieves DNA supercoiling during replication and transcription, and is critical for mitotic progression to the G1 phase. Tyrosyl-DNA phosphodiesterase 1 (TDP1) mediates the removal of trapped Top1-DNA covalent complexes (Top1cc). Here, we identify CDK1-dependent phosphorylation of TDP1 at residue S61 during mitosis. A TDP1 variant defective for S61 phosphorylation (TDP1-S61A) is trapped on the mitotic chromosomes, triggering DNA damage and mitotic defects. Moreover, we show that Top1cc repair in mitosis occurs via a MUS81-dependent DNA repair mechanism. Replication stress induced by camptothecin or aphidicolin leads to TDP1-S61A enrichment at common fragile sites, which over-stimulates MUS81-dependent chromatid breaks, anaphase bridges, and micronuclei, ultimately culminating in the formation of 53BP1 nuclear bodies during G1 phase. Our findings provide new insights into the cell cycle-dependent regulation of TDP1 dynamics for the repair of trapped Top1-DNA covalent complexes during mitosis that prevents genomic instability following replication stress.

Award/Recognitions :

- » Elected Fellow of Indian Academy of Science (FASc), Bengaluru

Publications in Journals :

1. *TDP1 phosphorylation by CDK1 in mitosis promotes MUS81-dependent repair of trapped Top1-DNA covalent complexes – S. Paul Chowdhuri and B.B. Das, *EMBO Journal*; **(17)**:3710-3732 (2024).[IF:11.4]. (*Corresponding authors)
2. Alterations in the mechanical properties of single dsDNA molecules, bare or cell-encapsulated, upon exposure to UVA-only radiation and sunlight – S. Mondal, S. Bhattacharjee, J. Biswas, B.B. Das and R. Mukhopadhyay, *J Photochem Photobiol B*, 261:113044 (2024).[IF :3.9]
3. Mitochondrial topoisomerase I targeted anti cancer therapy using irinotecan encapsulated mesoporous MIL-101(Fe) synthesized via a vapour assisted method – A. Ghosh, A. Ghosh, A. Bhattacharyya, R. Mitra, B.B. Das and A. Bhaumik, *Dalton Trans.*, **53**(7) :3010-3019 (2024). [IF:3.5] (*Corresponding authors)
4. Novel Pyrido[2',1':2,3]imidazo[4,5-c]quinoline Derivative Selectively Poisons Leishmania donovani Bisubunit Topoisomerase I to Inhibit

the Antimony-Resistant Leishmania Infection *in Vivo*. – S P Chowdhuri, S. Dhiman, S K Das, N Meena, S. Das, A. Kumar and B.B. Das, *J. Med.Chem*, **66**(5):3411-3430 (2023).[IF:8.03] (*Corresponding authors)

Ph.D. Degree Awarded :

(1) Sangheeta Bhattacharjee (IACS Deemed to be University)

Sponsored Project :

- » Exploring the role Covalent complexes (DAE-BRNS)
- » Investigating the role xenograft model (ICMR)
- » Exploring novel arginine anticancer drugs (DST-SERB)

Lectures Delivered:

- » Invited talk at (1) Miami, USA, (2) EMBO Meeting, Lonavela, (3) Burdwan University, (4) CCMB 2024, (5) Korean Society of Molecular Biology, (6) Interdisciplinary approaches for Modern Biology and (7) CHINTA meeting at Kolkata.



Deepak Kr. Sinha

Professor

Biological physics, Lipid droplets in development.

Associates : (1) Dipanjan Ray, RA, (2) Sayani Haldar (CSIR), (3) Bipasa Chaudhari (CSIR), (4) Sayani Haldar, (5) Basab B Bera (CSIR), (6) Pritha Das (CSIR) and (7) Youdhisthir Mondal (CSIR).

Our study focuses on understanding the **viscoelastic nature of the cytoplasm** and the mechanisms through which its mechanical properties are spatially regulated by the **cytoskeleton**. The cytoplasm is not a uniform fluid; instead, it exhibits **region-specific mechanical behavior**—behaving as both a solid and a liquid—and can actively adapt its

properties in response to internal and external cues. The major challenge in this field lies in **deciphering the complex, interdependent roles of different cytoskeletal components**—notably actin filaments, microtubules, and intermediate filaments such as vimentin—and how their local distribution affects cytoplasmic stiffness and elasticity.

Using pharmacological perturbations and rheological measurements, we investigated how the **dorsoventral polarity of the cytoplasm** is governed by localized cytoskeletal filament organization. A key finding is that **actin disassembly by Cytochalasin D (Cyto D)** results in a **region-specific mechanical response**: the ventral cytoplasm becomes softer, while the mid cytoplasm stiffens due to compensatory vimentin assembly. This interplay suggests that **cytoskeletal elements do not function in isolation** but instead show **dynamic compensatory behaviors**, a phenomenon mediated by the cytolinker **plectin**. In contrast, **microtubule disruption via Nocodazole** softens both regions and significantly alters vimentin

organization without affecting actin, indicating a distinct regulatory pathway.

A novel and unexpected insight from our work is that **Cyto D induces upregulation of vimentin through a ROS-dependent activation of NF- κ B**, highlighting a **mechanochemical feedback loop** where mechanical perturbation triggers biochemical signaling to restore cytoskeletal balance. This research is the first to demonstrate such **spatially resolved compensatory cytoskeletal remodeling**, offering new perspectives on **cytoplasmic mechanics regulation** in normal physiology and disease states such as cancer and fibrosis, where cytoskeletal remodeling plays a pivotal role.

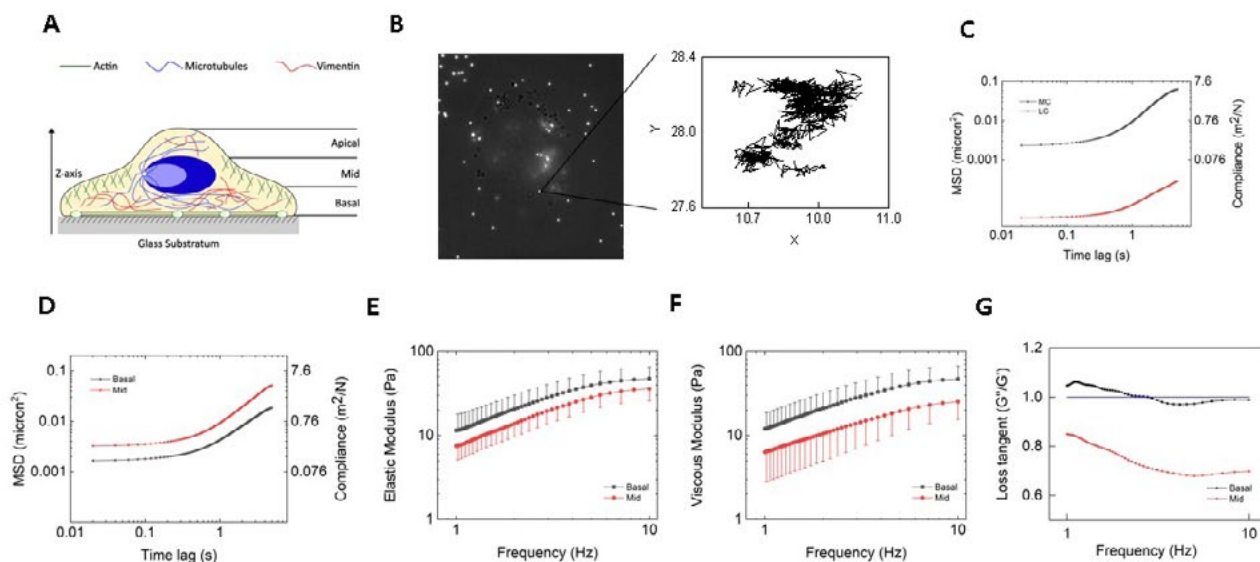


Figure 1: Heterogeneity in rheological properties of a cell along its apical basal axis is contributed by the anisotropic cytoskeletal density. (A) Cartoon depicting the variance of different types of cytoskeletal filaments along the z-axis. The cell can be divided into three distinct regions based on its height from the substratum. (B) Particle Tracking Microrheology: Fluorescent beads of 200nm diameter embedded into different regions of the cytoplasm. In inset, trajectory of one such bead undergoing Brownian motion. (C) Comparison of the least and most compliant regions of a cell. (D) Measurement of mean MSD along basal and mid planes of cells ($n > 40$). Quantification of elastic modulus (E) and dynamic viscosity (F) in the basal and mid planes. (G) Loss tangent of basal and mid planes over a range of frequency.

Ph.D. Degree Awarded :

(1) Parijat Biswash (Jadavpur University)

Publications in Journals :

1. Probing the role of macromolecular crowding in cell volume regulation using fluorescence anisotropy - Parijat Biswas, Dipanjan Ray, Subhamoy Jana, Jibitesh Das, Bidisha Sinha, Deepak Kumar Sinha8 bioRxiv

2022.04.07.487477; doi: <https://doi.org/10.1101/2022.04.07.487477> (also under review inelife)

2. JOCES/2023/261133 Size, location and metabolism are key regulators for lipid droplets' composition in zebrafish embryos: A polarity sensitive spectral imaging investigation - Sudipta Sarkar, Subhasis Mandal, Nandana Nanda, Sayani Halder, Prosenjit Sen, and Deepak Sinha* (Journal of cell sciences, Under review since march 2023).

Sponsored Project

- » Study of actin filament conformational dynamics (DST)

- » Study of cell-cell interaction mediated via substrate viscoelasticity (DBT)
- » DST Project



Prasanta Kumar Das, FASc, FRSC

Senior Professor

Biomedical chemistry of self-assembled functional soft nanocomposites

Associates : (1) M. Chowdhury, SRF (UGC), (2) S. Pal, SRF (UGC), (3) A. H. Khan, SRF (CSIR), (4) K. Roy, SRF (Integrated PhD), (5) A. Zaman, JRF (UGC), (6) D. Basu (DST-Inspire), (7) D. Shaw, JRF (UGC), (8) T. Ghosh, JRF (Institute fellowship), (9) D. Roy, JRF (UGC), (10) R. Yasmin, JRF (CSIR), (11) S. Biswas, (BS-MS Project Student) and (12) S. Pradhan, (BS-MS Project Student).

- » **Organic Nanoparticle-Carbon Dot Conjugates in Synergistic Combination Therapy for Cancer Treatment :** Nanoconjugates emerge as innovative theranostic probes, seamlessly combining diagnostic precision with the targeted therapeutic potential to revolutionize cancer treatment strategies. The present article delineates the design and fabrication of NIONP-CaCD conjugate between naphthalimide based organic nanoparticles (NIONPs) and Ca^{2+} -doped carbon dots (CaCDs). Naphthalimide based lysosome targeting unit appended boronic acid tethered amphiphile was synthesized that formed NIONP organic nanoparticles via J-aggregation in DMSO–water. CaCDs were synthesized via hydrothermal method. These two nanomaterials were linked via boronic acid–diol covalent interaction by Lewis acid–base chemistry between phenylboronic acid based NIONPs and hydroxyl group functionalized CaCDs to develop NIONP-CaCD nanoconjugate. This blue emitting NIONP-CaCD conjugate was used in bioimaging and in pro-drug-free drug combination cancer therapy. Hydroxychloroquine (HCQ) was encapsulated within this NIONP-CaCD conjugate with a higher loading capacity in comparison to the individual cargo carrier (NIONPs or CaCDs). The disintegration of NIONP-CaCD conjugate

to its native constituents took place through the cleavage of the boronate–diol bond at the lysosomal pH range (4.5–5.0), resulting in the liberation of HCQ and CaCDs. This pro-drug-free drug nanoformulation NIONP-CaCD-HCQ resulted in ~3.0-fold improvement in cancer cell death in comparison to standalone therapy by individually loaded cargo. Notably, it also exhibited a ~2.0-fold higher killing efficacy against cancer cells (A549 and HepG2) compared to normal cells (NIH3T3). This notable anticancer potential of NIONP-CaCD-HCQ could be attributed to Ca^{2+} overload induced apoptosis (calciptosis) in conjunction with lysosomal cell death by HCQ.

- » **Selective Sensing of Guanine by a Carbon dot doped with Cu^{2+} (CuCD) :** This present work aimed to craft copper (Cu^{2+})-doped carbon dots (**CuCDs**) for the selective and sensitive detection of a guanine nucleobase. By employing a hydrothermal method, we synthesized blue-emitting **CuCDs** having emission maxima at 423 nm. **CuCDs** were used as a fluorescence turn-on ratiometric probe to detect guanine, a critical purine base in DNA involved in energy transduction, cell signalling, and metabolic processes. In the presence of guanine, the fluorescence intensity of **CuCDs** significantly

increased due to the stable non-covalent interaction between Cu^{2+} and guanine. **CuCDs** achieved a very low limit of detection (LOD) of 0.59 nM for guanine as a highly sensitive probe. **CuCDs** demonstrated selectivity for guanine with no interference from other nucleobases (adenine, thymine, and cytosine) and various biomolecules and metal ions commonly found in the cellular environment. In addition, **CuCDs** demonstrated a higher affinity for guanine-enriched oligonucleotide cMYC G 27-mer over dsDNA 26-mer devoid of a large guanine population. Furthermore, the fluorescence intensity of **CuCDs** increased in guanine-treated mammalian cells and G-quadruplex-enriched cancer cells compared with that in noncancerous cells. Hence, we developed a highly sensitive ratiometric fluorescence probe, **CuCDs**, for the selective detection of guanine both in vitro and within mammalian cells via a “fluorescence turn-on mechanism”.

- » **Nanogel-Carbon Dot Conjugate mediated Enhanced Cancer Treatment through Combination Therapy:** The present study reports the development of a novel nanoconjugate, **NG-FACD**, comprising a positively charged self-assembled nanogel (NG) derived from a peptide amphiphilic hydrogelator and a negatively charged folic acid-functionalized blue-emitting carbon dot (**FACD**), bound via electrostatic interactions. **NG-FACD** was developed to combine the advantages of the individual nanocarriers and overcome their drawbacks. The presence of folic acid enables **NG-FACD** to be successfully used in selective bioimaging and targeted combination therapy against folate receptor-positive (FR+) B16F10 over FR- cells. **NG-FACD** demonstrated improved riboflavin (RbF) and paclitaxel (PTX) loading compared to individual nanocarriers that made it ~1.8- and 1.5-fold more cytotoxic toward FR+ B16F10 cells over RbF- and PTX-loaded individual nanocarriers. The concurrent presence of RbF and PTX on **NG-FACD** displayed ~1.9-2.8-fold higher cytotoxicity than single drug-loaded individual nanocarriers and ~3-4.5-fold higher cytotoxicity through RbF-mediated photodynamic therapy and PTX-induced chemotherapy in synergy compared to free drugs against FR+ B16F10 cells.

- » **Inherently targeted estradiol-derived carbon dots for selective killing of ER (+) breast cancer cells via oridonin-triggered p53 pathway activation :** One of the most prevalent cancers globally is breast cancer and approximately two thirds of the breast cancers are hormone receptor positive with estrogen receptors (ER) being a prominent target. Notably, p53 that controls several cellular functions and prevents tumor formation, gets suppressed in breast cancers. Reactivation of p53 can lead to cell cycle arrest as well as apoptosis. Therefore, targeting the estrogen receptor for selective delivery of anticancer drugs that can reactivate p53 in ER (+) breast cancers can be a crucial method in breast cancer therapy. Herein, we have designed and developed estradiol-derived inherently targeted specific carbon dots (**E2-CA-CD**) from 17β -estradiol and citric acid following a solvothermal method. The synthesized carbon dots were characterized using spectroscopic and microscopic techniques. The water soluble, intrinsically fluorescent **E2-CA-CD** showed excellent biocompatibility in MCF-7, MDA-MB-231 as well as NIH3T3 cells and demonstrated target specific bioimaging in ER (+) MCF-7 cells due to the overexpressed ER receptors. Furthermore, oridonin, a well-known hydrophobic anticancer drug capable of upregulating the p53 pathway, was loaded on the carbon dots to increase its bioavailability. **E2-CA-CD-Ori** caused ~2.2 times higher killing in ER (+) MCF-7 cells compared to ER (-) MDA-MB-231 cells and normal cells NIH3T3. Also, **E2-CA-CD-Ori** showed ~3 fold better killing in MCF-7 cells compared to native oridonin. **E2-CA-CD-Ori**-induced killing of MCF-7 cells took place through the early to late apoptotic pathway along with the elevation of the intracellular ROS level. Importantly, **E2-CA-CD-Ori** triggered the activation of the p53 pathway in MCF-7 cells, which in turn induced apoptosis involving the upregulation of Bax and downregulation of Bcl-2 leading to the selective and efficient killing of ER (+) MCF-7 cells.
- » **DON encapsulated carbon dot-vesicle conjugate in therapeutic intervention of lung adenocarcinoma by dual targeting of CD44 and SLCA5 :** Lung adenocarcinoma, recognized as one of the most formidable malignancies with a dismal prognosis and low survival rates, poses



a significant challenge in its treatment. This article delineates the design and development of a carbon dot-vesicle conjugate (**HACD-TMAV**) for efficient cytotoxicity towards lung cancer cells by target selective delivery of the glutamine inhibitor 6-diazo-5-oxo-L-norleucine (DON) within CD44-enriched A549 cancer cells. **HACD-TMAV** is composed of hyaluronic acid-based carbon dots (HACDs) and trimesic acid-based vesicles (TMAV), which are bound *via* electrostatic interactions. TMAVs are formed by positively charged trimesic acid-based amphiphiles through H-type aggregation in water. HACDs were synthesized through a one-step hydrothermal route. The blue-emitting **HACD-TMAV** conjugate demonstrated selective bioimaging in CD44-overexpressed A549 lung cancer cells due to specific ligand-receptor interactions between HA and CD44. **HACD-TMAV** exhibited notably improved DON loading efficiency compared to individual nano-vehicles. **HACD-TMAV**-DON exhibited remarkable (~6.0-fold higher) cytotoxicity against CD44-overexpressing A549 cells compared to CD44- HepG2 cells and HEK 293 normal cells. Also, DON-loaded **HACD-TMAV** showed ~2.0-fold higher cytotoxicity against A549 cells compared to individual carriers and ~4.5-fold higher cytotoxicity than by DON. Furthermore, **HACD-TMAV**-DON induced a ~3.5-fold reduction in the size of 3D tumor spheroids of A549 cells. The enhanced anticancer effectiveness was attributed to starvation of the A549 cells of glutamine by dual targeting of glutamine metabolism and solute linked carrier family 1 member A5 (SLC1A5) through HA-linked CD44-mediated targeted delivery of DON. This led to overproduction of reactive oxygen species (ROS) that induced apoptosis of cancer cells through downregulation of the PI3K/AKT/mTOR signalling cascade.

Publications in Journals:

1. Hypoxia: Intriguing Feature in Cancer Cell Biology - M Chowdhury and P K Das. *ChemMedChem*, e202300551 (2024).
2. Nanotechnology Meets Stem Cell Therapy for Treating Glioblastomas: A Review - A K Ghosh, A Ghosh and P K Das. *ACS Applied Nano Materials*, **7**, 2430-2460 (2024).

3. Organic Nanoparticle-Carbon dots Conjugate for Multimodal Cancer Therapy- A K Ghosh, K Roy and P K Das. *ACS Applied Nano Materials*, **7**, 4946–4959 (2024).
4. Multiscale Materials Engineering via Self-Assembly of Pentapeptide Derivatives from SARS CoV E Protein - D Sarkar, A H Khan, S Polepalli, R Sarkar, P K Das, S Dutta, N Sahoo and A Bhunia. *Small*, 2404373 (2024).
5. Cu²⁺-integrated carbon dots as an efficient bioprobe for the selective sensing of guanine nucleobase - M Chowdhury, D Basu and P K Das. *Sens. Diagn.*, **3**, 1329–1343 (2024).
6. Nanogel-Carbon Dot Conjugates: A Synergistic Approach for Enhanced Cancer Treatment through Combination Therapy. S Pal, R Mondal and P K Das. *ACS Med. Chem. Lett.*, **15**, 1668–1676 (2024).
7. Inherently targeted estradiol-derived carbon dots for selective killing of ER (+) breast cancer cells via oridonin-triggered p53 pathway activation - A H Khan, A Basak, A Zaman and P K Das. *J. Mat. Chem. B*, **12**, 11708-11720 (2024).
8. DON encapsulated carbon dot-vesicle conjugate in therapeutic intervention of lung adenocarcinoma by dual targeting of CD44 and SLC1A5 - A Zaman, A Ghosh, A K Ghosh and P K Das. *Nanoscale*, **16**, 21817-21836 (2024).

Ph.D. Degree Awarded :

- (1) Anup Kumar Ghosh (IACS Deemed to be University)

Sponsored Project :

- » Fabrication of Conjugates Combination Therapy (DST-SERB)

Lectures Delivered:

Invited talk at (1) NIT Warangal, (2) JIS, JISIASR), Manipur University, (3) NIT Warangal, (4) IACS, Kolkata, (5) NIT Warangal and (6) Lady Brabourne College, Kolkata, (7) FORCE-IISC 2024.



Prosenjit Sen

Professor

Molecular Dynamic Simulation and Computational Biology

Associates : (1) Subhojit Paul, (2) Arnab Ghosh, (3) Subhashish Mondal, (4) Avinandam Bhaowmik, (5) Akash Chetterjee, (6) Soumadeep Das, (7) Sandipan Das and (8) Rimi Halder

1. Synthesis of Bio-active Molecules and their Biological implication

Design and Synthesis of Biocompatible Amino Acid-Derived Cationic Amphiphiles for Enhanced Drug and Nucleic Acid Delivery

: Liposome-mediated drug and nucleic acid delivery offers therapeutic benefits, but stability and efficiency challenges persist. To address this, cationic amino acid-based amphiphiles, specifically incorporating histidine, were synthesized. Histidine's unique characteristics, such as pi-pi interactions and cationic nature, significantly impact delivery efficiency. Incorporating histidine into lipid head groups enhances zeta potential, promoting electrostatic interactions with nucleic acids for effective cellular delivery. The engineered histidine-based amphiphiles form stable lipid carriers, ensuring cellular uptake and safeguarding encapsulated substances. This innovative approach overcomes liposome delivery limitations, presenting a promising strategy for enhanced therapeutic applications across medical domains.

Design and synthesis of Triazine based NBD Derivatives for Organelle-Specific HOCl Sensing in cancer cell

: In this study, we developed two tumor-targeting fluorescent probes, NBD-Lyso and NBD-Mito, capable of specific hypochlorous acid (HOCl) sensing in lysosomes and mitochondria. The design incorporated biotin for tumor targeting and utilized the NBD chromophore for visualization and sensing, achieved within a single molecule using 1,3,5-triazine trichloride as a

reactive scaffold. Chemical changes during HOCl sensing were investigated, revealing a fluorescence "off" mechanism. Spectroscopic properties, detection limits, average lifetime, and Stern-Volmer constants were measured. Selective sensing of HOCl, pH effects, stability, and solvatochromic behavior were assessed. Probes demonstrated organelle specificity in cancer cells, confirming their potential for biological applications.

Design and Synthesis of Triazine-Based Hydrogel for Combined Targeted Doxorubicin Delivery and PI3K Inhibition

: Melanoma, an aggressive skin cancer, poses challenges for targeted drug delivery. Triazine-based hydrogelators, specifically TriaC-18, were designed for their tuneable, non-peptide, and fibrous structure, providing a platform for drug release control. Hydrogelation properties were confirmed via rheology, and morphological networks were visualized using FESEM and FEG-TEM. Doxorubicin-loaded TriaC-18 hydrogels demonstrated enhanced biocompatibility compared to free doxorubicin, suggesting a potential strategy for mitigating side effects. Notably, TriaC-18 displayed the ability to inhibit PI3K, an enzyme crucial in cancer cell processes, indicating a promising avenue for advancing melanoma and cancer treatment strategies.

Development of anticancer small molecules by inhibiting immunomodulatory Protein PDL1

: In this study, we employed structure-based drug design to create a series of triazine-based potential inhibitors targeting programmed death-ligand 1 (PD-L1). Following



synthesis, a subset of compounds underwent rigorous validation through both in vitro and in vivo studies. The designed molecules were strategically tailored for their inhibitory potential against PD-L1, a key immune checkpoint implicated in cancer. Our findings not only contribute to the expansion of potential PD-L1 inhibitors but also offer insights into their efficacy, laying a foundation for further exploration in the development of novel cost effective therapeutic strategies against cancer.

Deciphering the Comprehensive Structure-Activity Relationship of Sunshinamide for Breast Cancer therapy through Dual Modulation of Apoptotic and Ferroptotic Pathways via TrxR1 and Gpx4 Inhibition :

Disulfide-containing natural products hold promise for chemotherapy due to their unique pharmacological properties. Sunshinamide, a cyclodepsipeptide, has shown potent anti-cancer activity, prompting our investigation into its structure-activity relationship and apoptotic mechanisms in breast cancer. Structural analysis confirms the essential roles of its bicyclic ring and disulfide moiety. We reveal that sunshinamide targets TrxR1, leading to ROS accumulation and ER stress-induced apoptosis. Additionally, it selectively inhibits Gpx4, triggering lipid peroxidation and ferroptosis. Using a 4T1 breast cancer mouse model, we demonstrate that sunshinamide effectively reduces tumor growth by inducing both apoptotic and ferroptotic cell death. This dual mechanism overcomes chemoresistance linked to apoptosis evasion, highlighting sunshinamide as a promising breast cancer therapeutic.

2. Identify the Molecular Biological mechanism by hardcore Molecular Biology techniques

Mechanistic in sites of Cancer progression and Propagation

- » In addition to inducing PD-L1, the TF-FVIIa interaction shields breast cancer cells from macrophage-mediated phagocytosis. FVIIa activates PAR2, increasing CD47 surface expression, which interacts with SIRP receptors on macrophages, reducing

phagocytic potential. TF-FVIIa interaction activates STAT3, binding to the CD47 promoter, leading to its transcriptional induction.

- » Additionally, our laboratory directs attention to the role of activated protein C, the understanding of which within the context of cancer immunology remains incomplete. Our investigations identify that APC-mediated activation of endothelial protein C receptor (EPCR) facilitates the release of exosomes with significant immune-modulatory potential. Detailed investigation further elucidates that these exosomes are enriched with miR21, which sustains the level of GPX4 in regulatory CD25+ CD4 T cells (Treg). The elevated levels of GPX4 in Treg cells protect against lipid peroxide-mediated membrane damage and subsequent ferroptosis. Our ongoing efforts also aim to unravel the mechanisms by which miR21 enhances the levels of GPX4 in Treg cells.
- » Our study unveils the molecular mechanism of thrombin-mediated chemotherapeutic resistance in triple-negative breast cancer (TNBC). We identify MCL1 as a key player, regulated by PAR1 activation and involving CREB, CBP-P300, and CRTC2 interactions. Our experiments also reveal that MCL1 exhibits increased affinity to a deubiquitinase, USP9X without altering the level of these proteins, in response to thrombin, resulting in a retarded turnover of MCL1. In summary, we study how coagulation enables breast cancer progression and therapeutic resistance through metastasis, immune evasion, and anti-apoptosis mechanisms and endeavor to identify new therapeutic avenues for the treatment of breast cancer

Mechanistic in sites of monocyte to macrophage Differentiation

- » **Matriptase- mediated PAR2 Activation Drives Monocyte to Macrophage Differentiation and polarization under Hypoxic condition :** Hypoxia shapes immune cell dynamics within the tumor microenvironment. Our study reveals that

hypoxia-induced lactate accumulation (10 mM) activates Matriptase (TMPRSS2), triggering Protease-Activated Receptor 2 (PAR2) expression in monocytes (THP1) and PBMCs. Activated PAR2 drives M1 macrophage differentiation via the AKT2-NF- κ B axis, upregulating miR155 and suppressing SOCS1, enhancing proinflammatory cytokines and immune interactions. However, prolonged hypoxia (>48 hours) raises lactate levels to 25 mM, inhibiting Matriptase and shifting macrophages toward an M2 phenotype due to AKT2-NF- κ B inactivation and reduced miR155 expression. This dynamic polarization highlights Matriptase as a critical regulator of macrophage fate in hypoxic tumors, offering novel targets for immune-modulatory cancer therapies.

Publications in Journals

1. Matriptase-mediated PAR2 Activation Drives Monocyte to Macrophage Differentiation and polarization under Hypoxic condition - Arpana Singh, Avinandan Bhounick, Prosenjit Sen, *FEBS Journal* (292 (12), 3129)
2. Design and Synthesis of Triazine-Based Hydrogel for Combined Targeted Doxorubicin Delivery and PI3K Inhibition - Subhasis Mandal, Avinandan Bhounick, Arpana Singh, Sukanya Konar, Arkajyoti Banerjee, Arnab Ghosh and Prosenjit Sen, *ACS Biomaterials Science & Engineering*, **11**, 1, 354–370 (2025).[IF:5.5]
3. Deciphering the Comprehensive Structure Activity Relationship of Sunshinamide for Breast Cancer Therapy through Dual Modulation of Apoptotic and Ferroptotic Pathways via TrxR1 and Gpx4 Inhibition - Akash Chatterjee, Joyanta Mondal, Subhojit Paul, Himangshu Sharma, Rajib Kumar Goswami and Prosenjit Sen, *Journal of Medicinal Chemistry*, **67**, 24, 21952–21974 (2024).[IF:6.9]
4. FVIIa-PAR2 signaling facilitates immune escape by reducing phagocytic potential of macrophages in breast cancer - *Journal of Thrombosis and Haemostasis*, Arnab Ghosh, Avinandan Bhounick, Subhojit Paul, Akash Chatterjee, Subhasis Mandal, Abhimanyu Basu, Soma Mukhopadhyay, Kaushik Das and Prosenjit Sen: 1538-7836 (2024).[IF:5.5]
5. Thrombin confers chemotherapeutic resistance by promoting transcriptional induction and post- translational stabilization of pro-survival MCL1 in TNBC - Subhojit Paul, Akash Chatterjee, Kaushik Das, Anushka Ray, Abhimanyu Basu, Soma Mukhopadhyay and Prosenjit Sen." *Journal of Biological Chemistry*, **27**, 301(1):108025. (2024).[IF:4.0]
6. Cationic and amphiphilic peptide-based hydrogels with dual activities as anticancer and antibacterial agents - Tanushree Mondal, Akash Chatterjee, Biswanath Hansda, Biplab Mondal, Prosenjit Sen and Arindam Banerjee, *Soft Matter*, **20**, 1236-1244. (2024).[IF:2.9]
7. Unveiling the anticancer potential of Pestalotioprolide E, an unexplored macrolide: Targeting TRXR1-TRX1-ASK1-P38 signaling cascade in triple-negative breast cancer." *Toxicology in Vitro* Ruma Sarkar, Debabrata Paul, Akash Chatterjee, Anindita Bhattacharya, Sayantan Pradhan, Rajib Kumar Goswami and Prosenjit Sen, 100, 105920 (2024).[IF:2.6]



Ritesh Ranjan Pal

Assistant Professor

Host-pathogen interactions and infection biology

Associates : (1) Suparno Banerjee, SRF, (2) Anirban Naha, SRF, (3) Umme Umara, SRF, (4) Md. Aniruzzaman, JRF, (5) Swagata Char, JRF and (4) Debjani Ghosh, Project Assistant.

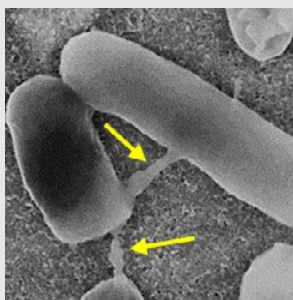
Intra and inter-kingdom crosstalk of bacteria

: The enormous versatility of bacteria enables the formation of multi-species communities that colonize nearly every niche on earth, making them the dominant life form and a major component of the biomass. Exchange of molecules among neighbouring bacteria in such microbial communities, as well as between bacteria and proximal eukaryotic cells, is key for bacterial success. One highly conserved strategy

for such communication is membranous nanotube formation. Experiments are going on to define this poorly understood principle controlling these multicellular interactions with following hypothesis (Fig 1) which may lead to the development of creative strategies to modulate, predict and even design bacterial communities, and may lay the foundation for new and innovative approaches to fight bacterial diseases.



CpdB



Membranous nanotubes

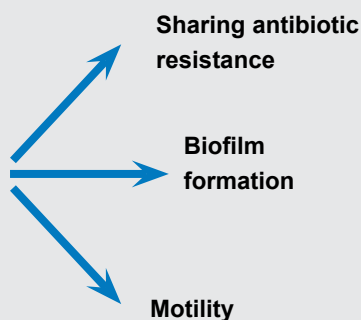


Fig 1. CpdB is the predicted *E. coli* homologue of YmdB of *B. subtilis*. Like YmdB, CpdB is predicted to activate membranous nanotube formation, which in turn activates sharing of antibiotic resistance and biofilm formation. Motility is also found to be down-regulated by CpdB.

Pathogenesis of communicable diseases :

Communicable diseases are caused by pathogenic organisms such as bacteria and virus. They take various strategies to cause and spread the disease. Using various model pathogens like *V. cholerae* and pathogenic *E. coli*, we are trying to understand the gene regulation of their virulence, effect of various conditions on it and their strategies for suppressing

host immune response. The advancement of knowledge in this direction will add to design better strategy to combat against those pathogens.

Therapeutic strategy development against infectious agents :

Drug resistance is a recurrent problem in treatment of infectious diseases. So, screening of new therapeutic candidates for various infectious agent is needed. With growing

knowledge for virulent strategies of different pathogen, development of new tactics against them will be more effective. For example, defect in membranous nanotube formation make pathogenic *E. coli* non-infective. Identifying nanotube formation protein inhibitor will be helpful for the treatment of the pathogen.

Publications in Journals :

1. Unlocking Cd(II) biosorption potential of *Candida tropicalis* XTA 1874 for sustainable wastewater treatment – KN Bhattacharyya, D. Bhattacharjee, TK Sen, AK Lai, R. Ghosh and RR Pal and S. Ganguly, *Scientific Reports*. **14(1)**: 15690 (2024).
2. Deciphering the inhibitory mechanism of antimicrobial peptide pexiganan conjugated with sodium-alginate chitosan-cholesterol nanoparticle against the opportunistic pathogen – S. Saha, R. Kar, K. Sikder, D.

Manna, R.R. Pal, S. Chakraborti, A.H. Khan, S. Barman, A.R. Maity and A. Basu, *Acinetobacter baumannii*. *Journal of Drug Delivery Science and Technology*. **101(B)**:106305 (2024).

Sponsored Project

- » Membranous Nanotube : The Unrevealed CORE-associated..... Interaction.
- » A combined experimentalindole based drugs or their precursors.
- » Response against for the therapy
- » Exploring the role of XIAP Lung Carcinogenesis
- » Molecular Modulation Antimicrobial Resistance

Lectures Delivered:

Invited talk at (1) 5th IABS-2025, IACS, Kolkata, (2) Techno India University, Kolkata, (3) BioMeet 2024, Adamas University, Kolkata.



Rupa Mukhopadhyay

Senior Professor

Nanoscale Biosensors and Single Molecule Structural Biology

Associates : (1) S. Mondal, SRF (CSIR), (2) B. Bhattacharya, SRF (Institute), (3) J. Biswas, SRF (DBT), (4) A. Paul, SRF (DBT) and (5) A. Ghosal, JRF (Institute)

Nanoscale Biosensors:

1. Applicability of the morpholino (MO)-AuNP conjugate-based secondary ion mass spectrometry (SIMS) assay that we have developed has been tested in detection of nucleic acid sequences in a label-free manner.
2. A fully PCR-independent, fluorescent label-free nucleic acid detection method using atomic force microscopy (AFM)-based single molecule force spectroscopy (SMFS) approach has been developed (patent granted). Clinically relevant

sensitivity (sub-pM), high target specificity and reproducibility have been achieved, using synthetic xeno nucleic acid (XNA) probes, e.g., locked nucleic acid (LNA). Using this assay, detection of EGFR gene mutations in non-small cell lung cancer patients is being carried out.

Single Molecule Level Structural Biology:

1. UV radiation-induced DNA damage has been studied at the single molecule level.

- Interaction between E-cadherin, which is a Type I classical Cadherin (Calcium Adhering protein) present on epithelial cell surface participating in cell-cell adhesion, and nectin-4 protein, where cadherins and nectins organize and assemble to form adherens junction, which thereby mechanically couples interacting cells,

has been studied at single molecule level by using the single molecule force spectroscopy (SMFS) approach. It has been found that these two proteins directly interact with each other with k_{off} value $31.48 \pm 1.53 \text{ s}^{-1}$ and lifetime of the complex $0.036 \pm 0.0026 \text{ s}$, suggesting that the interaction is weak and transient in nature.

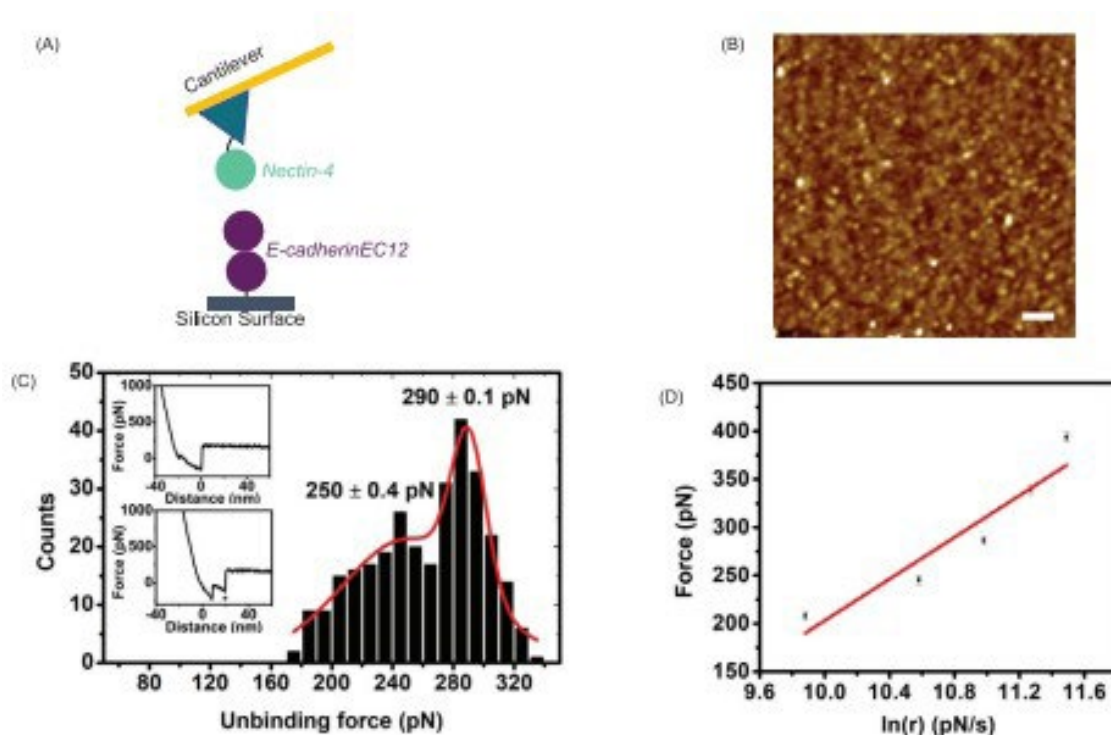


Figure caption: (A) Diagrammatic representation of SMFS between E-cadherin EC1-2 and nectin-4 (B) Representative top view AFM image of E-cadherin EC1-2 film. Scale bar: 100 nm, z-range: 0-5.5 nm (C) Histogram of the unbinding force values for E-cadherin-nectin-4 complex dissociation and the representative force-distance curves (inset figures). The mean unbinding force values of $250 \pm 0.4 \text{ pN}$ and $290 \pm 0.1 \text{ pN}$ are elicited from the peak values of the force distribution. (D) Representative dependence of the unbinding force values on the logarithm of loading rate. The solid line represents the numerical fit of the experimental data with Bell-Evans model.

From S. Dash, J. Biswas.... R. Mukhopadhyay* and D. Samanta* et al., *Journal of Molecular Biology*, 436(18) 168709 (2024).

Publications in Journals :

- Alterations in the mechanical properties of single dsDNA molecules, bare or cell-encapsulated, upon exposure to UVA-only radiation and sunlight - Sourav Mondal, Sangheeta Bhattacharjee, Jayita Biswas, Benu Brata Das and Rupa Mukhopadhyay, *Journal of Photochemistry & Photobiology, B: Biology*, **261**, 113044 (2024).[IF:3.9]
- Molecular crosstalk between adherens junction proteins, E-cadherin and nectin-4 - Sagarika Dash, Jayita Biswas, Saumyadeep Goswami,

Sarbartha Mukherjee, Namrata Ganguli, KheerthanaDuraivelan, Sourav Mondal, Rupa Mukhopadhyay* and Dibyendu Samanta*, *Journal of Molecular Biology*, **436(18)**, 168709 (2024).[IF:4.7]

Ph.D. Degree Awarded :

(1) Sourav Mondal (IACS Deemed to be University).

Lectures Delivered:

Invited talk at (1) St. Xavier's College, Kolkata and (2) Adichuchanagiri University, Mandya. Annual meeting of Chemical Biology Society (India).



Siddhartha S Jana

Senior Professor & School Chair
Molecular Cell Biology

Associates : (1) (1) Supon Roy, JRF, (2) Nitish Pal, JRF, (3) Soumi Sen, JRF, (4) Debapriya Dey, SRF, (5) Soham Naskar (BS-MS), (6) Sehasree Mohanta (BS-MS), (7) Nitish Tripathy (IntPBS), (8) Ditipriya Mallick, RA, (9) Suman Das, RA and (10) Arjama Mukherjee, RA.

- » An approach to inhibit cancer cell migration and growth by targeting Nonmuscle myosin II and Topoisomerase I (Funded by DBT).
- » Role of substratum in switching cellular membrane protrusive activity (Funded by CSIR)

A brain specific alternatively spliced isoform of nonmuscle myosin IIA lacks its mechanoenzymatic activities

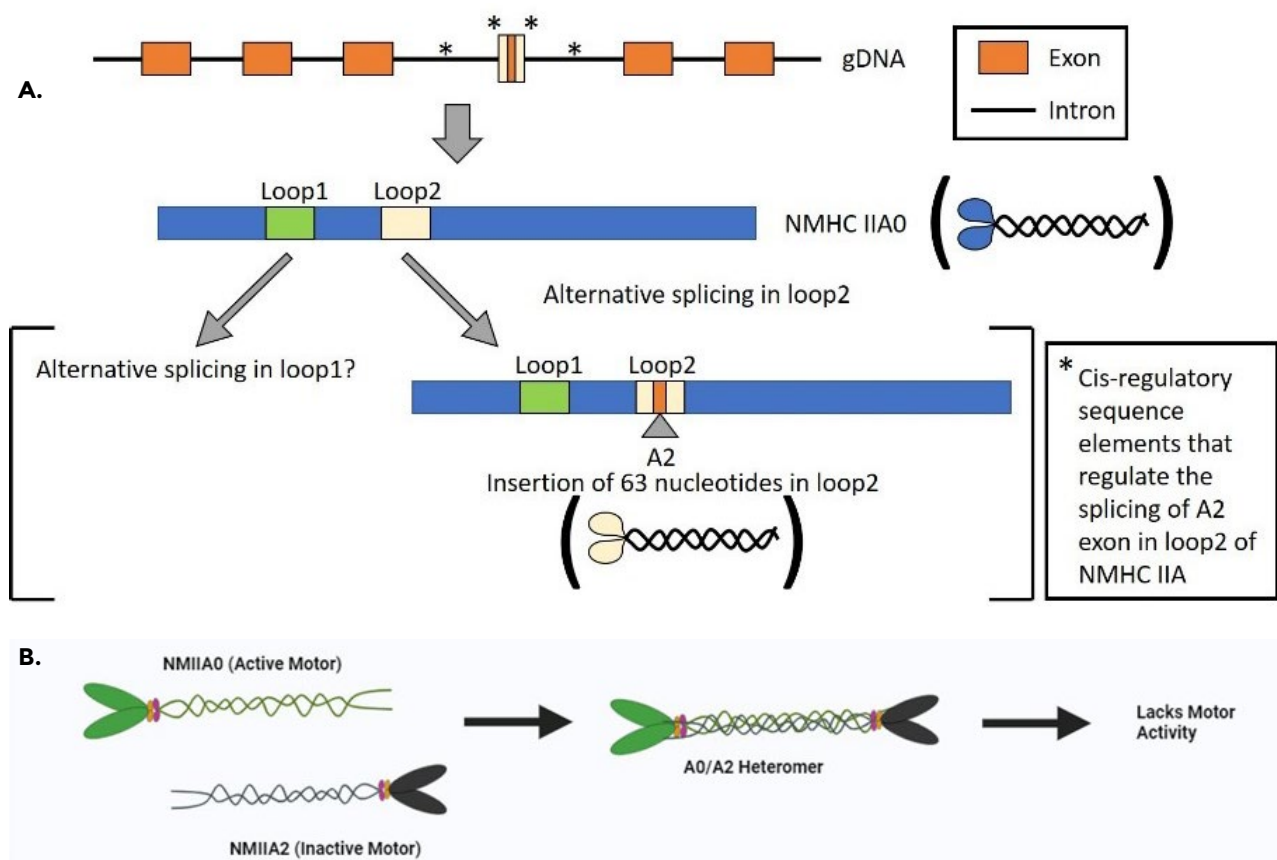


Fig: A) MYH9 encoded Nonmuscle myosin (NM) heavy chain IIA undergoes alternative splicing at Loop2 region, resulting in an alternatively spliced isoform, NM IIA2. **B)** Brain specific alternatively spliced isoform of NM IIA2, which is generated by the inclusion of 21 amino acids near the actin-binding region of loop 2 of the motor head domain of heavy chains. NM IIA2 lacks its motor activities and can make heterofilaments with NM IIA0 (non-inserted isoform of NM IIA) and can retard the mechano-enzymatic activity of NM IIA, highlighting its physiological importance in regulating NM IIA activity in the brain.



Publications in Journals:

1. Morphology Control in Supramolecular Assemblies of Sulfated π -Amphiphiles and Impact on the Antiviral Activity – R. Khamrui, A. Mukherjee, S S Jana and S. Ghosh, *Langmuir*, **41**, 13, 9027-9032. (2025).[IF:3.7]
2. Developing Non-Invasive Molecular Markers for Early Risk Assessment of Alzheimer's Disease - TK Sur, T. Mondal, Z. Noreen, J. Johnson, G. Nunlee-Bland, CA Loffredo, BE Korba, V. Chandra S.S. Jana, B. Kwabi-Addo, S. Sarkar, *Biomarkers in Neuropsychiatry*, **12**, 100120 (2025)

Ph.D. Degree Awarded :

(1) Ditipriya Mallick (IACS Deemed to be University).

Lectures Delivered :

- » Invited talk at (1) Bose Institute, Kolkata, (2) 5th IABS Conference, IACS, (3) Milano, Italy, (4) Guha Research Conference 2024 and (5) JU, Kolkata.

Sponsored Project:

- » An Approach to inhibit Topoisomerase I
- » Role of substratum Protrusive a activity



SCHOOL OF CHEMICAL SCIENCES

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Professor Abhishek Dey
School Chair

School Profile

People

Faculty	: 20
Post-doctoral Research Associate	: 30
Ph.D. Students	: 153
Non-Academic Staff	: 07

Extra Mural Funding

Projects (ongoing)	: 25
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Research Achievements

Research Papers in Journals	: 127
Book-Chapters/Books	: 03
Ph.D. degree awarded	: 24

Academic Activities

Colloquium Lecture/Conference organized	: 04
Talks delivered by members	National : 72
of School in conferences/symposia	Intl : 08



Abhishek Dey

Senior Professor & School Chair
Inorganic reaction mechanism

Associates : (1) Soumya Samanta (2) Souvik Dinda (3) Suman Patra (4) Soumili Ghosh (5) Triparna Roy (6) Nisha (7) Rabin Poiria (8) Kumarjit Banerjee (9) Srijan Sengupta (10) Apurba Pal (11) Sudip Barman (12) Somnath Das.

- » Investigation of NO reduction by systematically varying the number of electron withdrawing groups in iron porphyrins reveals that while the inductive effect of these groups raises the potential for NO reduction, the pK_a of the proton transfer processes are lowered. In particular, while the PCET to $\{FeNO\}^7$ to result in $\{FeHNO\}^8$ can be achieved using water as a proton source, further reduction to NH_4^+ requires a strong acid source. In the absence of a strong acid, the $\{FeHNO\}^8$ species, spectroscopically observed during NO reduction, reacts with NO to release N_2O via a $\{FeN_2O_2H\}^{10}$ hyponitrite intermediate, spectroscopically observed, making it a branching point in the mechanistic landscape. This allowed reduction of NO selectively to N_2O and NH_4^+ by either using H_2O and PTSA as the proton source, respectively.
- » Inclusion of a second-sphere pendent pyridine residue enables iron porphyrin to catalyze the reduction of CO to CH_4 as a single C_1 product using H_2O as a proton source with FY of 92.3%. Spectro-electrochemistry data and DFT calculations indicate that the pendent group avoids dissociation of CO from the reduced iron porphyrin center via a hydrogen bonding network through a distal water molecule. The activation and reduction of the very inert CO molecule is likely to herald new chemical transformations utilizing a pollutant like CO as a C_1 source.
- » An iron chlorin is reported to electrocatalytically reduce CO_2 to CH_3OH and $HCOOH$. The FY of CH_3OH could be optimized to 48% at 2 M H_2O concentration in the electrolyte, the rest being

$HCOOH$ ($HCOO^-$ in solution). In situ FTIR-SEC and rRaman as well as chemical reduction in the presence of CO_2 indicates that the key species directing the selectivity is a $S = 1/2 d^7 Fe^I-COOH$ species. The C-center of this species has a higher pK_a and can be protonated easily in weakly acidic solutions to result in $HCOOH$. The O center has a lower pK_a and can be protonated only in more acidic solutions to result in the formation of a $Fe-CHO$ species via a C-O bond cleavage, which is then further reduced to release CH_3OH , and this reaction pathway does not release CO. This is because the Fe^I-CO species of this porphyrinoid is stable in the CV time scale due to hydrogen bonding with a pendent amine allowing the direct reduction of CO_2 to CH_3OH .

Publications in Journals:

1. Synthesis of ethane from CO_2 by a methyl transferase-inspired molecular catalyst Proc - S. Patra, S. Dinda, S. Ghosh, A. Dey, *Natl. Acad. Sci.*, 122 (2) e2417764122 (2025).[IF:]
2. Electrochemical Reduction of CO_2 to CH_3OH Catalyzed by an Iron Porphyrinoid - P. Saha, Sk Amanullah, S. Barman, A. Dey, *J. Am. Chem. Soc.*, **147**, 2, 1497-1507 (2025).[IF:]
3. Skeletal substituents and the distal environment determine the spin state of natural and synthetic iron porphyrins: role in the O_2 reduction reaction - S. Samanta, S. Sengupta, S. Barman, C. Dey, A. Dey, *Dalton Trans.*, **54**, 6456-6471 (2025).[IF:]
4. Hydrogen Oxidation by Bioinspired Models of $[FeFe]$ -Hydrogenase - A. Nayek, R. K. Poria, Md

- Estak Ahmed, S. Patra, S. G. Dey,* A. Dey*, *ACS Org. Inorg. Au.*, **5**, 2, 105–116 (2025).[IF:]
5. Second Sphere Control of CO₂ Reduction Selectivity by Iron Porphyrins: The role of spin state - S. Patra, S. Ghosh, S. Samanta, A. Nayek, A. Dey, *J. Orgmet. Chem.*, **1023**, 123439 (2025).[IF:]
 6. Proton-Coupled Electron Transfer between a Pendant Thiol and a Ferrous Dioxygen Adduct - S. Dinda, T. Roy, S. Samanta, K. Banerjee, N. Cox, A. Dey, *Inorg. Chem.*, 21313-21322 (2024).[IF:]
 7. Amplifying Reactivity of Bio-Inspired [FeFe]-Hydrogenase Mimics by Organic Nanotubes - Md E. Ahmed, P.Das, Sk M. Ahamed, S. Chattopadhyay, A. Nayek, M. Mondal, S. Malik, A.Dey, *Chem Euro J.*, e202403011 (6th SABIC special issue) (2024).[IF:]
 8. Outer-Coordination Sphere Interaction in a Molecular Iron Catalyst Allows Selective Methane Production from Carbon Monoxide - S. Patra, S. Bhunia, S. Ghosh, A. Dey *ACS Catal.*, **14** (10), 7299-7307 (2024).[IF:]
 9. Cyclic(alkyl)(amino) carbene-Stabilized Gold Nanoparticles for Selective CO₂ Reduction - M. Ghosh, P. Saha, S. Roy, S. Barman, P. Pillai, A. Dey, S. Khan, *ACS Catal.* **14**, 9, 7011–7019 (2024).[IF:]
 10. Intermediates involved in the Reduction of SO₂: Insight into the mechanism of Sulfite Reductases - A. Bhattacharya, S. Samanta, A.K. Nath, A. Ghatak, S.G. Dey, A. Dey, *Chem. Commun.*, **60**, 7709-7712 (2024).[IF:]
 11. Kinetic isotope effect offers selectivity in CO₂ reduction - S. Patra, S. Atta, S. Ghosh, A. Majumdar, A. Dey, *Chem Comm.*, **60** (36), 4826-4829 (2024)[IF:]

Award/Recognition :

- » Fellow of the Indian National Academy of Science (INSA).
- » Editorial Advisory Board Chemical Reviews, ACS

Ph.D. Degree Awarded :

(1) Suman Patra (IACS Deemed to be University).

Sponsored Project

- » Iron-Sulfur iron porphyrin conjugates

Lectures Delivered:

Invited talk at (1) 11th Asian Biological Inorganic Chemistry Conference (AsBIC11), Guillin, China, (2) Israel Chemical Society Keynote Lecture, Tel Aviv, Israel, (3) MTIC-XXI, IIT KGP and (4) RACS, Gopalpur, Orissa.



Amit Majumdar

Professor

Inorganic and Bioinorganic Chemistry

Associates : (1) Dr. Sayan Atta (RA), (2) Kamal Hossain (Bridge fellow, IACS), (3) Anuj Baran Chakraborty (SRF, CSIR), (4) Soumik Karmakar (SRF, CSIR), (5) Amit Mandal (SRF, UGC), (6) Arindam Basak (SRF, UGC), (7) Ritapraavo Halder (JRF, UGC), (8) Rajib Hazra (JRF, UGC).

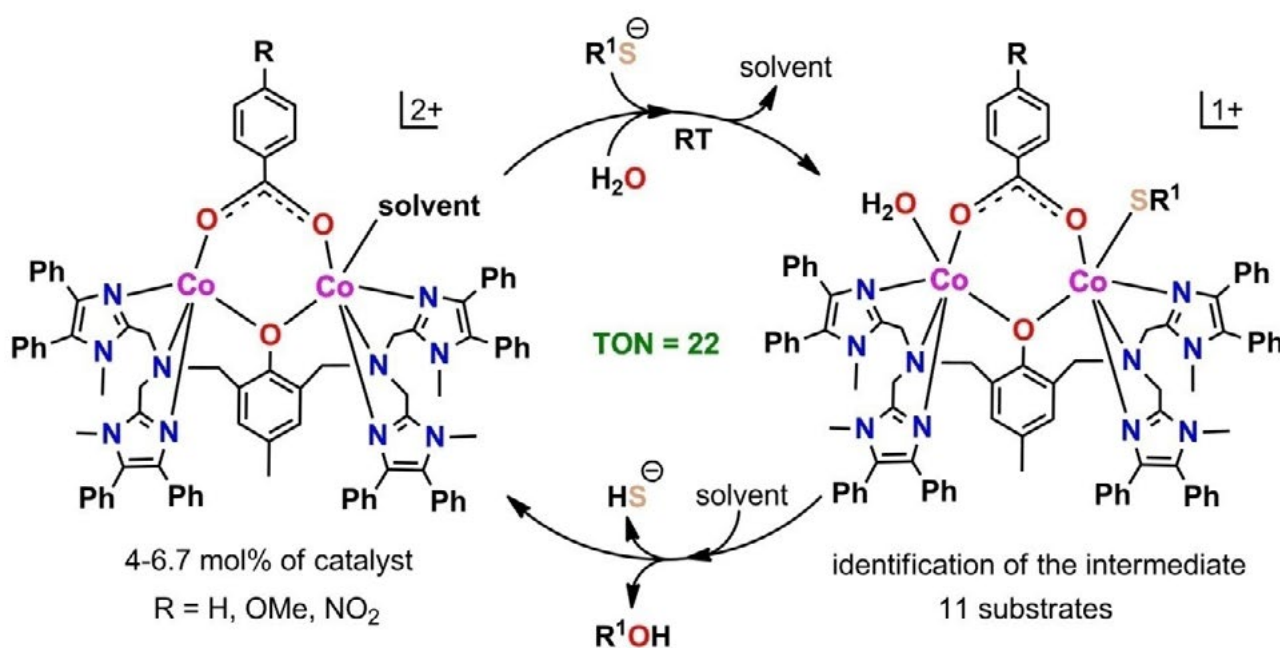
- » A detailed structural and spectroscopic study for the reduction of nitrite to nitric oxide in a new, seven-coordinate, iron(II)-nitrito compound by thiols and selenol revealed the generation of DNICs via the reaction of an isolated, unstable {FeNO}⁷ intermediate with thiolate/selenolate and showed the importance of protons and coordination of nitrite for nitrite reduction.
- » A five-coordinate and a six-coordinate mononuclear {FeNO}⁷ complex in a new N-donor

ligand framework were synthesized which displayed a very high NO stretching frequency in solution. Synthesis, characterization, electronic structure, redox reactions, and reactivity of the complexes toward thiolate and hydrosulfide were investigated.

- » A detailed bioinspired reactivity study of new binuclear Zn(II) complexes featuring coordinated thiolate, selenolate, trisulfide and diselenide was carried out which allowed the generation of thiosulfate ($S_2O_3^{2-}$), selenite

(SeO_3^{2-}), dithiosulfite ($S_2O_3^{2-}$), perthionitrite ($SSNO^-$), nitric oxide (NO) and reactive sulfur/selenium species (RSS/RSeS).

- » Carboxylate bridged binuclear cobalt(II) complexes were shown to catalyze the hydrolysis of thiolates to alcohols and phenols with low catalyst loading and moderate to high TON at ambient conditions without the requirement of additional initiators/reagents/cocatalysts.



Publications in Journals :

1. Reduction of Nitrite in an Iron(II)-nitrito Compound by Thiols and Selenol Produces Dinitrosyl Iron Complexes via an $\{FeNO\}^7$ Intermediate - Karmakar, S.; Patra, S.; Halder, R.; Karmakar, S.; Majumdar, A.* *Inorg. Chem.*, **63**, 23202–23220 (2024).[IF:]
2. Generation of Thiosulfate, Selenite, Dithiosulfite, Perthionitrite, Nitric Oxide, and Reactive Chalcogen Species by Binuclear Zinc(II)-Chalcogenolato-/Polychalcogenido Complexes - Atta, S.; Mandal, A.; Majumdar, A.* *Inorg. Chem.*, **63**, 15161–15176 (2024).[IF:]
3. Reactivity of Thiolate and Hydrosulfide with a Mononuclear $\{FeNO\}^7$ Complex Featuring a Very High N-O Stretching Frequency - Karmakar, S.; Patra, S.; Pramanik, K.; Adhikary, A.; Dey, A.*; Majumdar, A.* *Inorg. Chem.*, **63**, 8537–8555 (2024).[IF:]
4. Nonheme Binuclear Transition Metal Complexes with Hydrosulfide and Polychalcogenides - Hossain, K.; Atta, S.; Chakraborty, A.; Karmakar, S.; Majumdar, A.* *Chem. Commun.*, **60**, 4979–4998 (2024).[IF:]
5. Carboxylate Bridged Binuclear Cobalt(II) Complexes Catalyze the Hydrolysis of Thiolates to Alcohols - Chakraborty, A. B.; Ganguly, T.; Bera, A.; Majumdar, A.* *Eur. J. Inorg. Chem.*, **27**, e202400105 (2024).[IF:]
6. Kinetic Isotope Effect Offers Selectivity in CO₂ Reduction - Patra, S.; Atta, S.; Ghosh, S.; Majumdar, A.*; Dey, A.* *Chem. Commun.*, **60**, 4826–4829 (2024).[IF:]

Ph.D. Degree Awarded :

(1) Sayan Atta (IACS Deemed to be University).

Sponsored Project:

- » Reactivity of Nitric Oxide Diiron Complexes (SERB)

Lectures Delivered:

Invited talk at (1) 11th Asian Biological Inorganic Chemistry Conference (AsBIC11), Guillin, China and (2) (RACS 2024), IEST, Shibpur



Ankan Paul

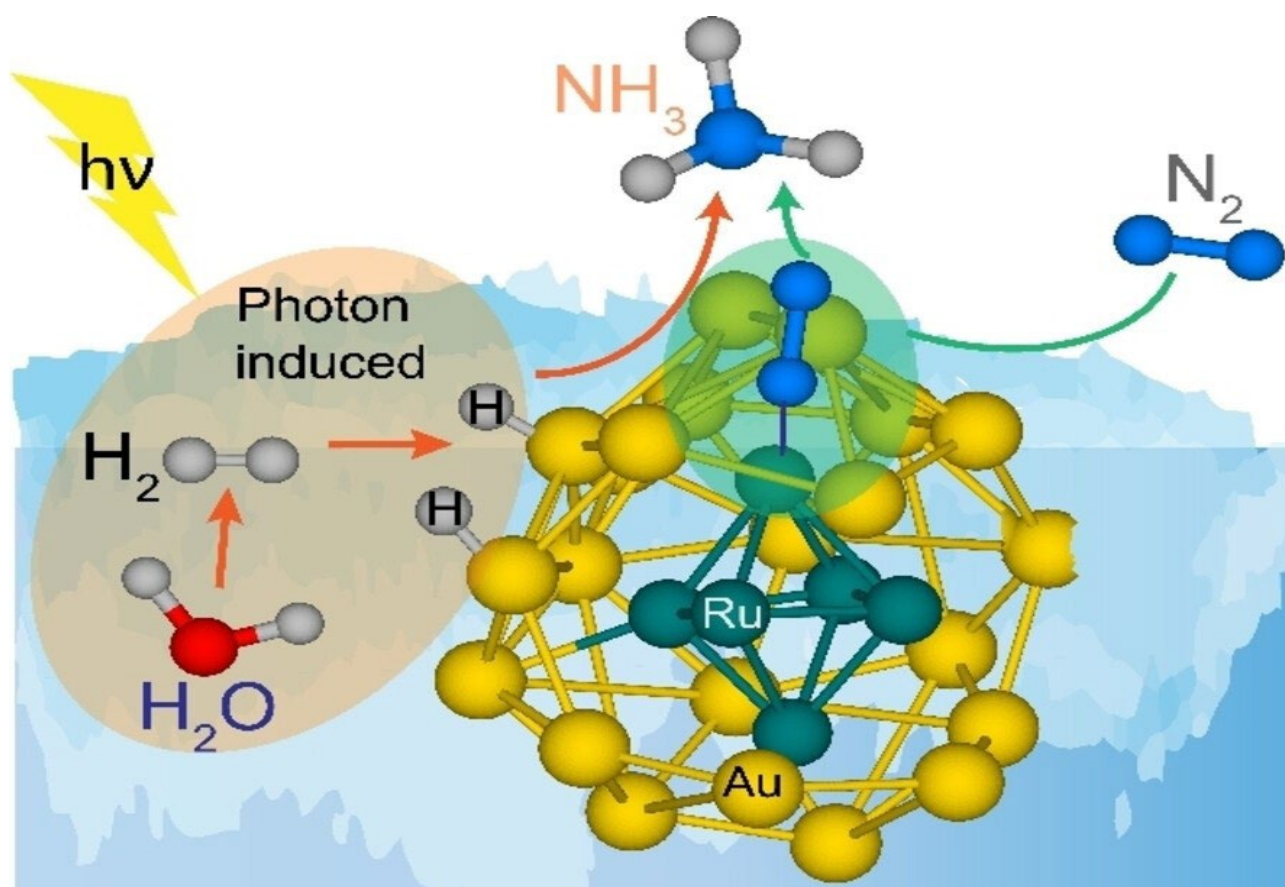
Senior Professor

Quantum computational chemistry

Associates : (1) Dr. IshitaBhattacharjee (RA-I), (2) Dr. Sourav Bhunya (RA-I) , (3) Dr. Bikash Mondal (RA-I), (4) Mr. RounakNath (Bridge-SRF), (5) Mr. Anuj Kumar Ray (CSIR-SRF), (6) Mr. Amit Mondal (CSIR-SRF), (7) Mr. Rahul Sutradhar (UGC-SRF), (8) Mr. Subhra Mohan Das (UGC-JRF, co-advisor Prof. JoyramGuin), (9) Mr. RitwikRoy (INSPIRE-JRF), (10) Mr. Arnab Roy (UGC-JRF), (11) Ms. Sneha Panja (External Int BS-MS), (12) Mr. SA Pranav (Int BS-MS) and (13) Ms. PratishrutiKundu Karmakar (Int BS-MS).

The research effort in our group is primarily focused on comprehending reaction mechanisms and pathways largely for catalytic processes, both in the ground and excited state surfaces. We have been investigating Salicylic Acid and Gentisic Acid Oxidation (Organic Substrate) by non-heme based metallo-enzyme systems using hybrid Quantum Mechanical /Molecular Mechanical approaches. Our findings contradict previous reports which suggested a crucial role of hydrogen bond from an enzyme pocket Arginine in stabilizing a Fe-OO(-) moiety. Long range Molecular Dynamics (MD) Simulations followed by QM/MM studies suggest that stray water molecules are involved in stabilizing intermediates along the oxidation reaction path. On a different project we are involved in unearthing the Photocatalytic pathways for toluene oxidation to benzaldehyde within a Supramolecular Host-Guest assembly, where the toluene molecule is encapsulated in an organic molecular cage. Our TDDFT and multireference computations reveal a cascade of Proton Coupled Electron Transfer (PCET) steps prior and after $^3\text{O}_2$ binding on photoexcitation

which facilitate such novel metal free oxidation processes. Additionally, we are investigating organic substrate oxidation by Bimetallic Transition Metal Cobalt complexes and Fe based metalloenzymes using Broken Symmetry Based DFT approaches and Multi-Reference based CASPT2 and NEVPT2 techniques. Our group is also involved in collaborative and solo endeavors in comprehending reaction mechanisms of different photo processes ranging from organic transformations to N_2 reduction to NH_3 , CO_2 to CH_4 conversion on metal clusters. Moreover, we are making slow but steady progress in developing Machine Learning Protocols for predicting relative energies of multiple spin states for Transition mono and bi Metallic Complexes. Furthermore, some of our efforts are invested in predicting the number of Bonds in Diatomic Species using a protocol developed in our group which employs excited state Potential Energy Curves (PECs).



DFT/TDDFT studies on pathways on N_2 conversion to NH_3 on doped Plasmonic Au Clusters. *Chem. Eur. J.* **31**, e202404254. (2025).

Publications in Journals :

1. Implicating the Role of Au-H Bonds in Photochemical N_2 Fixation by Ruthenium-Doped Gold Clusters - Munia Sultana, Sayan Paul, Amit Mondal, Ankan Paul*, *Chem. Eur. J.* **31**, e202404254 (2025).[IF:]
2. Phosphite mediated molecular editing via switch to meta-C-H alkylation of isoquinolines: emergence of a distinct photochemical [1, 3] N to C rearrangement - Soniya Rani, Anuj Kumar Ray, Devendra Kumar Dewangan, Nita Aruna Ramchandra Patil, M Aarthika, Ankan Paul*, Pradip Maity*, *Chem. Sci.*, **16**, 1809 (2025).[IF:]
3. Iridium/palladium dual photocatalysis for oxidative decarboxylative esterification of alcohols using α -keto acids" Subal Mondal, Soumya Mondal, Debabrata Halder, Siba P Midya, Ankan Paul, Pradyut Ghosh*, *Org. Chem. Front.*, **11**, 6367(2024).[IF:]
4. Copper-Catalyzed Carbogermylation of Electron-Deficient Alkenes via 3,4- Difunctionalization of Quinoxalin-2(1H)-ones: Mechanistic Insights from Computational Studies - Asim Kumar Ghosh, Amit Mondal, Sukanya Neogi, Frenki Mahato, Sourav Bhunya, Lisa Roy, Alakananda Hajra*, *Chem. Eur. J.*, **31**, e202404186 (2025).[IF:]
5. Silylarylation of Alkenes via meta-Selective C-H Activation of Arenes under Ruthenium/Iron Cooperative Catalysis: Mechanistic Insights from Combined Experimental and Computational Studies - Sukanya Neogi, Sourav Bhunya, Asim Kumar Ghosh, Biswajit Sarkar, Lisa Roy, Alakananda Hajra*, *ACS Catal.*, **14**, 4510 (2024).[IF:]

Ph.D. Degree Awarded :

(1) Rounak Nath (IACS Deemed to be University).

Lectures Delivered :

- » Invited talk at (1) PCAMC 2024, IISER, Kolkata, (2) SoPhyC 2024, IISER Molkata, (3) Pleanary Talk – HYCONC 2025, Suresh Vihar University, Rajasthan, (4) BITS Pilani 2025 and (5) SRAPCR 2025 at IACS.

Sponsored Project:

- » Decoding the Mechanism theoretical approaches.



Avisek Das

Associate Professor
Computational Biophysics

Associates : (1) Soumak Ghosh, (2) Sangeeta Das, (3) Sk. Hasibo Hassan, (4) Kaustav Chakraborty, (5) Argha Chakraborty, (6) Snehamay Bagchi, and (7) Hrithik Nandy

The main focus of our research group is to understand how fundamental molecular interactions control structure, dynamics and ultimately, any macroscopic property of interest in a wide variety of molecular systems at the interfaces of chemistry, molecular biology and soft materials science. Major accomplishments in three main areas of current interest are summarized in this write-up.

Peptide Self-assembly: Peptide self-assembly is an important topic in contemporary soft-matter research, due to the potential applications in biomedical and smartmaterials industries. For self-assembly of oligopeptides, there is a diversity in the initialbuildingunit, which encompasses peptide-amphiphiles, alternating hydrophobic-hydrophilic peptides and completely hydrophobic ultrashort peptides. In our group, we are focusing on ultrashort peptide self-assembly. We undertook a thorough study of the self-assembly processes of some ultrashort peptides leading to formation of different nanostructures from the randomized initial state by molecular dynamics simulations. The interplay of different chemical interactions leads to formation of nanostructures in water. We developed an algorithm namely **T**rajectory

Analysis of **M**ultidimensional **C**lustering **I**nteraction **S**pace(TAMCIS) algorithm to understand the role of possible chemical interaction in the self-assembly. We also developed another algorithm which can immediately identify the association and dissociation event in pathway of assembly. We are also interested in probing chirality transfer mechanisms from molecular to supramolecular length scales. Preliminary molecular dynamics studies with enantiomers of phenylalanine tripeptide shows self-assembled helical nanofibers with different chirality for different enantiomers. Consistency of these results were checked using multiple independent simulations. We also developed an algorithm to unambiguously detect chirality of supramolecular helical nanofibers by neglecting some of the details at molecular level. We also probed how chirality variations affect self-assembly of ultrashort peptides under achiral environment. We studied self-assembly of all eight possible stereoisomers of phenylalanine tripeptide in water for this purpose using molecular dynamics simulations. All of them consistently forms nanofibers similar in nature, whether through similar mechanism needs further investigations. Another research direction is to investigate how

enantiomers independently capable of self-assembly behave in their racemic modifications, whether they undergo self-sorting or form racemic assembled states. To investigate this, we performed simulations of racemic mixture of phenylalanine tripeptide which leads to racemic assembled state.

Enhanced sampling on pathway analysis: Because this association of large cluster is relatively time-consuming, we are employing a specialized method known as Forward Flux Sampling as a tool for enhanced sampling (FFS). The entire dynamical propagation is divided into segments between consecutive interfaces in the FFS method, where interfaces are defined in terms of order parameter. In this scenario, the order parameter used to track the spherical clusters is a combination of the number of clusters present and the minimum distance between these clusters. When the cluster number decreases or the minimum distance decreases while the cluster number remains constant in the trajectory, it is considered to have arrived at the next interface. The fusion is being tracked in this manner. We are currently working on automating the FFS mechanism and experimenting with various other order parameters to improve microstate sampling and reduce simulation world clock time.

Hard particle self-assembly: To study the crystallization in colloidal systems we use hard,

anisotropic, convex polyhedra as our model system which shows a rich behavior in terms of translational and orientational broken symmetry. We have investigated the presence of correlated orientational disordered phases in the hard polyhedral systems by a systematic study of the nature of orientational disorder at the unit cell level and discovered strong correlations in the distribution of pairwise orientational differences. We developed a completely new in-house algorithm to predict the unit cell of a given crystal from the simulation data in real space. We found an interesting connection between the alignment of the highest order rotational axis of symmetry of a convex polyhedra and the crystallographic symmetric axis of the unit cell in which the particle crystallizes in the correlated disordered phase. In addition, we studied the thermodynamic phase behavior of hard-sheared cubes and investigated the existence of the correlated orientational disordered phase. We observed that whenever the correlated orientational disordered phase is observed an empirical relation emerges between the point group of the particle and the point group of the unit cell. On top of that we also studied the phase behavior of hard convex sphero-polyhedra to study complex crystal structures as well as the newly discovered correlated orientational disordered phase.

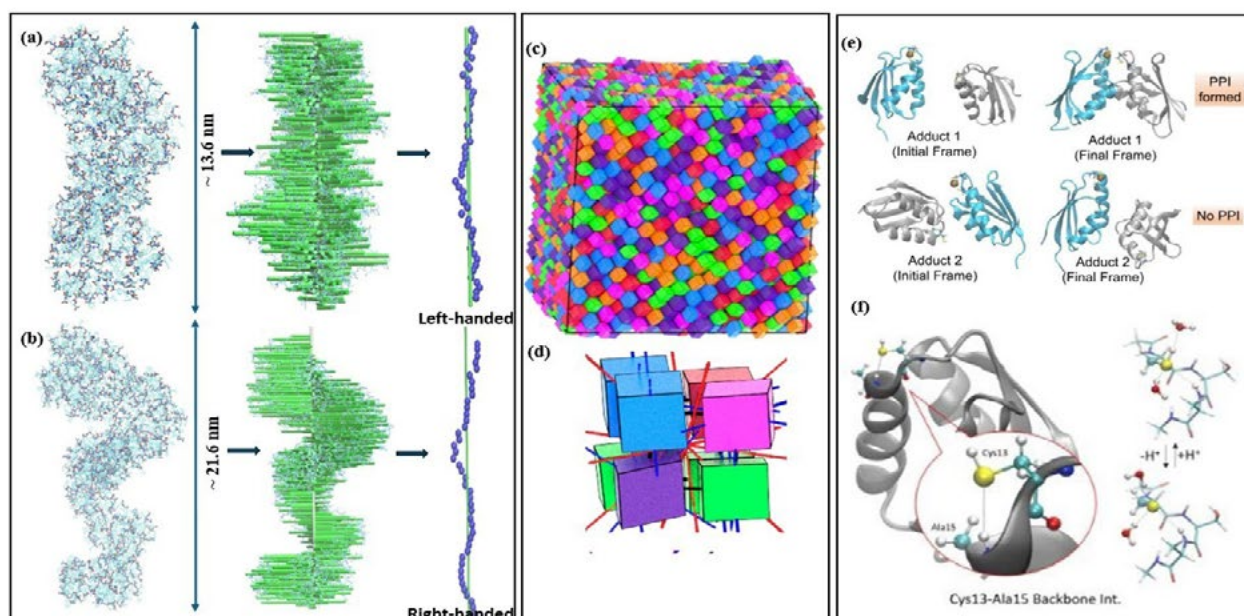


Figure (a) Left-handed helical nanofiber for self-assembled state of L-FFF, (b) Right-handed helical nanofiber for self-assembled state of D-FFF, (c) System snapshot of correlated orientational disorder phase for 10° sheared cube, (d) Unit Cell for 10° sheared cube having six unique orientations. (e) Initial adduct of Holo Chaperone-apo MBD, (f) QuantumPK_a calculation.

Copper trafficking in biology: The copper binding sites in both types of trafficking proteins are identical and are composed of a C-X-X-C motif (C stands for cysteine residue). Despite the availability of detailed structural information about the main molecular actors, the interplay between the timescale separated protein association/dissociation events and Cu(I) metal transfer reaction involving cysteine thiols/thiolates, remain poorly understood. Computational modeling of these molecular events is challenging due to the solvent exposed and fluctuating nature of the protein binding sites. Using multiple unbiased MD trajectories from multiple relative orientations of the partner proteins we aim to study energetics and kinetics of the protein association events and map the initial binding mechanism. Our studies also identified an array of preorganization events in the binding sites which are structurally essential for the metal transfer reaction.

Publications in Journals :

1. Electrostatic versus Hydrogen Bonding Control of Selectivity in CO₂ Reduction by Iron Porphyrins - Soumili Ghosh, Suman Patra, Asim Bisoi, Soumak Ghosh, Nisha Maurya, Avisek Das, Prashant Chandra Singh and Abhishek Dey*, *ACS Catal.* **15**, 5, 3595–3610 (2025). [IF:]
2. Understanding orientational disorder in crystalline assemblies of hard convex polyhedral - Sumitava Kundu, Kaustav Chakraborty and Avisek Das*, *J. Chem. Phys.* **161**, 204907 (2024). [IF:]
3. Correlating molecular structure and self-assembly mechanism via Temporal Analysis of Multidimensional Chemical Interactions Space: Application to assemblies of isomeric peptides - Sangeeta Das, Rumela Adhikary, Snehamay Bagchi, Argha Chakraborty and Avisek Das* (Accepted Manuscript in *Physical Chemistry Chemical Physics*) <https://doi.org/10.1039/D4CP04597A>
4. Understanding pathway complexity in assembly mechanisms of hydrophobic peptides in water: Insights from atomistic simulations via Event Tracking - Argha Chakraborty, Rumela Adhikary, Sangeeta Das and Avisek Das* (Accepted Manuscript in *The Journal of Chemical Physics*) .

Ph.D. Degree Awarded :

(1) Sumitava Kundu (IACS Deemed to be University) and (2) Rumela Adhikary (IACS Deemed to be University).

Sponsored Project

- » Understanding the Role of Protein..... Copper Trafficking (SERB).

Lectures Delivered:

- » Invited talk at (1) Buckling in 2D-Materials, IIT Bombay, (2) North Carolina, USA, (3) SMMK 2024, SNBNCBS, Kolkata, (4) IMSc, Chennai, (5) IIT Tirupati, (6) IISER-Kolkata, (7) IIT Mumbai and (8) NSM at IIT Palakkad.



Ayan Datta

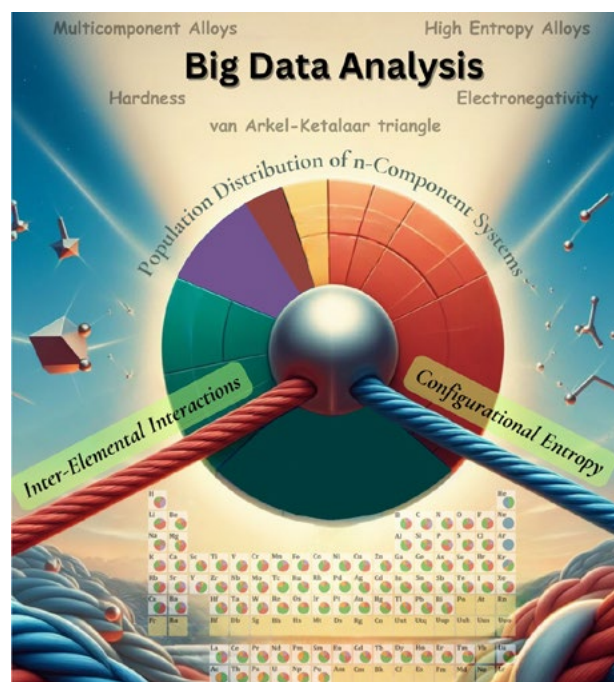
Senior Professor
Computational Chemistry

Associates : (1) Adrish Das , (2) Gourab Das, (3) Antara Dey, (4) Oshiya (5) Ankita Das, (6) Chandralekha Hajra, (7) Shovan Das, (8) Soumya Mondal, RA, (9) Arun Kr Pal and (10) Moumita Mukherjee (WOS-A, DST)

Our group focuses on a unified understanding of phenomena at various length and time scales using techniques based on ab-initio and extended quantum mechanical methods. This group has contributed towards two – dimensional systems like silicon and other graphene analogues and provided a relationship between electronic structure and ground state properties. We study various aspects of both homogeneous and heterogeneous catalysis and examine the role of metal particles. Quantum mechanical tunneling including carbon tunneling is investigated in various chemical transformations. Modeling of terahertz (THz) spectra of crystal polymorphs is studied through solid – state DFT phonon calculations. Optoelectronic properties of organic molecules for Singlet Fission is actively pursued for extremely high LED efficiency. Dynamical behavior of these systems at finite temperatures are captured using approximate methods like ab-initio MD or classical MD or even reactive MD depending on the time-scale of the chemical or physical phenomenon of interest. Recent interest has been to study solvent phase exfoliation of two-dimensional materials from their bulk van der Waals state of aggregation. One of our long-term interest lies in exploring rare and unusual interactions in chemistry like nc-2e bonds or ultrashort H...H non-bonded contacts and even hypervalent species in constrained environments. While, these structures have at best, fleeting existence at ambient conditions many new phases of molecules/solids remain yet to be discovered particularly in the emerging area of high pressure chemistry.

Though computational chemistry is evolving and improving, we do realize that quantitative numbers

are model dependent. Hence, most importantly, to gain a qualitative picture, we are always eager to work very closely with experimentalists to refine, reframe and even refute predictions.



R. A. Oshiya, B. Verghese, Ayan Datta, *J. Am. Chem. Soc.* **2024**, 146, 17995–18001.

Publications in Journals :

1. Machine learning for predicting enantioselectivity in chiral phosphoric acid-catalyzed naphthyl-indole synthesis R. A. Oshiya, Ayan Datta, *J. Chem. Sci.*, 137, 28 (1-8) (2025).[IF:2.5]
2. Two-and Three-Dimensional Silver Cluster Assemblies:Effect of Argentophilic Interactions in

- Photoluminescence - Priyanka Chandrashekar, Dayona Aleyamma Varghese, Teena Thomas, Arun K Pal, Arunima Muraleedharan, Abdul Salam, Meghna Ghosh, Pradip Kumar Mondal, Sona Velaparambil Suresh, ChayanKanti Nandi, Ayan Datta, Sukhendu Mandal, *J. Phys. Chem. Lett*, **16**, 4107 – 4113 (2025).[IF:3.5]
3. A Crystals of Organic Acid–Base Complexes Defy the ΔpK_a Rule Under Compression - S. Das, S. M. Pratik, A. Datta. *J. Phys. Chem. C*, **128**, 40, 17175–17183 (2024).[IF:3.5]
 4. A non-B DNA binding peptidomimetic channel alters cellular functions - R. Paul, D. Dutta, T. K. Mukhopadhyay, D. Müller, B. Lala, Ayan Datta, H. Schwalbe, J. Dash, *Nat. Commun.* **15**, 5275 (2024).[IF:15.5]
 5. Oriented external electric field controls the rupture forces in mechanophores - A. Das, Ayan Datta, *J. Phys. Chem. B*, **128**, 6951–6956. (2024).[IF:3.0]
 6. Unlocking enantioselectivity: Synergy of 2-pyridone and chiral amino acids in Pd-catalyzed β -C(sp³)-H transformations - N. Mandal, P. Mondal, S. Mandal, A. Datta, *J. Org. Chem.* **89**, , 9223–9232 (2024).[IF:3.5]
 7. Pressure-induced insulator-to-metal transition in few-layer FePS₃ at 1.5 GPa - B. Mallick, M. Palit, R. Jana, S. Das, A. Ghosh, J. Sunil, S. Maity, B. Das, T. Kundu, C. Narayana, Ayan Datta, S. Datta, *Phys. Rev. B*. **109**, 235417 (2024).[IF:3.5]
 8. CsPbBr₃ perovskite polyhedral nanocrystal photocatalysts for decarboxylative alkylation via C_{sp}³-H bond activation of unactivated ethers - S. Mondal, S. Banerjee, S. Bera, S. Mondal, S. P. Midya, R. Jana, R. K. Behera, Ayan Datta, N. Pradhan, P. Ghosh. *ACS Catal.* **14**, 6633–6643 (2024).[IF:12.5]
 9. Pressure Induces Six-fold Coordination for the Lighter Pnictides Phosphorus and Arsenic triiodide - P. Gain, S. Mondal, Ayan Datta, *Chemphyschem* **25**, , e202400046 (2024).[IF:3.5]
 10. Role of Electronegativity on the Elemental Diversity in Hgh-Entropy Alloys - R. A. Oshiya, B. Verghese, Ayan Datta*, *J. Am. Chem. Soc.* , **146**, 17995 – 18001 (2024).[IF:15.6]
 11. First-principles Design of Heavy-atom-free Singlet Oxygen Photosensitizers for Photodynamic Therapy - A. K. Pal, Ayan Datta*, *J. Chem. Phys.* , **160**, 164720 (2024).[IF:3.0]
 12. Pressure Induced Alteration and Stabilization of Intermolecular Stacking in Square-Planar Osmium Tetracarbonyl - Shovan Das, A. K. Pal, Ayan Datta. *ChemPhysChem* , **25**, e202300720 (2024).[IF:3.0]
 13. Computational Assessment of the Biocompatibility of Two-Dimensional G-C₃N₃ toward Lipid Membranes - A. Ghosh, T. K. Mukhopadhyay, Ayan Datta. *ACS Appl. Mater. Interfaces.*, **16**, 7, 8213–8227 (2024).[IF:10.0]
 14. Evidence for Exclusive Direct Mechanism of Urea Electro-Oxidation Driven by in Situ-Generated Resilient Active Species on a Rare-Earth Nickelate - N. N. Rao, A.Chandraraj, M. Mukherjee, S. Roy, A. Tayal, Ayan Datta, N. John. *ACS Catal.*, **14**, 2, 981–993 (2024).[IF:12.5]
 15. Effect of the Cyano Group on Colour-Tunability of Aryl-Substituted Buta-1,3-Diene Based Solid-State Emissive Copolymers - P. Pal, Ayan Datta, S. Mukherjee, A. Perumal, S. Malik. *J. Mater. Chem. C*, **11**, 16594-16604. (2024).[IF:3.5]
 16. Computational Assessment of the Biocompatibility of Two-Dimensional G-C₃N₃ toward Lipid Membranes - A. Ghosh, T. K. Mukhopadhyay, Ayan Datta. *ACS Appl. Mater. Interfaces.*, **16**, 7, 8213–8227 (2024).[IF:10.0]
 17. Evidence for Exclusive Direct Mechanism of Urea Electro-Oxidation Driven by in Situ-Generated Resilient Active Species on a Rare-Earth Nickelate - N. N. Rao, A.Chandraraj, M. Mukherjee, S. Roy, A. Tayal, Ayan Datta, N. John. *ACS Catal.*, **14**, 2, 981–993 (2024).[IF:12.5]

Ph.D. Degree Awarded :

(1) Anupam Ghosh (IACS Deemed to be University)

Sponsored Project

» CO₂ to Useful chemicals (SERB)

Lectures Delivered:

Invited talk at (1) Skoltech – 2025 and (2) IIT Bombay.



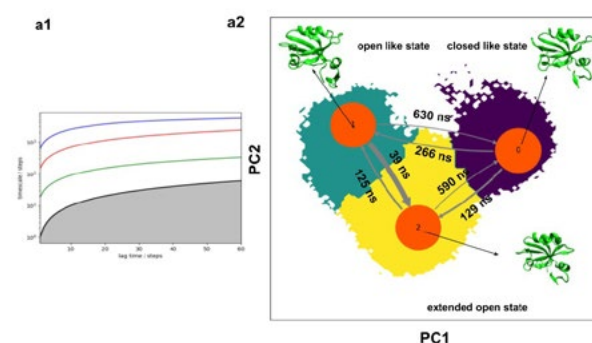
Biman Jana

Professor
Theoretical Physical Chemistry

Associates : (1) Prasun Pal (SRF), (2) Rahul Aich, SRF, (3) Rohon Mitra, SRF, (4) Pradipta Kumar Das, SRF, (5) Subhajit Sarkar, SRF, (6) Subhabrata Hazra, JRF, (7) Sourav Satapathi, JRF, (8) Saikat Dhibar, JRF and (8) Kingshuk Das (JRF)

While allosteric signal transduction is crucial for protein signaling and regulation, the dynamic process of allosteric communication remains poorly understood. The third PDZ domain (PDZ stands for the common structural domain shared by the postsynaptic density protein (PSD95), *Drosophila* disc large tumor suppressor (DlgA), and zonula occludens-1 protein (ZO-1)) serves as a classic example of a single-domain allosteric protein, demonstrating a long-range coupling between the C-terminal α helix (known as the $\alpha 3$ helix) and ligand binding. A molecular level understanding of how the $\alpha 3$ helix modulates the ligand binding affinity of the PDZ3 domain is still lacking. In this study, extensive molecular dynamics simulations corroborated with principal component analysis (PCA), ligand binding free energy calculations, energetic frustration analysis and Markov state model analysis are employed to uncover such molecular details. We demonstrate the definite presence of a binding competent closed-like state in the conformational landscape of wild-type PDZ3. The population modulations of this closed state and other binding incompetent states in the landscape due to $\alpha 3$ -truncation/mutation of PDZ3 are explored. A correlation between the closed state population and calculated binding free energy is established, which supports the conformation selection mechanism. Covariance analysis identified the presence of correlated motion between two distant loops ($\beta 1$ - $\beta 2$ and $\beta 2$ - $\beta 3$) in the wild-type PDZ3 system, which weakened due to truncation/mutation in the distant $\alpha 3$ helix. It has also been observed that whenever the $\alpha 3$ helix was perturbed, the $\beta 2$ - $\beta 3$ loop got further away from the binding groove and it is found to

be correlated with the binding free energy values. Energetic frustration analysis of the PDZ3 domain also showed that the $\beta 2$ - $\beta 3$ loop is highly frustrated. Finally, MSM analysis revealed a relevant timescale (closed to open state transition), which is similar to the observed experimental signal transduction timescale for the system. These observations led to the conclusion that the distantly located $\alpha 3$ helix plays a pivotal role in regulating the conformational landscape of the PDZ3 domain, determining the ligand binding affinity and resulting in allosteric behavior of the domain.



Publications in Journals :

1. Modulation of the conformational landscape of the PDZ3 domain by perturbation on a distal non-canonical $\alpha 3$ helix: decoding the microscopic mechanism of allostery in the PDZ3 domain - Subhajit Sarkar and Biman Jana*. *Phys. Chem. Chem. Phys.*, **26**, 21249-21259 (2024). [IF:2.9]
2. Modulation Registry Alteration in Dynein's Microtubule-Binding Domain: A AAA domain-guided event - Pradipta Kr Das and Biman Jana. *Chem Phys Impact*, **9**, 100702, (2024).[IF:3.8]

3. Optimized Collective Variable for Collapse Transition in Linear Hydrophobic Polymers: Importance of Hydration Water and End-to-End Distance - Saikat Dhibar and Biman Jana*. *J. Chem. Theory Comput.*, **20**, 17, 7404–7415, (2024).[IF:5.7]
4. Molecular Insight of the Ice Nucleation by Ice Binding Protein: A Comparative Study With Ice Nucleating Protein, Antifreeze Protein, and Non- Ice-Binding Protein - Prasun Pal, Subrata Pal and Biman Jana*. *J. Phys. Chem. C*, **129**, 1, 600–610, (2025).[IF:3.3]
5. Evaluating long-range orientational ordering of water around proteins: Signature of a tug-of-war scenario - Subhabrata Hazra and Biman Jana*. *Phys. Chem. Chem. Phys.*, **27**, 3930-3940, (2025).[IF:2.9]

Award/Recognition :

- » CRSI Bronze Medal, CRSI.

Ph.D. Degree Awarded :

- (1) Prasun Pal (IACS Deemed to be University)

Sponsored Project

- » Characterizing the effect of IBS.....ice nucleation and growth

Lectures Delivered:

Invited talk at (1) BARC Mumbai, (2) IIT Tirupati, (3) CRSI-NSC meeting in IISER-Bhopal, (4) IIT Bombay, (5) RARE 2025, (6) IMSC Chennai and (7) Kaleidoscope Meeting.



Debashree Ghosh

Professor

Theoretical and Computational Chemistry

Associates : (1) Mr. Koushik Seth, SRF, (2) Mr. Arpan Chowdhury, SRF, (3) Mr. Supriyo Santra, SRF, (4) Ms. Mandira Dey, SRF, (5) Mr. Pradipta Dey, SRF, (6) Debroop Pal, JRF, (7) Somsuta Ray, JRF, (8) Samidh Ghosh, JRF, (9) Ananya Sinha, JRF and (10) Naomi Karmakar (RA-1).

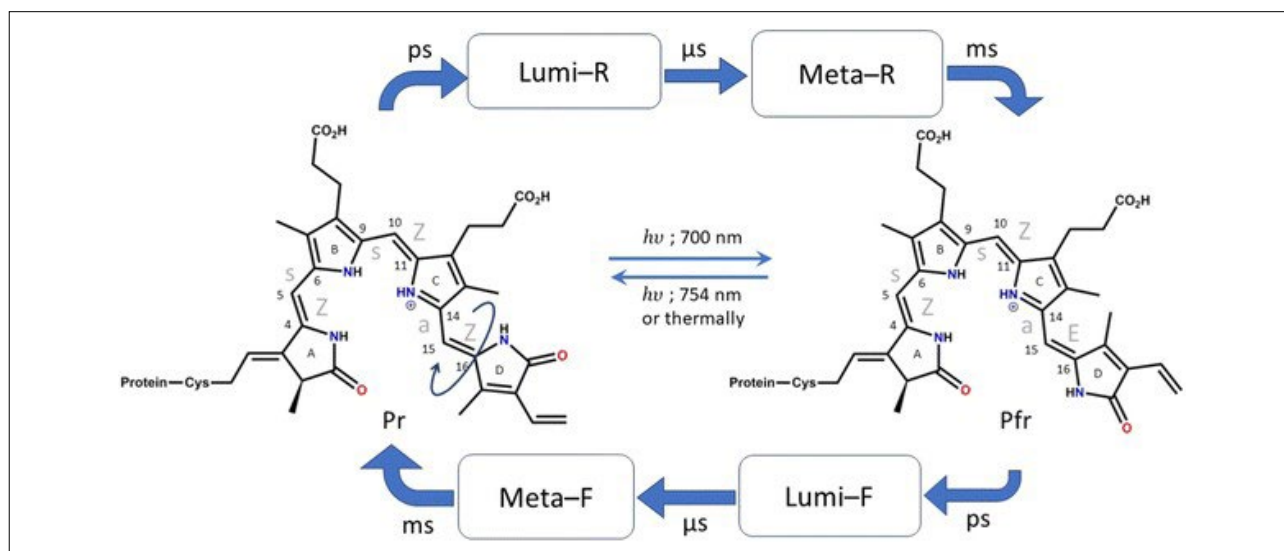
The overarching theme of the research in the Ghosh group revolved around development of strategies to understand ground and excited state electronic structure of strongly correlated systems.

(a) Photophysics of bacteriophytochromes –

Phytochromes and bacteriophytochromes are a class of photoreactive protein that is responsible for light sensitivity and many other light activated processes in plants and bacteria. The chromophoric structure and their photoprocesses are studied in our group. The absorption spectra and the relative intensities of the Q and Soret band was observed to vary

immensely due to single point mutations. The reason behind this unusual property was studied in our group and we ascertained that the structure of the chromophore in different protein environment was the main cause behind this spectral change.

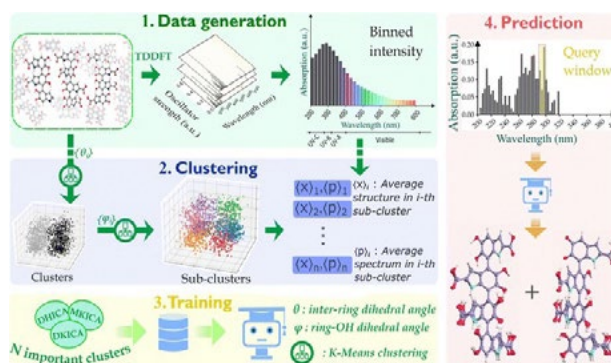
Furthermore, we studied the effect of protein environment on the photocycle of these protein. The first steps of the photocycle were studied with state-of-the-art multireference methods and the structural changes that leads to the Lumi-R form was ascertained.



(b) Hybrid supervised/unsupervised machine learning for identifying molecular structural fingerprints from ensemble property

Understanding and elucidating the structure of the heterogeneous biopolymer melanin has been a holy grail problem in the community for well over several decades. This is also related to its spectacular photoproperties. We use a combination of machine learning (inverse design) and computational chemistry to ascertain the structure responsible for different parts of the UV-visible spectra. It has been applied to a single form of melanin as a first test case.

This methodology was published J. Comput. Chem. as article.

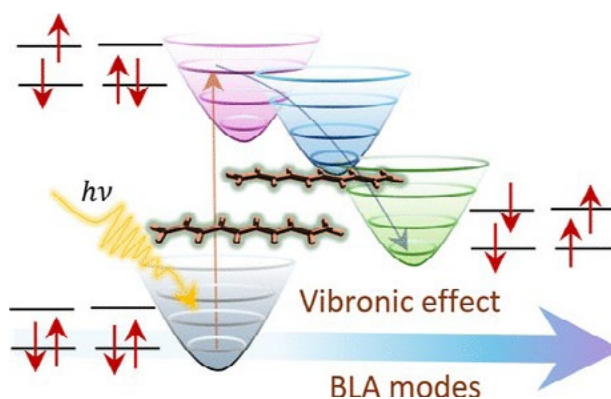


(c) Multichromophore interactions and singlet fission

Previously, in our group we had elucidated the effect of excitonic coupling and the role it plays in multichromophore phenomena such as singlet fission. In this year, we have delved deeper into the topic and have unearthed the effect of vibronic coupling. We notice that both excitonic and vibronic coupling in tandem are responsible for a successful exciton transfer and formation of triplet pair state.

We are also studying the effect of more late stage processes in singlet fission and the dynamics of the exciton after the triplet pair formation. For these studies we have developed

a new approach based on the frontier orbitals which can be scaled to much larger systems or oligomers.



Award/Recognition :

- » Pople Medal, APATCC
- » Topic Editor, Journal of Chemical Theory and Computation.

Publications in Journals:

1. Conformational effects on the absorption spectra of phytochromes - S. Santra, R. Manna, S. Chakrabarty, D. Ghosh, *J. Phys. Chem. B*, **128(15)**, 3614 (2024). [IF:2.8]
2. Photophysics of nitro-substituted unnatural nucleic acid base - A. K. Pradeep Kumar, S. Santra, D. Ghosh, *J. Phys. Chem. A*, **128(44)**, 9551 (2024).[IF:2.7]
3. External photocatalyst-free photocycloaddition between triplet vinylnitrenes with 1,3-biradical character and activated olefins under 420 nm leds - S. Malo, S. Santra, J. Saha, D. Ghosh, I. Das, *Chem. Comm.*, **60(86)**, 12545 (2024). [IF :4.3]
4. Photosensitizer-free photoinduced ground-state triplet carbene-assisted aryloxy radical generation via HAT - *Org. Lett.*, **26(41)**, 8674 (2024).[IF:4.9]
5. A nine-ring fused terrylenediimide exhibits switching between red TADF and near-IR room temperature phosphorescence - S. Jha, K. Mehra, M. Dey, S. Sujesh, D. Ghosh, J. Sankar, *Chemical Science*, **15**, 8974 (2024).[IF:7.6]
6. Effect of protein environment on the excited state phenomena in bacteriophytochrome - P. Dey, S. Santra, D. Ghosh, *Phys. Chem. Chem. Phys.*, **26**, 20875 (2024).[IF:2.9]
7. Understanding the photoprocesses in biological systems - need for accurate multireference treatment - A. Choudhury, S. Santra, and D. Ghosh, *J. Chem. Theory Comput.*, **20(12)**, 4951 (2024).[IF:5.7]
8. Unraveling the geometrical effects on singlet fission of carotenoids: A model perspective - S. Santra, D. Ghosh, *J. Phys. Chem. A*, **129 (11)**, 2738 (2025). [IF :2.7]

9. Effect of conjugation in photophysics of methoxycinnamate - K. C. Pal, S. Ray, D. Ghosh, *J. Chem. Sci.*, **137**, 18 (2025).[IF:1.7]
10. Hybrid unsupervised/supervised machine learning for identifying molecular structural fingerprints from ensemble property - A. Choudhury, D. Ghosh, *J. Comput. Chem.*, **46**, e70038 (2025).[IF:3.4]

Publications in Books Chapter :

- » Excited state electronic structure – effect of environment” in “Electron density” – Wiley, Inc, 121-128, 2024.
- » Understanding the melanin spectra and photophysics” in *Theoretical Methods, Algorithms, and Applications of Quantum Systems in Chemistry, Physics, and Biology*, Conference proceeding, 39-47, 2024.

Ph.D. Degree Awarded :

- (1) Koushik Seth (IACS Deemed to be University) and (2) Arpan Choudhury (IACS Deemed to be University).

Lectures Delivered :

- (1) Central University of Jammu, (2) IIT Goa, 2024 (3) Qingdao, China, 2024, (4) DAE-BRNS Symposium, BARC, Mumbai, 2024, (5) Chemistry Meet 2024, Konark, (6) Tiruvananthapuram, 2024, (7) InAdvanCS 25, IACS, Kolkata, (8) Tiruvananthapuram 2025 and (9) ACS Science Talk.

Sponsored Project

- » Structure and rational design of melanin and melanin-based materials – an in-silico approach (SERB-POWER fellowship)
- » Development and application of machine Metalloproteins (Indo-Japan)
- » Design principles (NARS-CRG Project) Machine learning.



Harapriya Rath

Professor

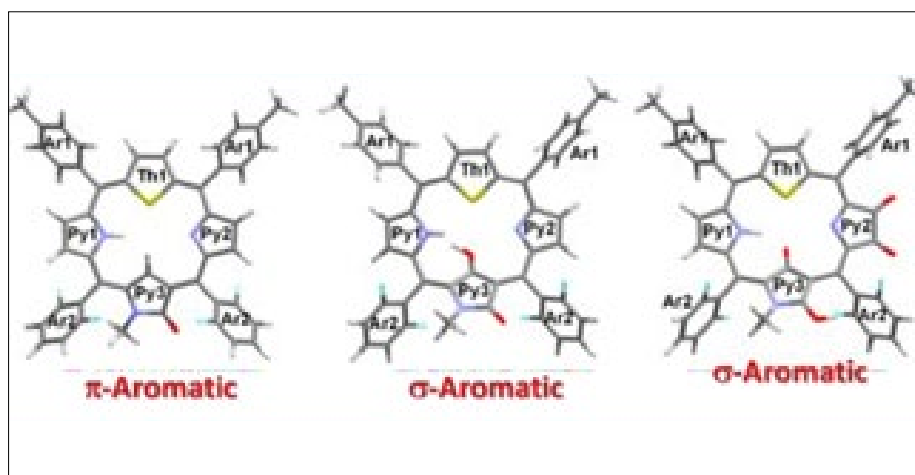
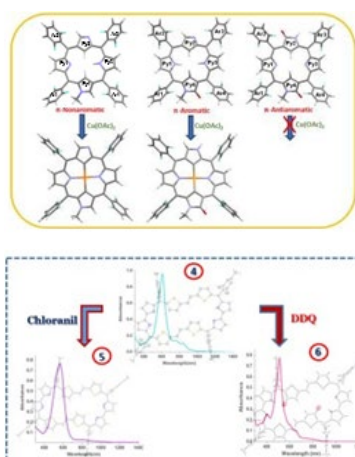
Unraveling σ -Aromaticity, π (anti)Aromaticity [Hückel, Möbius, Bicyclo, Excitedstate], Anion Recognition, NIR Absorption/NIR Emission of N-confused N(C)Fused Heterocyclic macrocycles

Associates : (1) Sumit Sahoo, RA (Institute), (2) Manik Jana, SRF (Institute), (3) Anirban Panua, SRF (CSIR), (4) Suman Das, JRF (Institute), (5) Pallab Chatterjee, JRF (UGC) and (6) Nilesh Ranjan Ghosh, JRF (Institute).

First ever structural isolation of core-modified N-methyl N-confused fused porphyrinogen. The first report on the facile chemical transformation of porphyrinogen by precise interplay between the types of oxidants leading to the unique reconstructions via N-C fusion and/or C-oxygenation of thiophenening with the genesis of 20 antiaromatic core-modified N-methyl N-confused N-fused porphyrinoid, and aromatic core-modified N-methyl N-confused fused porphyrinoid. The first ever structural isolation of core modified N-confused N-fused porphodimethenes which have been readily oxidized to N-confused N

Fused porphotrimethenes. The scientific highlight is unraveling the anion recognition abilities of these modified N-confused N-fused porphodimethenes and porphotrimethene that hitherto remain so far unexplored in the science of N-confused porphyrinoids where N confused porphodi(tri)methene analogues have never been exploited towards their anion binding.

Developed a series of expanded porphyrins from functionalized bithiophene synthons as near infrared absorptive chromophores and aromaticity switching upon chemical oxidation and/or protonation. The very first-time report of the dual macrocyclic π -conjugation in the paramagnetic Cu(II) organometallic complex of meso-meso N-methyl N-confused pyrrole bridged highly stable nonaromatic doubly N-methyl N-confused hexaphyrin analogue. The first report of unraveling Differing affinity of Nonaromatic, aromatic and antiaromatic doubly N-confused porphyrinoids towards stabilizing Cu(III) by meso-aryl substituted modified doubly N-confused porphyrinoid analogues with sustained cross-conjugation, aromaticity and antiaromaticity. Developed the strategies to stabilize aromaticity and aromaticity in trans-doubly N-confused porphyrinoids triggered by chloranil vs DDQ oxidation via amalgamation of N-methyl N-confused pyrrole, N-confused pyrrole and core modification.



Publications in Journals:

1. Copper (III) organometallic complexes of non (anti)aromatic and aromatic doubly N- confused porphyrinoids: syntheses and characterization - Anirban Panua, Gunasekaran Velmurugan, Peter Comba, and Harapriya Rath*. [Invited article main group element compounds in materials and catalysis themed collection] *Dalton Trans.* **54**, 4267- 4275 (2025).[IF:]
2. Syntheses of Variants of $\pi(\sigma)$ Aromatic Modified N-Methyl N-ConfusedPorphyrinoidswith Adaptive Properties - Anirban Panua, Gunasekaran Velmurugan,Peter Comba, and Harapriya Rath*. *Chem Asian J.*, 20, e202401196. [Invited article; Luminescent Materials: From Fundamentals to Applications] (2025)
3. Chemical Oxidation induced Aromaticity switching of E-Ethylene bridged [38] Octaphyrin (1.2.1.0.1.2.1.0) with NIR Absorption - Sumit Sahoo, Pallab Chatterjee, Daniel Blasco, Dage Sundholm and Harapriya Rath*, *Organic Letters*, **26**, 11045-11050 (2024).[IF:]
4. X-ray Characterization of core-modified N-confused fused porphyrinogen and genesis

of $\pi(\sigma)$ (anti) Aromatic N-confused fused porphyrinoids - ManikJana,G.Velmurugan,Peter Comba and Harapriya Rath*, *Org. Chem. Front.*,**11**, 5077-5085 (20240).[IF:]

5. Organometallic Copper (II) Complex of meso-meso N-Methyl N-Confused Pyrrole-Bridged Doubly N-Methyl N-Confused Hexaphyrin – Manik Jana, Daniel Blasco, Dage Sundholm and Harapriya Rath*. *Org. Biomol. Chem.*, 22, 4461 – 4465 (2024).[IF:]
6. Rational and Controllable Syntheses of variants of modified N-confused N-fused Porphodimethenes and Porphotrimethene with Adaptive properties; Manik Jana, Sumit Sahoo, S. Kottekad, D. Usharani, and Harapriya Rath*. *Dalton Trans.*, 53, 7397-74051 (2024).[IF:]

Ph.D. Degree Awarded :

(1) Manik Jana (IACS Deemed to be University)

Sponsored Project

» Mutant Heterocyclic macrocycles
Fluorescent Molecular Probes, SERB



Joyram Guin

Professor

Asymmetric N-heterocyclic carbene catalysis; dual transition metal/ photoredox catalysis; development of new methods for organic synthesis using radical chemistry.

Associates : (1) Ujjwal Maji, RA-1 (Institute), (2) Bhaskar Deb Mondal, SRF (Institute), (3) Jayanta Dey, SRF (Institute), (4) Sourav Dutta, SRF (CSIR), (5) Ishita Roy, SRF (IntPCS), (6) Arpita Baidya, SRF (CSIR), (7) Bitasik Khatua, SRF (CSIR), (8) Anjulika Ghosh, JRF (CSIR), (9) Sadhan Gorai, JRF (UGC), (10) Shubhra Mohan Das, JRF (UGC, jointlywith Prof. Ankan Paul), (11) Prithvish Bhattacharjee, JRF (Institute), (12) Shreya Deb, JRF (UGC) and (13) Anumit Bhowmik, JRF (CSIR).

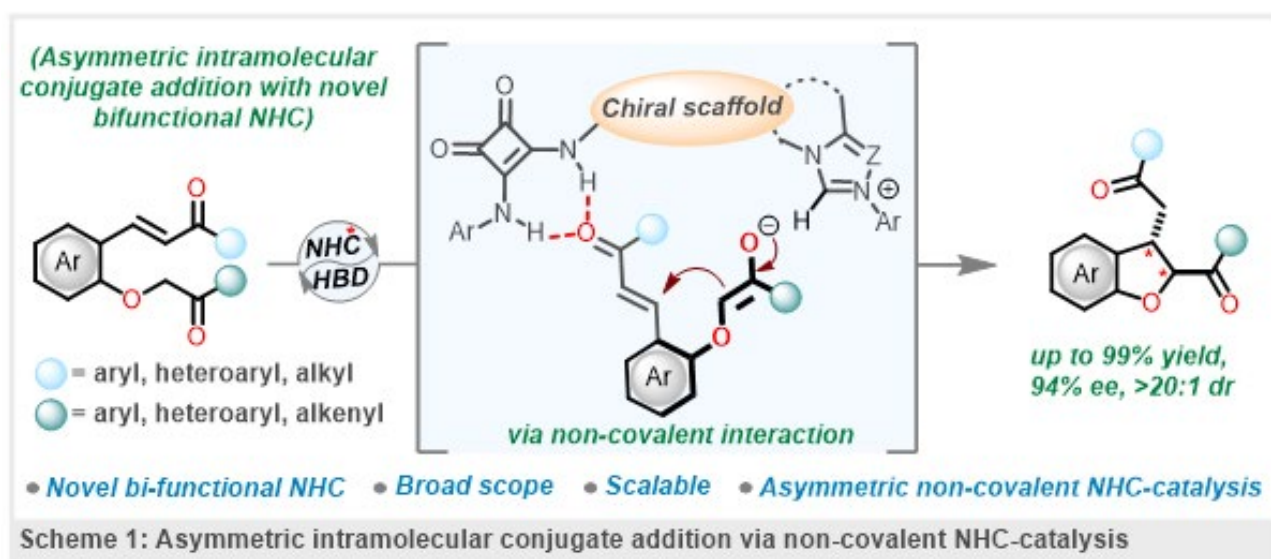
The research interest of our group primarily focuses on the development of new generation strategies for the efficient conversion of feedstock chemicals into high-value materials using various methods, including radical chemistry, photocatalysis, asymmetric organocatalysis, and transition metal catalysis. Recently, we introduced a novel

principle for asymmetric catalysis based on non-covalent interactions between N-heterocyclic carbenes (NHCs) and substrates. By utilizing this previously underdeveloped non-covalent mode of NHC catalysis, we successfully conducted an asymmetric addition-cyclization cascade

involving amidoesters and iminoquinones. This process allows for the synthesis of a variety of biologically active benzofuranones, featuring an all-carbon quaternary stereocenter, with high yields and enantiomeric excess (ee). The reaction demonstrates a broad substrate scope, and through product modifications, we achieved the enantioenriched synthesis of spirocyclic lactones and lactams of biological significance. Additionally, we have developed a novel squaramide containing a chiral bifunctional NHC for the first time. Also we report the successful application of this new chiral functional NHC in asymmetric intramolecular conjugate addition, which operates through non-covalent interactions. By concurrently activating both electrophilic and nucleophilic centers of substrates, this reaction produced various functionalized dihydro-benzofurans. Furthermore, we achieved an efficient NHC-catalyzed asymmetric conjugate addition that generates synthetically challenging benzofuranone derivatives featuring

vicinal all-carbon quaternary and tertiary stereocenters. This reaction relies solely on the non-covalent interaction between the newly designed NHC and the substrates, resulting in the production of a range of functionalized benzofuranones with good yields and ee.

In addition, the group has profound interest in developing catalytic functionalization of C-H bonds utilizing aldehyde autoxidation. In this context, we have reported Pd-catalyzed C(sp²)-H acylation using aldehyde as acyl source and O₂ as the green oxidant at room temperature. The key feature of the process is the selective association of acyl radical formed in situ during aldehyde autoxidation with Pd-catalysis. This reaction yields products in good yields reaching up to 82%, and it is scalable. Moving forward, our group's future research direction is focused on exploring this novel aerobic catalytic process to functionalize more challenging C-H bonds.



Publications in Journals :

1. Bifunctional NHC-Catalyzed Asymmetric Intramolecular Conjugate Addition via Noncovalent Interaction - Ujjwal Maji, Arpita Baidya, Supriyo Das and Joyram Guin*, *Org. Lett.*, **27**, 2423-2428 (<https://doi.org/10.1021/acs.orglett.5c00315>) (2025).[IF:4.9]
2. C(sp²)-H Acylation of Benzo[h]quinolines at Room Temperature via Aldehyde Autoxidation and Palladium Catalysis Cooperation - Ishita Roy, Nilangshu Mandal, Promita Biswas, Ayan Datta, and Joyram Guin*, *Chem. Eur. J.*, **31**, e202403975 (<https://doi.org/10.1002/chem.202403975>) (2025). [IF:5.02]
3. (R,S) and (S,R) N-Trip indanol triazolium NHC catalysts - Sourav Dutta, Ujjwal Maji & Joyram Guin*, *Electronic Encyclopedia of Reagents for Organic Synthesis (e-EROS)*; J. Wiley & Sons, (2025) (accepted)
4. Asymmetric Synthesis of Benzofuranones with a C3 Quaternary Center via an Addition/Cyclization Cascade Using Noncovalent N-Heterocyclic Carbene Catalysis - Ujjwal Maji, Supriyo Das, Arpita Baidya, Ishita Roy and

Joyram Guin*, *Org. Lett.* 26, 8719–8724(<https://doi.org/10.1021/acs.orglett.4c03014>) (2024). [IF:4.9]

5. Asymmetric Intermolecular Conjugate Addition of 3-Substituted 2-Benzofuranones to Maleimides via Noncovalent NHC Catalysis - Bhaskar Deb Mondal, Sadhan Gorai, and Joyram Guin*, *Synlett*, **35**, 2453-2458(DOI: 10.1055/a-2403-2383) (2024).[IF:1.7]

Ph.D. Degree Awarded :

(1) Ujjwal Maji (IACS Deemed to be University) and (2) Bhaskar Deb Mondal (IACS Deemed to be University).

Sponsored Project :

» Asymmetric N-Heterocyclic Non-Covalent Interaction

Lectures Delivered:

Invited talk at (1) ICOMC 2024, (2) ISCHA 2024, (3) ICCHD – 2025, (4) IEST Shibpur and (5) TIFR, Mumbai.



Jyotirmayee Dash

Senior Professor

Synthesis of small molecules targeting non canonical nucleic acid structures in multidrug resistant bacterial strains and construction of artificial membrane channels.

Associates : (1) Soumya Jyoti Basak RA, (2) NabinParui SRF, (3) Charles Patriot Roy SRF, (4) Sandip Maiti SRF, (5) Pratap Paul SRF, (6) Sk. JubayarAhashan SRF, (7) Binayak Lala SRF, (8) Neha Poddar SRF, (9) Sudeshna Mondal SRF, (10) Swomi Basu SRF, (11) Tathagato Bhattacharyya SRF, (12) Debasmita Biswas SRF, (13) Kousik Maji JRF, (14) Syed Ramizul Kabir JRF, Manab Diasi JRF, Tunil Naskar JRF, Khushnood Fatma SRF, Semantee Bhattacharya RA, Rakesh Paul RA, Raj Paul RA, Shilpi Karmakar RA, Joyshree Karmakar RA, Sayantan Pradhan RA, Amrita Das RA, Urmila Saha RA

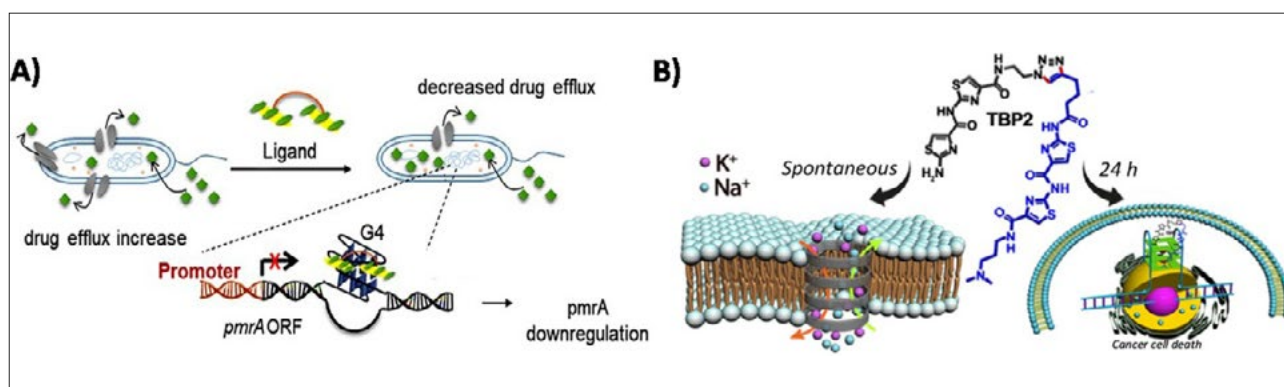
We reported an efficient, metal free method for synthesizing tetracyclic spirooxindole derivatives from N-protected isatins and propargyl bromide via Huisgen cycloaddition (*ChemComm*, 2024) and an efficient synthetic strategy for phenanthrenes and 1-hydroxyphenanthrenes through aromatization-assisted ring-closing metathesis (RCM) (*J. Org. Chem.*, 2024). A novel and cost-effective method has been accomplished for synthesizing biologically important α -keto esters in a single-step reaction via C(O)-N Bond Cleavage of Isatins (*Synlett*, 2024). Cyclohepta[b]indoles, prevalent in natural products and pharmaceuticals, are conventionally accessed via metal or Lewis acid-mediated cycloadditions with prefunctionalized substrates (*Chem. Eur. J.*, 2024). An efficient synthesis of 6-substituted imidazo[2,1-b]thiazoles from 2-aminothiazoles and acetophenones has been achieved through

intramolecular cyclization of in situ generated thiazolium ylides (*Synthesis*, 2025).

Combating multidrug resistance bacteria: We introduced a novel approach to counter antibiotic resistance by stabilizing G-quadruplex structures within the open reading frames of key resistance-associated gene *pmrA* of *S. pneumonia*. A bis-anthracene derivative demonstrated remarkable binding and stabilization of the G-quadruplex in the *pmrA* gene responsible for drug efflux, thus enhancing the drug retention time within bacteria (*NAR Molecular Medicine*, 2024). In another study total synthesis of natural prenylacridone alkaloids has been reported. The difluoro glycositine II derivative exhibits the highest potency against *Streptococcus* species (*Org. Chem. Front.*, 2025).

Synthesis of artificial membrane channels within membrane bilayer: We synthesized guanosine derivatives, containing lipophilic and hydrophilic linkers and side chains that self-assemble into tubular, branched, and spherical-shaped nanostructures in the presence of metal ions and integrate into the lipid membranes to replicate the function of natural membrane transporters. These assemblies can transport small molecules or drugs with high efficiency (*Cell Rep Phys Sci*, 2024). Furthermore, we synthesized a thiazole-

based DNA binding peptide mimic which forms transmembrane ion channels, impacting cellular ion concentration and consequently stabilize G-quadruplex DNA structures (*Nat. Commun.*, 2024). Formation of artificial ion channels with the peptidomimetic within Droplet Interface Bilayers (DIBs) is investigated through real-time electrophysiology, TIRF microscopy, and single channel recordings demonstrating high-conductance transport of Na^+ and K^+ across the DIBs (*ChemComm*, 2025).



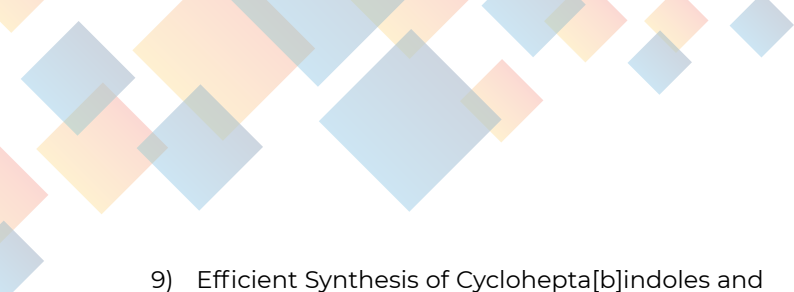
(A) G-quadruplex mediated drug-efflux inhibition in bacterial cell (B) Time-dependent functions of peptidomimetic channel.

Award/Recognition :

- » Dr. Satyajit Chakrabarti Memorial Award at ICCAES 2025, IEM, Kolkata.
- » Editor of Bioorganic & Medicinal Chemistry Letters, Elsevier.

Publications in Journals :

- 1) Ion Transport and Membrane Channel Formation Using a Peptidomimetic in Droplet Interface Bilayers - R Paul, D Dutta, M Wallace, J. Dash*, *ChemComm*, **61**, 3876-3879 (2025).[IF:4.3]
- 2) Synthesis and Antibacterial Evaluation of Prenylacridone Alkaloids and Analogues - S. Karmakar, K. Maji, S. Mondal, S. Bhattacharya, J. Dash*, *Org. Chem. Front.*, **12**, 1485-1490 (2025).[IF:4.6]
- 3) Transition-Metal Catalyzed Rapid Synthesis of Imidazo[2,1-b]thiazoles: Access to Aza-Fused Heterocycles via Aerobic Oxidative Coupling of 2-Aminothiazoles and Acetophenones - S. Basak, P. Paul, J. Dash*, *Synthesis*, **57**, 196-208 (2025).[IF:2.2]
- 4) Potassium tert-Butoxide Promoted α -Keto Ester Synthesis via C(O)-N Bond Cleavage of Isatins - T. Ghosh, S. J. Basak, J. Dash*, *Synlett*, **35**, 2532-2536(2024).[IF:2.0]
- 5) Self-assembled lipophilic guanosine derivatives modulate membrane transport across lipid bilayer - Y P. Kumar, M. Debnath, T. Das, R. Paul, J. Dash*, *Cell Rep Phys Sci.*, **5**, 102298 (2024). [IF:7.9]
- 6) Synthesis of triazole fused tetracyclic spirooxindole derivatives via metal-free Huisgen cycloaddition - S. Maiti, N. Parui, J. Halder, J. Dash*, *Chem. Comm*, **60**, 10009-10012 (2024).[IF:4.3]
- 7) Synthesis of Phenanthrenes and 1-Hydroxyphenanthrenes via Aromatization-Assisted Ring-Closing Metathesis: Towards Polynuclear Aromatic Hydrocarbons - C. P. Roy, S. Karmakar, J. Dash*, *J. Org. Chem.*, **89**, 10511-10523 (2024).[IF:3.4]
- 8) A non-B DNA binding peptidomimetic channel alters cellular functions - R. Paul, D. Dutta, T. K. Mukhopadhyay, D. Müller, B. Lala, A. Datta, H. Schwalbe, J. Dash*, *Nat. Commun.*, **15**, 5275 (2024).[IF:16.6]

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- 9) Efficient Synthesis of Cyclohepta[b]indoles and Cyclohepta[b]indole-Indoline Conjugates via RCM, Hydrogenation, and Acid-Catalyzed Ring Expansion: ABiomimetic Approach - N. Parui, T. Mandal, S. Maiti, J. Dash*, *Chem. Eur. J.*, **30**, e202401059 (2024).[IF:5.02]
 - 10) Combating Multidrug-Resistance in S. pneumonia: A G-quadruplex Binding Inhibitor of Efflux Pump and its Bio-Orthogonal Assembly - R. Chaudhuri, P. Thumpati, D. Biswas, S. Mandal, J. Dash*, *NAR Molecular Medicine*, **1**, ugae005 (2024).[IF: not available yet]

Publications in Book Chapter :

- » Roadmap : Click and combinatorial approaches to quadruplex ligand discovery, Book Chapter in ARMC 62 : Annual Reports in Medicinal Chemistry, 205-229, 2024.

Ph.D. Degree Awarded :

- (1) Soumya Jyoti Basak (IACS Deemed to be University)

Lectures Delivered:

- » Invited talk at (1) IISER, Berhampur, (2) NASI, IACS, Kolkata, (3) RSC ChemComm 60th Year Symposium, IACS, (4) Central University of Jharkhand, Ranchi, (5) CHEM 24 Conference, IACS, Kolkata, (6) POLYSOLVAT 15, IACS, Kolkata, (7) First Nucleic Acid Therapeutics Regional Meeting, (8) Visva Bharati University, (9) Dr. Satyajit Chakrabarti Memorial Award Lecture, ICCAES).

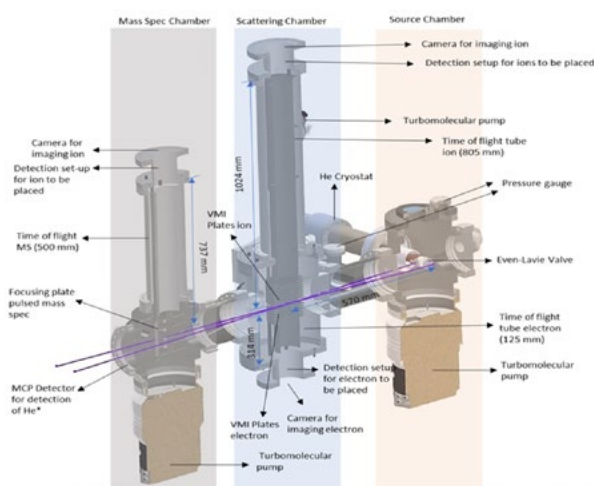
Sponsored Project

- » Regulation of non-canonical Molecular probes
- » Design and Construction of Nucleic Nanopores
- » Molecular modulationantimicrobial resistance
- » Cold Collisions
- » Cold Chemistry



Nabanita Deb
Assistant Professor
Cold Chemistry

Associates : (1) Anushree Dutta, SRF (Inspire), (2) Sukanya Jana, JRF (Institute), (3) Subhas C. Makhal, RA-I (Institute) and (4) Archisman Sinha, JRF (Inspire).



Cold chemistry investigates atom-molecule interactions at ultra-low temperatures, where quantum mechanical effects like tunneling and scattering resonances dominate reaction dynamics, surpassing classical models. Our group has developed a fully in-house, state-of-the-art cold collision apparatus at IACS Kolkata,

designed to probe such interactions using intersecting supersonic beams, a time-of-flight mass spectrometer, and a velocity map imaging setup—all housed within an ultra-high vacuum system. This facility enables precise control over collision energies and reaction dynamics, offering insights relevant to astrochemical and atmospheric environments. Additionally, we have performed detailed SIMION simulations on quadrupole mass filters, revealing how structural asymmetries generate higher-order multipole fields that significantly affect ion transmission and filtering resolution (paper submitted). We have also studied the non-linear optical properties of BODIPY molecules (paper submitted).

Lectures Delivered:

- » Invited talk at (1) NCAMP 2025, Dhanbad, (2) Symposium on Recent Advances in Physical Chemistry, 2025, (3) SoPhys Kolkata Chapter 2024 and (4) Workshop on Quantum Simulation and Quantum Metrology.



Parthasarathi Dastidar, FASc

Senior Professor

Supramolecular chemistry towards the design of soft-materials for developing biomaterials such as vehicle free drug delivery (VFDD) platforms

Associates : (1) Nabanita Roy, (2) Abhishek Dutta, (3) Asish Pharas, (4) Tanmay Chanda, (5) Manoj K Baskey, (6) Dr. Gobinda Dolai, RA-I (Institute), (7) Dr. Subhajit Ghosh, RA-I (Institute) and (8) Partha Sakha Gayen

Application of supramolecular synthons/ coordination chemistry in the context of crystal engineering is being exploited to generate intriguing supramolecular materials for various applications including VFDD or self-drug delivery.



Publications in Journals :

1. Developing Supramolecular Metallogel Derived from Pd_2L_4 Cage Molecule for Delivering an Anti-Cancer Drug to Melanoma Cell B16-F10 - Sourabh Bera, Abhishek Dutta and Parthasarathi Dastidar*, *Chemistry - An Asian Journal*, 19(17), e202400419 (2024).[IF:3.5]

2. Exploiting Urea-Carboxylate Synthon for Designing Supramolecular Topical Hydrogel via Simple Organic Salt Formation: Synthesis, Crystal Structures, and Anticancer Behavior against Melanoma B16-F10 Cells, Poulami Chakraborty, Nabanita Roy, Protap Biswas, Deep Sekhar Biswas, Hemanta Kumar Datta, Abhishek Dutta and Parthasarathi Dastidar*, *Chem. Mater.*, **36**, 7317-7331 (2024).[IF:8.6]
3. Supramolecular Gels Derived from Primary Ammonium salts of Naproxen and its Amino Acid Derivatives: Design, Synthesis, Structures and its Application as Anti-cancer Agent Against Melanoma Cell B16-F10, Utsab Manna, Subhajit Ghosh, Asish Pharas, Nabanita Roy, Pradip Pal and Parthasarathi Dastidar*, *Chem. Eur. J.*, 31, e202403999 (2025).[IF:3.9]

Sponsored Project

- » Developing Fenton reaction for cancer therapy.



Pradyut Ghosh, FNA, FASc, FRSC

Senior Professor & Dean (Infrastructure)
Molecular Recognition, Sensing, Catalysis

Associates : (1) Dr. Abu Saleh Musha Islam, RA (TRC), (2) Dr. Raju Biswas, RA, (TRC), (3) Dr. Hasina Mamataj Begam (SERB-NPDF), (4) Ambreen Rashid, SRF (CSIR), (5) Subal Mondal, SRF (CSIR), (6) Sourav Pramanik, SRF (CSIR), (7) Subham Mandal SRF (CSIR), (8) Soumya Mondal SRF (CSIR), (9) Iti Ghosh, JRF (INSPIRE), (10) Tarun Jana, JRF (CSIR), (11) Mintu Sarkar, JRF (INSPIRE), (12) Souvik Maiti JRF (UGC), (13) Rajashri Ghosh, JRF (UGC), (14) Soumadeep Ghosh, JRF (Institute), (15) Kiranmay Mahato JRF (CSIR), (16) Satakshi Dey, Int MSc-PhD student (1 year project), (17) Sangita Bayal, Int MSc-PhD student (1 year project).

1 d) (i) A tetrapodal tetra-cationic Se-based ChB donor $\text{Se}_4\text{Me-Br}$ has been demonstrated for the selective recognition and extraction of perrhenate. (Figure 1). The anion recognition ability is well elucidated through solution phase NMR and ITC studies, which clearly reveal the selective binding of ReO_4^- in presence of various halides and oxo-anions. Eventually, this ChB donor receptor exhibits ~62 % ReO_4^- extraction efficiency via precipitation method. Furthermore, to enhance the efficiency, a hydrophobic ChB receptor $\text{Se}_4\text{Do-PF}_6$ has been prepared, achieving an efficiency of up to ~93 % at a very low concentration (~5 ppm) by liquid-liquid extraction. Moreover, a selenoimidazolium-based chalcogen bond (ChB) donor bis-heteroleptic Ru(II) complex (Ru-Se) has been designed for recognition of both I^- and H_2PO_4^- . (ii) In catalysis work, we have explored different facets of CsPbBr_3 nanocrystals and their semiconductor-metal heterostructures as photocatalysts for a selective $\text{C}_{\text{sp}}^3\text{-C}_{\text{sp}}^3$ cross-coupling in cyclic ethers. Later, an unprecedented oxidative decarboxylative chemical domain of α,β -unsaturated acids and amines for C-N cross-coupled α -ketoamidation is disclosed. Following this, we have reported an unprecedented oxidative decarboxylative C-O cross-coupling reaction for the esterification of feedstock α -keto carboxylic acids and alcohols under mild conditions. We have merged these two carboxylic acids to access 2,4-diarylquinolines via visible-light-promoted metal-free three-component decarboxylative annulation pathway. (iii) Moreover,

we have explored the π -cavity of a nano-vessel made up of a palladium complex of an amino-ether heteroditopic macrocycle to access C2-selectivity of unsubstituted indole over facile C3-substitution. Functional group tolerance (cyano, nitro, halo, ester, etc.), a broad substrate scope and outstanding selectivities with excellent yields (80–93%) of the desired products have been achieved in 12 h by maintaining all sustainable conditions like aqueous medium, recyclable catalyst, one-pot reaction, no external additives, mild temperature, etc. (iv) A homo-bimetallic Ru(II) complex, $\text{Ru-NDI}[\text{PF}_6]_4$, which incorporates 1,10-phenanthroline and triazole-pyridine ligands and linked *via* a $(-\text{CH}_2)_3$ spacer to the reputed anion- π interacting NDI system has been reported for fluoride sensing, DNA binding and photocatalysis.

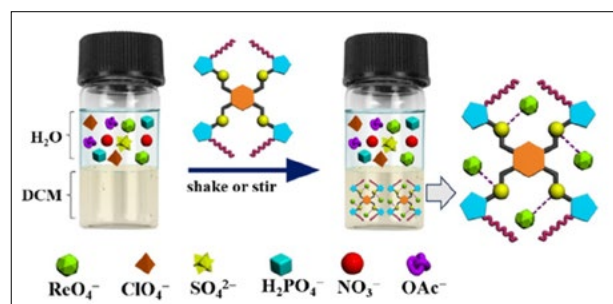


Figure 1: Efficient LLE of Perrhenate from Water, [Chem. Eur. J.2024, 30,e202402153]

Award/Recognition :

- » Fellow of the Royal Society of Chemistry (FRSC), 2025, Royal Society of Chemistry.

Ph.D. Degree Awarded :

(I) Ambreen Rashid (IACS Deemed to be University)

Publications in Journals:

1. Visible-Light-Induced Decarboxylative Annulation of α,β -Unsaturated Acids with Amines and α -Keto Acids for 2,4-Diarylquinoline Synthesis - S. Das, S. Maiti, S. Mondal, S. Mondal, S. P. Midya, P. Ghosh*, *Org. Lett.*, **27**, 6, 1537-1543 (2025).[IF:5.0]
2. A Potent Bis-Heteroleptic Ruthenium(II) Complex-based Chalcogen Bonding Receptor for Selective Sensing of Phosphates - I. Ghosh, Abu S. M. Islam, S. Pramanik, P. Ghosh*, *Inorg. Chem.*, **64**, 4, 1768-1776 (2025).[IF:4.7]
3. Recent advances in recognition, sensing and extraction of halides: 2019 onwards - A. S.M. Islam, I. Ghosh, A. Rashid, S. Pramanik, P. Ghosh*, *Coord. Chem. Rev.*, 522, 216225 (2025).[IF:23.5]
4. Photocatalytic Decarboxylative Cross-Coupling of α, β -Unsaturated Acids with Amines for α -Ketoamides via C-N Bond Formation - S. Mondal, S. Das, S. Mondal, S. P. Midya*, P. Ghosh*, *J. Org. Chem.*, **89**, 22, 16750-16758 (2024).[IF:3.6]
5. Iridium/palladium dual photocatalysis for oxidative decarboxylative esterification of alcohols using α -keto acids - S. Mondal, S. Mondal, D. Halder, S. P. Midya, A. Paul*, P. Ghosh*, *Org. Chem. Front.*, **11**, 6367-6379 (2024).[IF:4.7]
6. Naphthalene Diimide and Bis-heteroleptic Ru(II) Complex-Based Hybrid Molecule with 3-in-1 Functionalities - A. Rashid, S. Mondal, A. S. M. Islam, S. Mondal, P. Ghosh*, *Chemistry- An Asian Journal*, , e202400724 (2024).[IF:3.3]
7. A macrocycle based new organometallic nano-vessel towards sustainable implementation of selectivity for C2-H arylation of free indole

in water - S. Mandal, P. Sarkar, P. Ghosh*, *Org. Biomol. Chem.*, **22**, 7438-7447 (2024).[IF:2.7]

8. Superiority of imidazolium over triazole moiety in Bis-Heteroleptic ruthenium(II) complex toward selective sensing of phosphates - A. Rashid, S. Mondal, P. Ghosh*, *Inorg. Chim. Acta*, 122311 (2024).[IF:3.2]
9. Photocatalytic decarboxylation of free carboxylic acids and their functionalization - S. Mondal, S. Mandal, S. Mondal, S. P. Midya, P. Ghosh*, *Chem. Commun.*, **60**, 9645-9658 (2024).[IF:4.2]
10. Chalcogen Bonding in Selective Recognition and Liquid-Liquid Extraction of Perrhenate - S. Pramanik, A. S. M. Islam, I. Ghosh, P. Ghosh*, *Chem. Eur. J.*, **30**, e202402153 (1-6) (2024).[IF:3.7]
11. Supramolecular chemistry of liquid-liquid extraction - S. Pramanik, A. S. M. Islam, I. Ghosh, P. Ghosh*, *Chem. Sci.*, **15**, 7824-7847 (2024).[IF:7.4]
12. CsPbBr₃ Perovskite Polyhedral Nanocrystals Photocatalysts for Decarboxylative Alkylation via C_{sp}³-H Bond Activation of Unactivated Ethers - S. Mondal, S. Banerjee, S. Bera, S. Mondal, S. P. Midya, R. Jana, R. K. Behera, A. Datta*, N. Pradhan*, P. Ghosh*, *ACS Catal.*, **14**, 6633-6643 (2024).[IF:13.1]

Sponsored Project

- » Chalcogen Bond (ChB) Based Anions and Ion-Pairs.
- » JC Bose Fellowship, SERB.

Lectures Delivered:

- » Invited talk at (1) ICMGS-2025, Tamil Nadu, (2) InAdvanCS-2025, IACS, (3) ICBS-2025, Surendranath College, Kolkata, (4) IEST Shibpur, Howrah, (5) RACS-2024, Mayfair, Gopalpur, Orissa, (6) FORCE-IICS 2024, Alappuzha, Kerala and (7) MTIC-XXI, IIT Kharagpur.



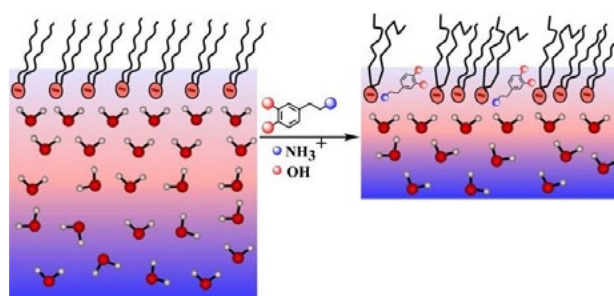
Prashant Chandra Singh

Professor
Spectroscopy

Associates : (1) Asim Bisoi, (2) Tridip Majumder

Interface of the two medium is an unique place where the the several complex process take place. For example, membrnane interface is an unique place where several complex biological process proceeds. However, understanding solely the property of the interfaces is difficult due to the technical issue. Even order nonlinear spectroscopy technique has the unqie nature as it provides the specific signal from the interfaces. In our laboratory, we study the different complex processes at the membrane interfaces as well as aqueous interfaces using the surface selective vibrational sum frequency generation technique. In our lab, we used VSFG to understand the role of the interfacial

water in the lipid-DNA complexation, protein – lipid complexation and fibrillation of different proteins, lipid-neurotransmitter interaction in brain signaling process.



Publications in Journals :

1. Loop nucleobases-dependent folding of G-quadruplex in normal and cancer cell-mimicking KCl microenvironments - A. Bisoi, S. Sarkar, P.C. Singh,* *Int. J. Biol. Marcomol.*, **265**, 131050 (2024).[IF:]
2. Flanking Effect on the Structure and Stability of Human Telomeric G-Quadruplex in Varying Salt Concentrations - A. Bisoi, S. Sarkar, P.C. Singh,* *J. Phys. Chem. B.* **128**, 29, 7121-7128 (2024).[IF:]
3. Ionic Liquids-Induced Recovery of the G-Quadruplex DNA Destabilized by Diodine Fungicide - A. Bisoi, T. Majumder, P.C. Singh,* *J. Phys. Chem. B.*, **128**, 38, 9111-9119 (2024).[IF:]
4. Flanking Effect on the Folding of Telomeric DNA sequences into G-Quadruplex Induced by Antimalarial Drugs - A. Bisoi, T. Majumder, S. Sarkar, P.C. Singh,* *J. Phys. Chem. B.*, **129**, 3, 835-843 (2025).[IF:]
5. Electrostatic versus Hydrogen Bonding Control of Selectivity in CO₂ Reduction by Iron Porphyrins - S. Gosh, S. Patra, A. Bisoi, S. Ghosh, N. Maurya, A. Das, P.C. Singh, A. Dey* *ACS. Catal.*, **15**, 5, 3595-3610 (2025).[IF:]



Rajib Kumar Goswami

Senior Professor

Total Synthesis of bioactive natural products and their suitable analogues. Evaluation of biomedical importance (anticancer, antibacterial, antifungal) synthesized meta-bolites and their variants.

Associates : (1) Dr. Subhro Mandal, NPDF, (2) Dr. Joyanta Mondal, CSIR-SRF then continued as IACS bridge fellow, (3) Dr. Sanu Saha, RA-1 (Institute), (4) Dr. Himangshu Sharma, SRF (CSIR-SRF) then continued as SRF (Institute), (5) Dr. Sourya Shankar Auddy, SRF (CSIR) then continued as SRF (Institute), (6) Dr. Moinul Haque Sahana, SRF (CSIR) then continued as IACS bridge, (7) Nasif Ali, (DST-Inspire), (7) Subrata Mandi, SRF (UGC), (8) Sandip Kr Mondal, SRF (UGC), (9) Sujan Paul, SRF (UGC), (10) Sanju Bhaskar, JRF (UGC), (11) Kaushik Bhagat, Integrated MS-PHD Project-JRF, (12) Leena Baidya, JRF (UGC), (13) Kaustuv Bag, Integrated MS-PHD Project Student, (14) Subhadip Bhoj, Integrated MS-PHD Project Student and (15) Arghyadip Panda, Integrated MS-PHD Project Student.

Total Synthesis of Natural Products and Evaluation of their Bio-medicinal Application :

Secondary metabolites play an important role in the drug development program. However, in most of the cases, those have been isolated from the natural sources in minute quantities. Therefore, chemical synthesis of those metabolites and their new variants as well as evaluation of their biological activities are the subject of immense importance. In this process, the structure of a novel complex molecule, which is proposed generally based on physical data, is also unambiguously proved. Keeping all these aspects in mind, we envisaged the chemical synthesis of a number of bioactive natural products and their different analogues. The targeted natural products include biselyngbyolides A-C, mohangic acids A-E, nemamide A & euglenatides D-E, bacilotetrin C, neaumycin B, pestalotioprolide E and sunshinamide (Figure-1). We developed synthetic

routes to access some of them efficiently and in some cases, their advanced intermediates and their different analogues. We have evaluated the biological activities of some of the natural products and their analogues with proper collaborations. The results are quite promising. We have shown first time that synthesized macrolide biselyngbyolide C helped mitochondrial fission-induced cytotoxicity in cancer whereas total synthesis of bacilotetrin C facilitated the discovery of potent anticancer congeners promoting autophagy. Moreover, the study with synthesized macrolide pestalotioprolide E revealed its anticancer effect against triple-negative breast cancer by targeting TRXR1-TRX1-ASK1-P38 signaling cascade whereas sunshinamide helped in breast cancer therapy through dual modulation of apoptotic and ferroptotic pathways via TrxR1 and Gpx4 inhibition.

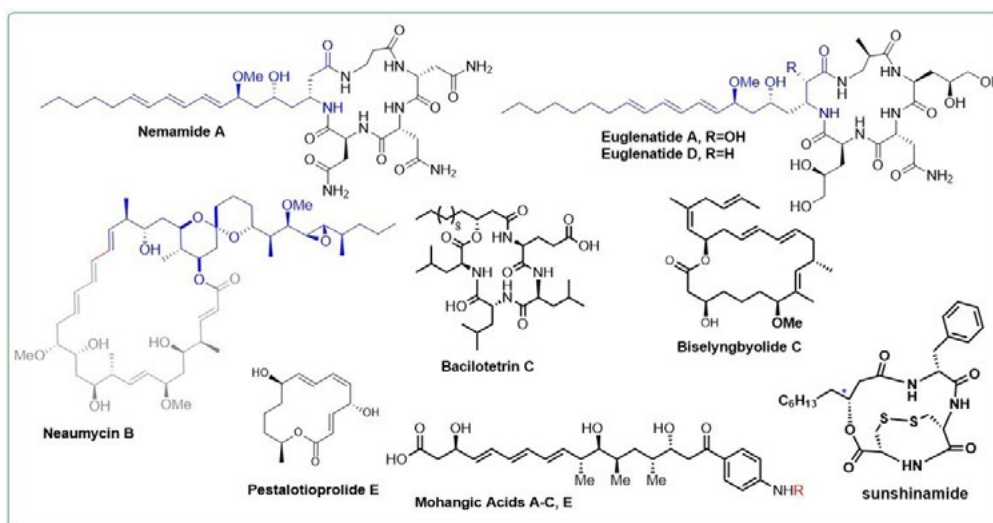


Figure 1: Targeted Natural Products of Our Interest.

Award/Recognition :

- » Fellow (FAScT), West Bengal Academy of Science & Technology

Publications in Journals :

1. Deciphering the Comprehensive Structure-Activity Relationship of Sunshinamide for Breast Cancer therapy through Dual Modulation of Apoptotic and Ferroptotic Pathways via TrxR1 and Gpx4 Inhibition - Akash Chatterjee, Joyanta Mondal, Subhojit Paul, Himangshu Sharma,, Rajib Kumar Goswami* and Prosenjit Sen*; *Journal of Medicinal Chemistry*, **67** (24), 21952-21974 (2024).[IF:6.9]
2. Unveiling the Anticancer Potential of Pestalotioprolide E, an unexplored macrolide: Targeting TRXR1-TRX1-ASK1-P38 Signaling Cascade in Triple-Negative Breast Cancer - Ruma Sarkar, Debobrata Paul, Akash Chatterjee, Anindita Bhattacharya, Sayantan Pradhan, Rajib Kumar Goswami* and Prosenjit Sen*; *Toxicology in Vitro*, 2024 (doi.org/10.1016/j.tiv.2024.105920) (2024).[IF:2.6]
3. Stereoselective Synthesis of the Northern Hemisphere of Proposed Structure of NeaumycinB - Himangshu Sharma, Sujan Paul, Swapnamoy Ganguly, Sourya Shankar Auddy and Rajib Kumar Goswami*; *Org. Biomol. Chem.*, **22**, 7203-7217(2024).[IF:2.9]
4. Total Synthesis of Lipopeptide Bacilotetrin C: Discovery of Potent Anticancer Congeners Promoting Autophagy - Sourya Shankar Auddy, Shalini Gupta, Subrata Mandi, Himangshu Sharma, Surajit Sinha,* and Rajib Kumar Goswami*; *ACS. Med. Chem. Lett*, **15**, 1340-1350. (2024).[IF:3.5]

5. Stereoselective Synthesis of Polyketide Segments of Nemamide A and Euglenatides D-E - Himangshu Sharma, Sujan Paul and Rajib Kumar Goswami*; *Synlett*, **35**, 2554-2558 (2024). [IF:2.2]
6. Stereoselective Synthesis of Key Skeleton of Mohangic Acids A-E - Joyanta Mondal, Sandip Guchhait, Himangshu Sharma and Rajib Kumar Goswami*; *Euro. J. Org. Chem*, **27**, e202400365 (2024).[IF:2.5]
7. Structure-Activity Relationship Study of Biselyngbyolide B Reveals Mitochondrial Fission-Induced Cytotoxicity in Cancer - Pratiti Mandal, Debobrata Paul, Himangshu Sharma, Sanu Saha, Partha Chakrabarti,* and Rajib Kumar Goswami*; *ACS. Med. Chem. Lett*, **15**, 696-705 (2024).[IF:3.5]

Ph.D. Degree Awarded :

- (1) Sourya Shankar Auddy (IACS Deemed to be University), (2) Himangshu Sharma (IACS Deemed to be University) and (3) Moinul Haque Sahana (IACS Deemed to be University).

Sponsored Project

- » Total Synthesis of Macrocyclic Anticancer Activities (SERB-DST)
- » Total Synthesis of Hybrid Analogues There of (SERB-CRG)

Lectures Delivered:

Invited talk at (1) ACS Spring 2025, San Diego, CA, USA, (2) IIT Bombay, (3) BBRC-Bangalore and (4) IIT Bombay.



Raju Mondal

Professor

Crystal Engineering, Metallogelation, Magnetic materials, Synthesis and characterization and reactivity studies of metal-organic frameworks, Role of hydrogen bonds and weak interactions in coordination polymers

Associates : (1) Subhendu Pramanik, RA, (2) Anniruddha Das, RA and (3) Gopeswar Das (Int. MS-PhD project)

Our research goals are centred around the synthesis and characterization of Metal-Organic Frameworks (MOF) and coordination polymers, coupled with identification of structure-property relationships in these systems. As a part of our ongoing research several novel 1D, 2D and 3D coordination polymers have been synthesized using a divergent sterically hindered polydentate ligand, methylenebis (3,5-dimethylpyrazole) (H_2MDP).

One of the most successful approaches for generating metal-organic frameworks (MOFs) would be reticular synthesis using a secondary building unit (SBU). The strategy is to identify a robust and reproducible building block (SBU) as a vertex and subsequently design a network by linking them with organic ligands of well-defined geometry. This, in effect, can pave the way for the strategic control of vertex geometry in the resulting MOFs, which should enable us to predict the topology of the resulting structure. We have identified a robust and reproducible metal-carboxylate non-cluster type SBU, designed with the proper utilization of the complimentary hydrogen bonding of the H_2MDP molecule and carboxylate group. Subsequently, we have successfully synthesized a series of coordination polymers based on this tailor-made SBU using benzene polycarboxylic acids as auxiliary ligands. It has been observed that the conformational freedom of the linker molecules plays a crucial role in determining both the dimensionality and topology of the final structure.

The Pyrazole molecules possess two different nitrogen atoms, which may be involved in both metal coordination and/or hydrogen-bonding

interactions. The H_2MDP molecule has two H-bond acceptor sites as well as two protonated nitrogen atoms, which can be used for hydrogen bond donating purpose. It has been observed earlier that the hydrogen bonds formed between coordinated H_2MDP and carboxylate groups play some pivotal role in the metal-organic coordination framework formation. This prompts us to evaluate the potential of this molecule as a co-crystallization agent to produce interesting supramolecular architecture. Accordingly, we have synthesized various interesting supramolecular architectures, including a polyrotaxane type network, constructed with heterosynthons in cocrystals of H_2MDP and acids. We have been able to identify three major supramolecular synthons that would be helpful in the prediction of structural motifs for these kinds of studies.

Publications in Journals :

1. Electrical-Magnetic Properties of Solvent-Induced Di- and Hexanuclear Lanthanide Complexes Based on an Unorthodox N-Rich Ligand - S. Saha, I. Tarannum, P. Pal, R. Datta, S. Bala, A. Ghosh, S. K. Singh* and R. Mondal*, *Cryst. Growth & Des.*, **25**, 624–638 (2025).[IF:]
2. Exploring the Water Oxidation Catalytic Activity of a Mn-Based Magnetic Metal-Organic Framework: The Role of Proton Conductivity and Oxygen Evolution Reaction Overpotential - S. Saha, A. De, S. Banerjee, A. K. Das, C. A. Ohlin,* and R. Mondal*, *Inorg. Chem.*, **63**, 110619-110633 (2024).[IF:]

3. Utilization of a trinuclear Cu-pyrazolate inorganic motif to build multifunctional MOFs - S. Saha, S. Akhtar, S. Pramanik, S. Bala and R. Mondal*, *Dalton Trans.*, **53**, 11021–11037 (2024). [IF:]

Sponsored Project

- » Nanometric Sensitizer Water Splitting – DST
- » Studies on Inorganic Cluster Research Foundation (ANRF), New Delhi



Satrajit Adhikari, FASc, FNASc

Senior Professor & Academic Coordinator (Result)

Theoretical developments on beyond Born-Oppenheimer treatment.

Associates : (1) Dr. Gourhari Jana, RA-1 (DST-SERB), (2) Saikat Hazra, SRF (DST-INSPIRE), (3) Mantu Kumar Sah, SRF (NF-OBC), (4) Mr. Ahitagni Roy, JRF (Institute), (5) Amarendra Ghosh, JRF (Institute) and (6) Avik Guchait, JRF (Institute).

- » Calculation of low-temperature based collision-induced rate coefficients for ortho-para conversion in the $H^+ + H_2$ reaction has been recently performed. Using a 3D time-dependent wave packet method on an ab initio adiabatic potential energy surface, we compute reaction probabilities and rate constants at low collision energies (up to 0.3 eV). The resulting ortho-para conversion ratios show very good agreement with quantum statistical models and reveal a temperature-dependent peak linked to low-rotational-state transitions.
- » Construction of the effective Hartree potential for H_2 on Cu(111) as introduced in our earlier work, is now extended on the interaction between H_2 and the Cu(111) surface by incorporating the effects of surface expansion at 925 K and using different models to describe surface vibrational modes. The results show that using 925 K phonons leads to the highest chemisorption probabilities and the lowest reaction threshold, closely matching experimental data. The 925 K surface temperature also proves more effective for excitation processes compared to other models.
- » Investigation of H_2 scattering from a Cu(111) surface at 925 K, comparing two models: effective Hartree potential (EfHP) and sudden approximation (SCM). Both models predict the reaction probability broadening with increased surface temperature. The SCM model shows improvements in scattering and diffraction, with significant attenuation in specular diffraction probabilities.
- » The quasi-classical dynamical calculations on a 2-state ab initio potential energy surface including nonadiabatic coupling terms as friction for $D^+ + H_2$ collisions, has been performed. It is shown that the resulting dynamics correctly accounts for nonreactive charge transfer, reactive non-charge transfer and reactive charge transfer processes. In addition, it leads to the formation of triatomic DH_2^+ species as well.
- » Development and application of the first-principles-based Beyond Born-Oppenheimer (BBO) theory, focusing on its accuracy and completeness in modelling electron-nuclear coupling effects. The BBO approach has been used to construct diabatic Hamiltonians for a

range of systems-including spectroscopically important molecules (e.g., NO_2 , NO_3 , Na_3), perovskite materials undergoing phase transitions, and reactive scattering processes (e.g., $\text{F} + \text{H}_2$). These Hamiltonians enable

quantum dynamical calculations that produce observables (e.g., spectra, rate constants) in strong agreement with experimental results. The article also highlights the integration of Jahn-Teller theory within the BBO framework.

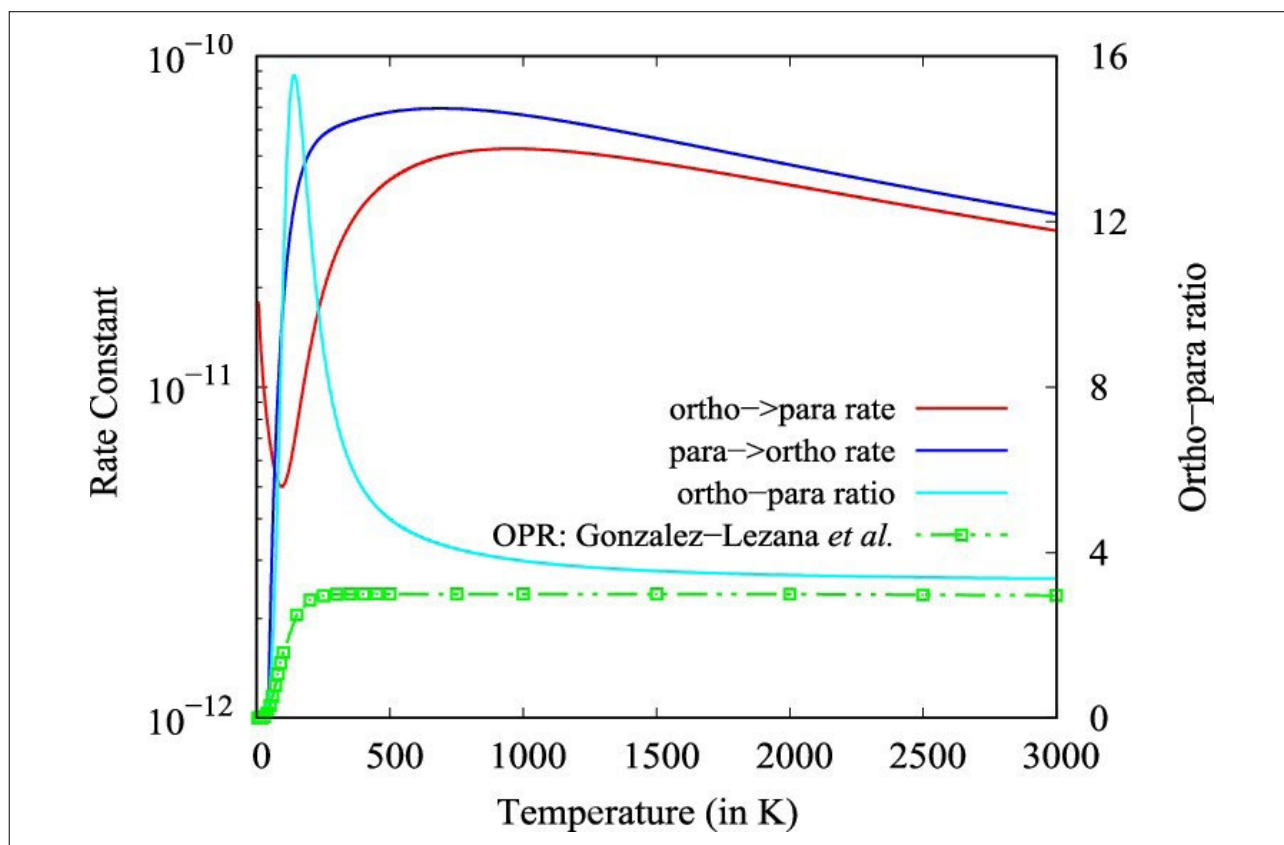


Fig. 1. Overall ortho-to-para and para-to-ortho rate constants along with the comparison of the ortho-to-para rate constant ratio with the results of other theoretical studies as a function of temperature.

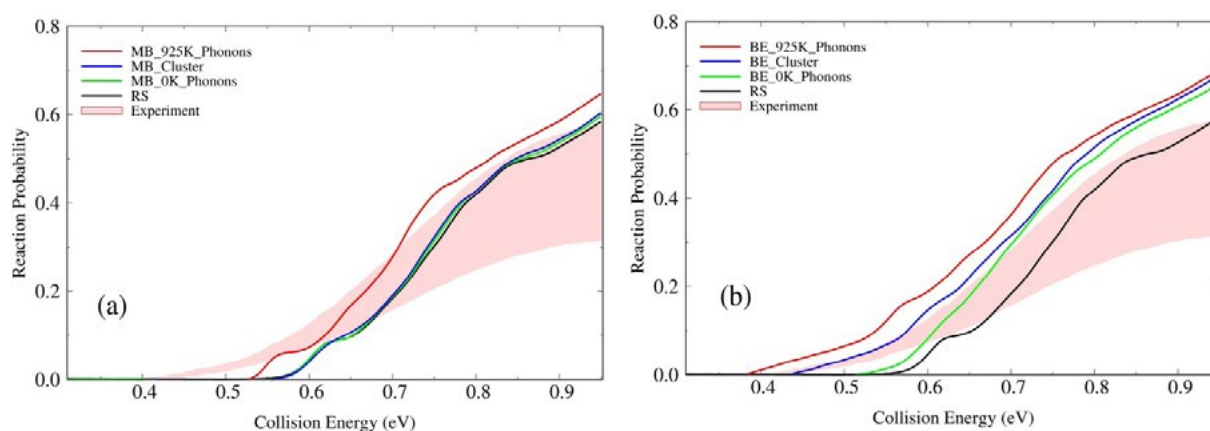


Fig. 2. Effect of BE vs. MB distribution of the vibrational states of surface modes of H_2 -Cu (111) system.

Ph.D. Degree Awarded :

(1) Koushik Naskar (IACS Deemed to be University).

Publications in Journals:

1. Beyond Born-Oppenheimer Treatment for Multi-State Photoelectron Spectra, Phase Transitions of Solids and Scattering Processes - S. Mukherjee, K. Naskar, S. Hazra, M. K. Sah, S. Adhikari, *J. Phys.: Conf. Ser.*, **2769**, 012012 (2024) [IF:0.94]
2. On the quantum dynamical treatment of surface vibrational modes for reactive scattering of H₂ from Cu (111) at 925 K-M. K. Sah, K. Naskar, S. Adhikari, B. Smits, J. Meyer, M. F. Somers, *J. Chem. Phys.*, **161**, 014306 (2024). [IF:3.1]
3. Quasi-Classical Trajectory Calculations on a Two-State Potential Energy Surface Including Nonadiabatic Coupling Terms as Friction for D⁺ + H₂ Collisions - S. Mukherjee, S. Saha, S. Ghosh, S. Adhikari, N. Sathyamurthy, M. Baer, *J. Phys. Chem. A*, **128**, 7691–7702 (2024). [IF: 2.7]

4. Ortho–Para Conversion for H⁺ + H₂ Collision in Low Temperature: A Fully Close-Coupled Time-Dependent Wave Packet Study – S. Hazra, K. Naskar, S. Adhikari, A. J. C. Varandas, *J. Phys. Chem. A*, **128**, 8833–8844 (2024). [IF:2.7]
5. Reactive scattering of H₂ on Cu (111) at 925 K: Effective Hartree potential vs sudden approximation –B. Smits, M. K. Sah, K. Naskar, S. Adhikari, J. Meyer, M. F. Somers, *J. Chem. Phys.*, **161**, 244116 (2024). [IF:3.1]

Sponsored Project

» Electron-Nuclear Coupling Scattering Processes.

Lectures Delivered:

Invited talk at (1) Istanbul, Turkey, (2) IIT Bombay, (3) CTTC – 2024, Mumbai, (4) DAE-SAACM – 2024, Mumbai, (5) IISER-Kolkata, (6) IISER-Mohali, (7) IISER-Kolkata and (8) IACS Kolkata.



Somdatta Ghosh Dey

Senior Professor

Bioinorganic Chemistry associated with Alzheimer's disease and Type 2 Diabetes : Spectroscopy and Kinetics.

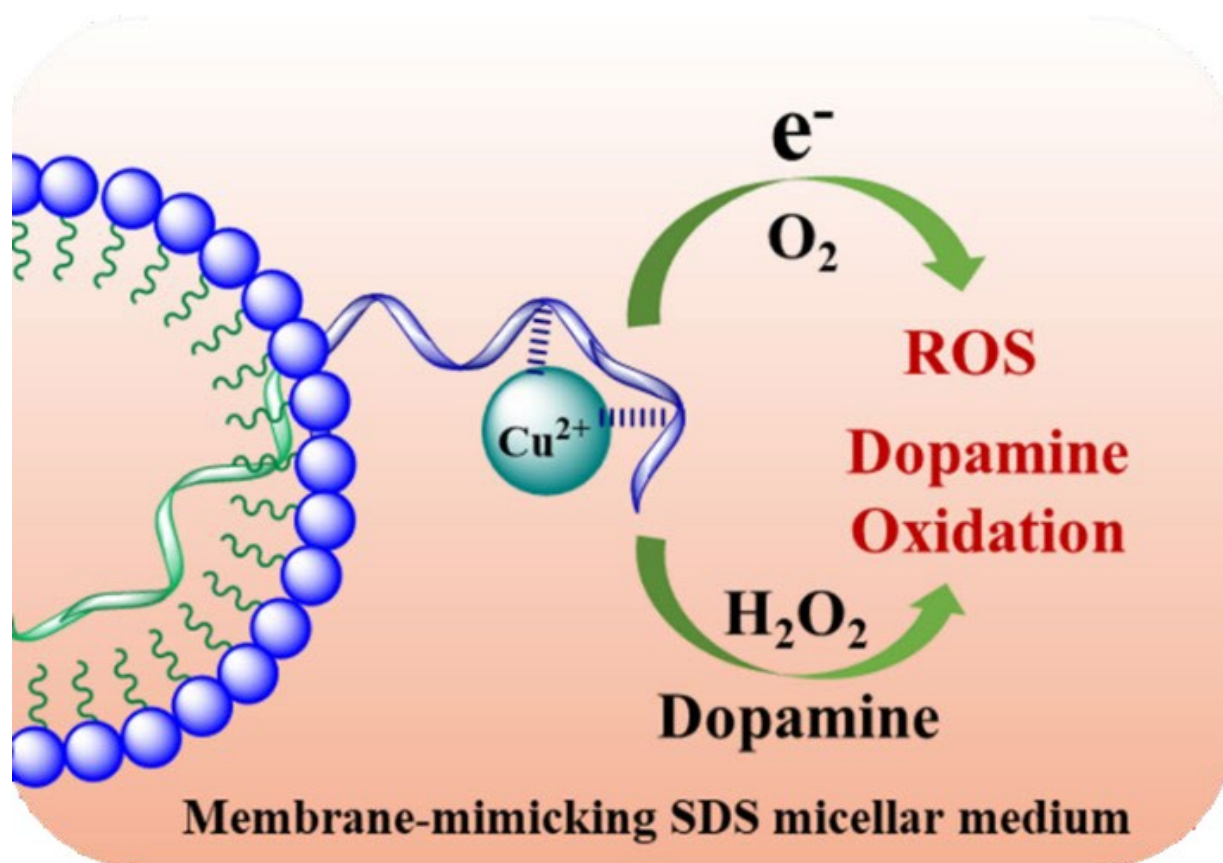
Associates : (1) Madhuparna Roy, (2) Chinmay Dey, (3) Rimi Ghosh and (4) Puja Pal.

Alzheimer's disease (AD) is characterized by the abnormal aggregation of amyloid β (A β) peptide in extracellular deposits generated upon proteolysis of Amyloid Precursor Protein (APP). While copper (Cu(II)) binds to A β in soluble oligomeric and aggregated forms, its interaction with membrane-bound A β remains elusive. Investigating these interactions is crucial for understanding AD pathogenesis. Here, utilizing SDS micelles as

a simplified membrane mimic, we focus on elucidating the interplay between membrane-anchored A β and copper, given their pivotal roles in AD. We employed spectroscopic techniques including UV, CD, and EPR to characterize the active site of Cu-A β complexes. Our findings demonstrate that copper interacts with A β peptides in membrane-mimicking micellar environments similarly to aqueous buffer solutions. Cu-A β complexes in this

medium also induce higher hydrogen peroxide (H_2O_2) production, potentially contributing to AD-related oxidative stress. Moreover, we observe an increased oxidation rate of neurotransmitter such

as dopamine by Cu-A β complexes. These results enhance our understanding of Cu-A β interactions in AD pathology and offer insights into potential therapeutic interventions targeting this interaction.



Schematic representation depicting copper interaction with A β peptides in membrane-mimicking SDS micellar environments, forming Cu-A β complexes that induce higher hydrogen peroxide (H_2O_2) production leading to an increased oxidation rate of neurotransmitter such as dopamine.

Publications in Journals :

1. Heme-A β Compound O: A Common Intermediate in ROS Generation and Peroxidase Activity - C Dey, P Pal, S Samanta, S Ghosh Dey, *Dalton Trans.* (Accepted), (2025).[IF: 3.5]
2. Hydrogen Oxidation by Bioinspired Models of [FeFe]-Hydrogenase - A Nayek, R K Poria, E Ahmed, S Patra, S Ghosh Dey, A Dey, *ACS Org. Inorg. Au.* **5**,105(2024).[IF:3.72]
3. Active Site Environment and Reactivity of Copper-A β in Membrane Mimetic SDS Micellar

Environment - C Dey, M Roy, R Ghosh, P Pal, D Roy, S Ghosh Dey, *Chem. Eur. J.*, **30**, e202401531 (2024).[IF:3.9]

Ph.D. Degree Awarded :

(1) Abhijit Nayek (IACS Deemed to be University), (2) Aishik Bhattacharya (IACS Deemed to be University) and (3) Madhuparna Roy (IACS Deemed to be University).

Sponsored Project

» Lytic Polysaccharide Amyloid- β Peptides

Lectures Delivered:

» Invited talk at (1) Keynote lecture at 20th International Conference on Biological Inorganic Chemistry, Adelaide, Australia and (2) RACS (IITB), Gopalpur.



Tapan Kanti Paine

Senior Professor & Vigilance Officer

Biomimetic Inorganic Chemistry and Bioinspired Catalysis.

Associates : (1) P Pal, NPDF (SERB); (2) M Pal, RA-I (SERB Project); (3) P Bhunia, RA-I (CSIR); (4) S N Chowdhury, RA-I (TRC Project); (5) S Biswas, RA-I (TRC Project) (6) S Sutradhar, SRF (IACS); (7) E Ghosh, Extended SRF (IACS); (8) A Bhowmik, Extended SRF (IACS); (9) R Samanta, SRF (CSIR); (10) S Mahapatra, SRF (CSIR); (11) T Mukherjee, SRF (CSIR); (12) A Maity, JRF (UGC); (13) P Ghosh, JRF (UGC); (14) A Dutta, JRF (UGC).

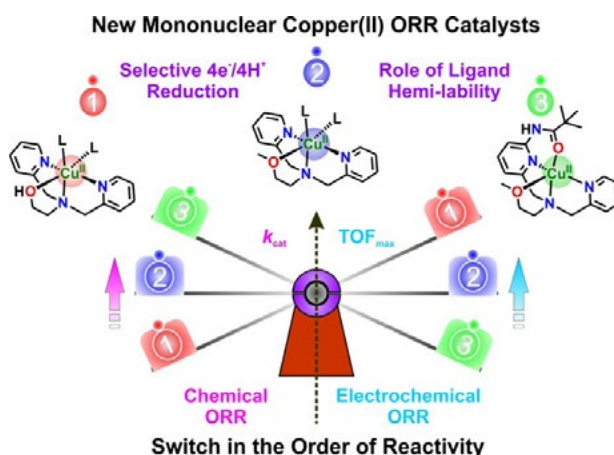
(1) Satadal Paul (TARE Fellow of SERB) : Computational Chemistry

Influence of Hemilabile Arm and Amide Functionality in Ligand Backbone on Chemical and Electrochemical Dioxxygen Reduction Catalyzed by Mononuclear Copper(II) Complexes:

Four mononuclear copper(II) complexes, [(DPA-OH)Cu(CH₃OH)(ClO₄)](ClO₄) (**1**), [(DPA-OMe)Cu(CH₃OH)(ClO₄)](ClO₄) (**2**), [(6-Amide-DPA-OMe)Cu](ClO₄)₂ (**3**) and [(6-Amide₂-DPA-OMe)Cu](ClO₄)₂ (**4**), of flexidentate ligands bearing hemilabile (hydroxy) methoxyethyl and/or amide group on DPA (di(2-picoyl)amine) backbone were isolated to explore their potency in catalyzing chemical and electrochemical oxygen reduction reaction (ORR). The role of a hemilabile arm, as well as amide functionality on the ligand backbone in affecting the rate-determining step (RDS) of the overall catalytic cycle has been explored and compared with that of the analogous [(tmpa)Cu(X)₂](ClO₄)₂ (tmpa = tris(2-pyridylmethyl)amine) and [(PV-tmpa)Cu](ClO₄)₂ (PV-tmpa = bis(pyrid-2-ylmethyl)[6-(pivalamido)pyrid-2-yl]methyl-amine) complexes. The hemilabile arm in these complexes results in an overall third-order rate, with k_{cat} values ranging from 10³ to 10⁴ M⁻²s⁻¹ during dioxxygen reduction catalysis. All the complexes except complex **4** selectively reduce dioxxygen via the 4e⁻/4H⁺ reduction pathway to water (H₂O) using decamethyl ferrocene (Fc*) as a sacrificial reductant in acidic acetone at 298 K. In contrast, altering the reaction conditions from a chemical to an electrochemical ambience in phosphate buffer displays a reverse order of ORR activity of the complexes while maintaining the

same product selectivity as observed in chemical ORR catalysis in acetone.

Inorg. Chem. **64**, 4983 (2025)



Award/Recognition :

» Editorial inorganic chemistry communications, ELSEVER Chemistry, Springer Nature.

Ph.D. Degree Awarded :

(1) Subhankar Sutradhar (IACS Deemed to be University),

Publications in Journals:

1. Influence of Hemilabile Arm and Amide Functionality in Ligand Backbone on Chemical and Electrochemical Dioxxygen Reduction Catalyzed by Mononuclear Copper(II) Complexes - A Das, S N Chowdhury, S Biswas, R Samanta, A N Biswas and T K Paine, *Inorg. Chem.*, **64**, 4983 (2025).[IF:4.3]

2. Stereoelectronic Tuning of Bioinspired Nonheme Iron(IV)-Oxo Species by Amide Groups in Primary and Secondary Coordination Spheres for Selective Oxygenation Reactions - R D Jana, A Das, R Samanta, S. Banerjee, S. Paul and T. K. Paine, *Inorg. Chem.* **63**, 21042 (2024). [IF:4.3]
3. Cobalt Catalyzed α -Hydroxylation of Arylacetic Acid Equivalents - R D Shinde, A R Paraskar, J Kumar, E Ghosh, T K Paine and S Bhadra, *J. Org. Chem.*, **89**, 9666 (2024). [IF:3.5]
4. Oxygenolytic cleavage of 1,2-diols with dioxygen by a mononuclear nonheme iron complex: Mimicking the reaction of myo-inositol oxygenase - S Sutradhar, R Rahaman, S Bhattacharya and T K Paine, *J. Inorg. Biochem.*, **257**, 112611 (2024). [IF: 3.8]
5. Sequential Oxygenation of Bis(β -Diketimate) on a Selective Diruthenium Platform - L Seikh, S Sutradhar, S Dhara, S K Bera, S Panda, T K Paine and G K Lahiri, *Inorg. Chem.* **63**, 10312 (2024). [IF:4.3]

Sponsored Project

- » Evaluation of Factors Oxidation Catalysis (SERB).
- » Probing into the molecule activation (SERB)

Lectures Delivered:

- » Invited talk at (1) BIT Mesra, (2) Sister Nivedita University, Kolkata, (3) IEST, Shibpur, (4) IIT Kanpur, (5) MTIC, IIT Kharagpur, (6) Chandannagar College, Hooghly and (7) Scottish Church College, Kolkata, (8) Chem-24, Kolkata, (9) ReACT-2025 and (10) RACS – 2024).



Tarun Kumar Mandal

Senior Professor

Polymer chemistry, Controlled polymerizations, Stimuli-responsive polymers, Polymer-peptide biohybrids, Functionalized polypeptides, Fluorescent polymers, Ionic liquids/Poly(ionic liquid)s, Polyzwitterions, Amino acid-based polymers, DNA/RNA polyplexation, Antifouling polymers.

Associates : (1) P. Dinda, SRF (SERB Project), (2) M. Kar, SRF (Institute), (3) A. Basak, SRF (CSIR), (4) J. Das, SRF (UGC), (5) S. Karmakar, SRF (Institute), (6) S. Barik, JRF (UGC) and (7) Bachchu Mandal, JRF (Institute).

Our group focus on various aspects of polymer chemistry where several different controlled/living polymerization techniques are used to synthesize stimuli-responsive smart homo-/block-copolymers, peptide-polymer conjugates, amino acid-based polymers, poly(ionic liquid)s, poly(zwitterions) and functionalized polypeptides.

Our other major focus is the studies of self-assembly behavior of unfunctionalized polypeptides, block copolymers and amino acid-based polymers into polymer nanostructures of different morphologies and their various specific applications including their use as delivery vehicles.

We are also continuing research on the development of poly(2-oxazoline)-based stimuli-responsive block/graft copolymers and their self-assembly into micelles/reverse micelles/conjugate micelles/vesicles for potential applications in drug delivery.

The development of novel poly(ionic liquid)s (PILs), PIL-based copolymer, poly(zwitterions) are also the key focus of our research group. Further, the special emphasis is given towards applications of these polymers in generating materials for sensing, energy storage and in particular for antifouling applications of poly(zwitterions).

The functionalization of polypeptides and amino-acid based polymers to introduce water solubility, thermoresponsiveness and for various biological applications including study of their antifouling are the key part of our research.

The development of fluorescent perylene-based and azopolymers/copolymers including their stimuli-responsiveness and self-assembly into fluorescent nanostructures is also the focus of our recent studies.

Publications in Journals :

1. Versatile Azo-Coupling Route to Amphiphilic Poly (2-Oxazoline) Graft Copolymers for Multi-Responsive Micelles and Enzymatic Demicellization -M. Kar and T. K. Mandal, *Macromolecules*, **58**, 1835-1850 (2025).[IF:5.2]
2. Multistimuli-Responsive Antiprotein-Fouling Benzimidazolium Poly (zwitterionic ionic liquid) s with Tunable UCST for Dispersion of Carbon Nanotubes and Cross-Linked Hydrogels - A Basak, M Kar, TK Mandal, *ACS Appl Polym Mater*, **6**, 11798-11812 (2024).[IF:4.7]
3. Individual and simultaneous encapsulation and delivery of incompatible dyes in biocompatible multicompartment terpolymer micelles - S. Jana, K. Bys, M. Stepanek, E. Pavlova, M. Psurski,

T. K Mandal, M. S. Appavou, M. Uchman, *Euro Polym J.*, **218**, 113344 (2024).[IF:6.3]

4. g-C₃N₄ Catalysed Sustainable Synthesis of (Hetero) aryl Acids and Regioselective α -bromo ketones In One Pot Under Visible Light Catalysis - S. Bischi, M. Kar, T.K. Mandal and D. Sarkar, *Catal. Sci. Technol.*, **14**, 2503-2513 (2024).[IF:6.2]
5. End-/side-chain fluorescent polymer conjugates: Stimuli-responsiveness and biological applications - M. Kar and T. K. Mandal, *J. Polym. Sci.*, **62**, 1074-1114 (2024).[IF:3.6]

Ph.D. Degree Awarded :

(I) Priyanka Dinda (IACS Deemed to be University)

Sponsored Project

- » Stimuli-Responsive Block..... And applications
- » Ionically Functionalized including Antifouling.

Lectures Delivered:

- » Invited talk at (I) Keynote address at WBSSTC-2025 in Presidency University, Kolkata.



SCHOOL OF MATHEMATICAL & COMPUTATIONAL SCIENCES



SCHOOL OF MATHEMATICAL & COMPUTATIONAL SCIENCES



Dr. Partha Basuchowdhury
School Chair

School Profile

People

Faculty	: 07
Post-doctoral Research Associate	: 04
Ph.D. Students	: 25
Non-Academic Staff	: 02

Extra Mural Funding

Projects (ongoing)	: 02
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Research Achievements

Research papers in Journals	: 30
Ph.D. degree awarded	: 01

Academic Activities

Talks delivered by members of department in conferences/symposia	National : 10
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Abhijit Kumar Das

Senior Professor

Theoretical and Computational Science

Associates : (1) R. Rathi JRF (UGC) (2) A. Ghosh, RA (Institute) (3) S. Banerjee, RA (Institute) and (4) S. Sarkar, RA (Institute)

1. Superalkali

Design of superalkalis and their possible applications.

2. Fullerene Functionalization

Functionalization of BN fullerenes for potential applications in hydrogen storage.

3. Solar energy

Enhancement of light harvesting in dye-sensitized solar cells

4. Hydrogels

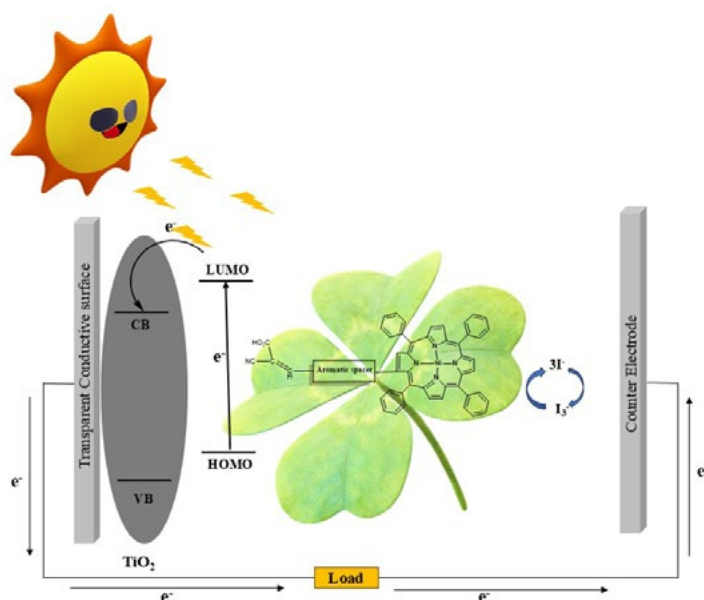
Mechanism and applications of self-healable hydrogels from vegetable oil.

5. Porphyrin systems

Porphyrin systems for effective use in solar cells.

6. Medicinal chemistry

Physicochemical properties, bioactivity and toxicity of drugs.



Enhancement of light harvesting in dye-sensitized solar cells

Publications in Journals

1. Superalkalies with Hydrogen as Central Electronegative Atom and their Possible Applications: Ab Initio and DFT Study - Subhendu Sarkar, Tanay Debnath, Abhijit K. Das, *Chem. Eur. J.* **30**, e202304223 (2024)[IF:]
2. Boosting Efficacy of Luminescent Zn (II) Grafted N-Doped GOQD Nanomaterial in Propelling Parkinson's Disease Care: A Computational Mechanistic Framework Exploring Doping Effect - Sneha Biswas, Tania Chowdhury, Soumadip Banerjee, Koushik Dutta, Abhijit K. Das, Debasis Das, *Chem. Asian J.* **19**, e202400629(2024)[IF:]
3. Construction of a series of pH stable Ca-based MOFs, their CO₂ adsorption and catalytic activity - Sudip Bhattacharjee, Tonmoy Chakraborty, Soumadip Banerjee, Abhijit K. Das, Asim Bhaumik, *Dalton Trans.* **53**, 11120-11132 (2024)[IF:]
4. Exploring the water oxidation catalytic activity of a Mn-based magnetic MOF: role of proton conductivity and OER Overpotential - Sayan Saha, Avik De, Soumadip Banerjee, Abhijit K. Das, C. André Ohlin, Raju Mondal, *Inorg. Chem.* **63**, 23, 10619 (2024)[IF:]
5. Fluorometric and naked eye detection of cadmium ion by reduced Schiff base zinc-based probe in potable water: Theoretical and experimental approach - Aditi Dhar, Tania Chowdhury, Soumadip Banerjee, Sayan Saha, Abhijit K. Das, Asim Bhaumik, Debasis Das, *Inorganica Chim. Acta.* **570**, 122162 (2024)[IF:]
6. UV-Assisted Photochemical Transformation of Tetranuclear Copper (II) Complex: A DFT Supported Study in β -Lactamase Inhibitory Activity Towards Antibiotic Resistance - Sneha Biswas, Suhana Karim, Pradip Bhunia, Soumadip Banerjee, Koushik Dutta, Abhijit K. Das, Debasis Das, *Dalton Trans.* **53**, 9979 (2024) [IF:]
7. A torquoselective thermal 6π -electrocyclization approach to 1,4-Cyclohexadienes via solvent-aided proton transfer: experimental and theoretical studies - Jayanta Saha, Soumadip Banerjee, Sidhartha Malo, Abhijit K. Das, Indrajit Das, *Chem. Eur. J.* **30**, e202304009 (2024)
8. Comparative analysis of Zn (II)-Complexes as model metalloenzyme for mimicking Jack Bean Urease - Rinku Ghanta, Tania Chowdhury, Avik Ghosh, Abhijit K. Das, Tanmay Chattopadhyay, *Dalton Trans.* **53**, 2373 (2024)
9. Theoretical Investigation of Physicochemical Properties, Bioactivity, and Toxicity of Common Anxiety Medications - Soumadip Banerjee, Pritha Ghosh, Rama Rathi, Avik Ghosh, Ria Sinha Roy, Abhijit K. Das, *Chemistry Select.* **9**, 45, e202404146 (2024)[IF:]
10. Self-Healable Hydrogels from Vegetable Oil: Preparation, Mechanism, and Applications - Chandrapaul Mukherjee, Avik Ghosh, Tamilarasi M, Kartik Ravishankar, Abhijit K. Das, Mariappan Selvaraj, Saikat Chaudhuri, Jit Sarkar, *Biomacromolecules.* **25**, 11, 7323-7333 (2024)[IF:]
11. Visible Light-Induced Regioselective E to Z Isomerization of Polarized 1,3-Dienes: Experimental and Theoretical Insights - Jayanta Saha, Soumadip Banerjee, Sidhartha Malo, Sidhartha Malo, Abhijit Bankura, Avik Ghosh, Abhijit K. Das, *J. Org. Chem.* **89**, 21, 15964-15971 (2024)[IF:]
12. Rational Design of Highly Porous Donor-Acceptor Based Conjugated Microporous Polymer for Photocatalytic Benzylamine Coupling Reaction - Sudip Bhattacharjee, Sumanta Mondal, Anirban Ghosh, Soumadip Banerjee, Abhijit K. Das, Asim Bhaumik, *Small.* **20**, 51, 2406723 (2024)
13. A Comparative Study of Electronic Structure, Adsorption Properties, and Optical Responses of Furan and Tetrahydrofuran Adsorbed Pristine, Al and Ga Doped B12X12 (X=N and P) Nanocages - Ria Sinha Roy, Soumadip Banerjee, Suniti Ghosh, Avik Ghosh, Abhijit K. Das, *J. Mol. Struct.* **1296**, 136854 (2024)[IF:]



Debarshi Kumar Sanyal

Assistant Professor

Machine learning, Deep learning, Natural language processing, Digital library technologies.

Associates : (1) Suman Adhya, SRF (Institute), (2) Prantika Chakraborty, SRF (Institute), (3) Avishek Lahiri, SRF (Institute) and (4) Anal Roy Chowdhury, JRF (Institute)

His research focuses on natural language processing, with a specific emphasis on analyzing scholarly documents. He and his collaborators and students have developed techniques to enhance the performance of neural topic models. His published work also includes datasets for named

entity recognition (NER) in AI/ML scholarly literature, algorithms for extracting named entities and relations from agricultural research papers, and the design of improved text summarization systems. His research seeks to develop effective information retrieval systems for academic literature.

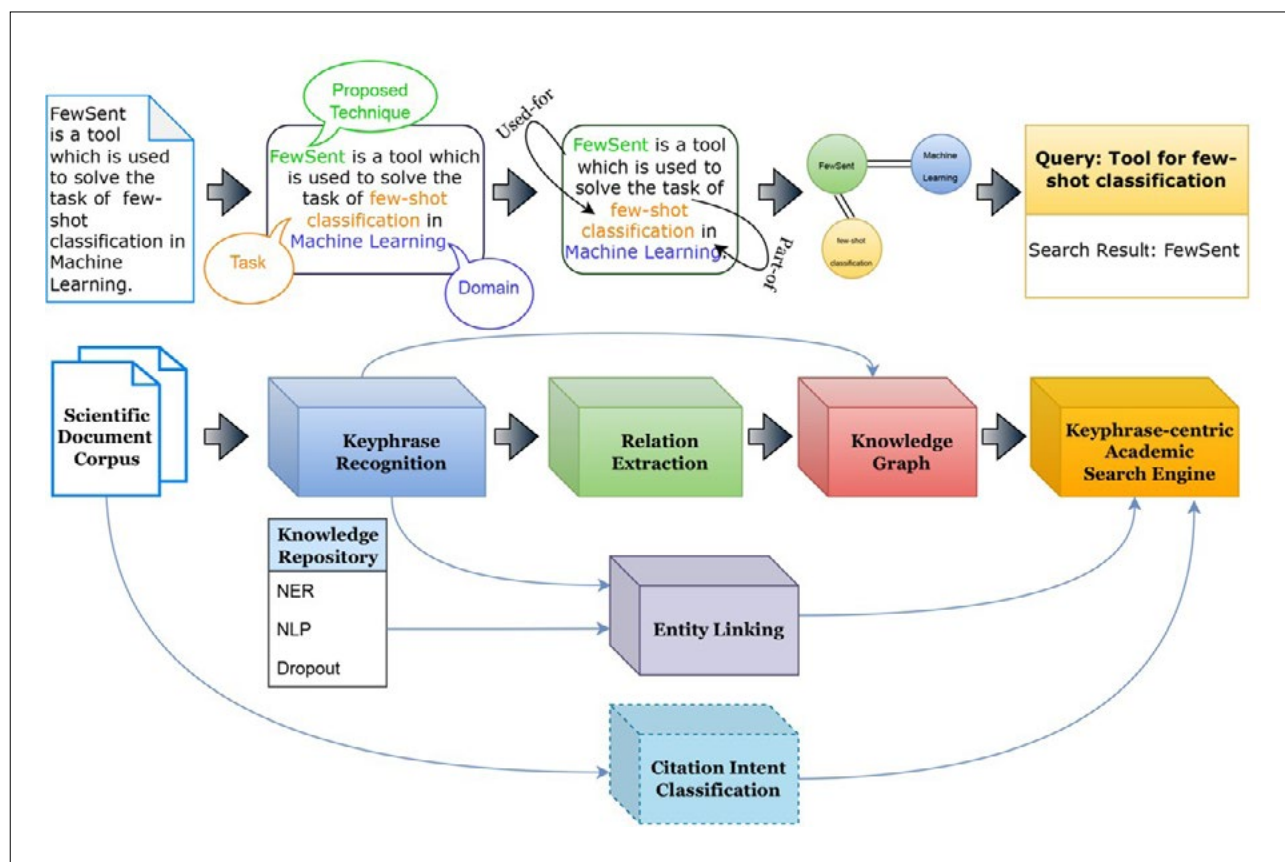


Figure 1: Search engine for academic literature.

Publications in Journals

1. Can pre-trained language models generate titles for research papers? - T. Rehman, Sanyal, Sanyal and S. Chattopadhyay, In *Proceedings of the 26th International Conference on Asian Digital Libraries (ICADL)* (pp. 154-170). (2025) Springer, Singapore. (Best Student Paper Runner-Up Award)
2. Fine-tuned encoder models with data augmentation beat ChatGPT in agricultural named entity recognition and relation extraction – S. De, D.K. Sanyal, and I. Mukherjee, *Expert Systems with Applications*, 277, 127126. (2025).[IF: 7.5]
3. Evaluating negative sampling approaches for neural topic models – S. Adhya, A. Lahiri, D.K. Sanyal and P.P. Das, *IEEE Transactions on Artificial Intelligence*, 5(11), 5630-5642. (2024). [IF:]
4. Few-TK: A dataset for few-shot scientific typed keyphrase recognition. A. Lahiri, P. Sarkar, M. Sen, M, D.K. Sanyal and I. Mukherjee, In *Proceedings of the 2024 Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL Findings)*. (2024).
5. GINopic: Topic modeling with graph isomorphism network – S. Adhya, and D.K. Sanyal, In *Proceedings of the 2024 Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL)* (2024).[IF:]
6. Hallucination reduction in long input text summarization T. Rehman, R. Mandal, A. Agarwal and D.K. Sanyal, In *Proceedings of the International Conference on Security, Surveillance and Artificial Intelligence (ICSSAI-2023)* (pp. 307-316). CRC Press. (2024).

Sponsored Project :

- » Extraction, Organization and Query (DST-SERB) (with IIIT Kalyani)

Lectures Delivered :

Invited talk at (1) Jadavpur University, (2) NIT Uttarakhand and (3) Tata Consultancy Services.



Mithun Mukherjee

Associate Professor

Operator Algebra, Operator Theory, Dilation Theory, Non-Commutative Dynamics, Linear Algebra.

Associates : (1) Atanu Dhang (SRF) (2) Saheb Ali Rakkha (PG), (3) P. Biswas (PG) and (4) A. Talukdar (PG).

- » Higher rank numerical range of an operator is well known. We give a description of higher rank numerical range of a normal operator on an infinite dimensional Hilbert space and using this description we find various results in dilation theory. We found an affirmative solution of a conjecture posed by Halmos.
- » We generalize Halmos conjecture in various generalized ranges and obtain various interesting results.
- » Matricial range of an operator was introduced by Arveson. We obtain various results on matricial range and its connection to dilation theory. This work is still in progress.



Partha Basuchowdhuri

Associate Professor & School Chair

Applications of Deep Learning in Natural Language Processing (NLP) and Bioinformatics, Biomedical Image Processing, Social Networks.

Associates : (1) Madhusudan Ghosh NLP, (2) Shrimon Mukherjee (SRF) : Drug repurposing, (3) Payel Santra (SRF): Fact verification; (4) Samiran Dey (SRF, funded by DBT-Vinnova project): Biomedical image processing.

The research group led by Dr. Partha Basuchowdhuri focuses on applications of machine learning, specifically deep learning in several domains, such as natural language processing (NLP), biomedical image processing and crystal property prediction. In NLP, we have worked on context-relevant information extraction and claim verification. In image processing, we have worked on both radiology, as well as histopathology images, for attaining different goals. However, super-resolving low-resolution images has been one focus area for all types of medical images. We have also worked towards generating a distributed representation (embedding) for atoms present in crystals, for the purpose of crystal property prediction.

Natural language processing (NLP), biomedical image processing and crystal property prediction.

We focus on advancing artificial intelligence for impactful applications across crystal property prediction, biomedical imaging, scientific document understanding, and natural language processing. Our recent efforts extend to addressing misinformation propagation and improving the robustness and reliability of large language models (LLMs) through data-efficient learning and information retrieval-based methods. We also explore the intersection of AI with basic sciences, contributing to materials science and genomics by developing deep learning frameworks that capture complex patterns in structural and sequence data. A key aspect of our research is the extraction of structured information from unstructured scientific and clinical texts, enabling better access to critical insights and accelerating knowledge discovery. In

the biomedical domain, we work on uncertainty estimation, cross-modal medical data synthesis, cancer grading and survival risk prediction, leveraging multimodal data to improve diagnostic accuracy and clinical outcomes. Our work is unified by a commitment to developing generalizable, interpretable, and robust AI solutions that adapt across domains and data types, addressing both theoretical challenges and real-world problems.

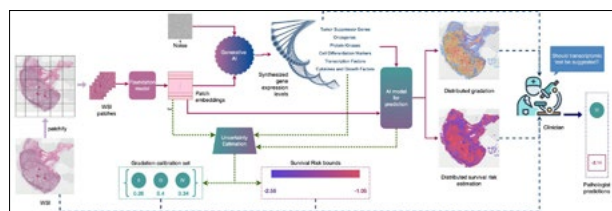


Fig 1. Our novel diffusion based crossmodal generative model, PathoGen, synthesizes transcriptomic features from whole slide image patch embeddings, obtained using a state-of-the-art foundation model from the whole slide images. Multimodal prediction is performed for both diagnosis (cancer grading) and prognosis (survival risk) using the synthesized transcriptomic data and histopathology images to predict the added value of transcriptomic data, for each patient. Uncertainty quantification provides a patient-level estimate of model reliability and provides clinicians with survival risk bounds and tumour grade prediction sets which are guaranteed to contain the ground truth with a specified probability. Distributed predictions also provide a window to understand the intra-tumour heterogeneity. (under review Nature Comm.)

Publications in Journals :

1. Uncertainty estimation using boundary prediction for medical image super-resolution - S. Dey, P. Basuchowdhuri, D. Mitra, R. Augustine, S. K. Saha, and T. Chakraborti, *Computer Vision and Image Understanding*, **256**, (2025).[IF:]
2. *Generating crossmodal gene expression from cancer histopathology improves multimodal AI predictions* – S. Dey, C.R. Banerji, P. Basuchowdhuri, S.K. Saha, D. Parashar and T. Chakraborti, *ArXiv*, *abs/2502.00568*. (2025). (under review in *Nature Comm.*)

Lectures Delivered :

Invited talk at (1) Heritage Institute of Technology, Kolkata, (2) Vardhaman College of Engineering, Hyderabad and (3) Viswa-Varati University.

Sponsored Project:

- » AI based Detection of Acute Respiratory Distress Syndrome (AI-DARDS): An artificial intelligence aidedmicrowave sensors - DBT



Raja Paul

Professor

Soft-matter biophysics & statistical mechanics

Associates : (1) Apurba Sarkar, RA-I (2) Pinaki Nayak, SRF, (3) Aditya Kumar Dutta, SRF, (4) Surabhi Saha, JRF (5) Prasanta Kumar Biswas, JRF, (6) Kritika Biswas (MS project) and (7) Jaydip Barua (MS project)

The research group led by Prof. Raja Paul focuses on the physics of both living and non-living systems. They use statistical mechanics along with Monte Carlo and molecular dynamics simulations to study active matter and biological processes, including cell division, intracellular transport, and structural organization. The group also investigates phase transitions and domain coarsening in disordered materials through computational modeling.

The Paul group explores the large-scale behavior of both living and non-living systems using theoretical and computational approaches (see Figure 1). A core part of their work involves developing agent-based models to study biological processes at the sub-cellular and tissue levels, such

as organelle assembly, chromosome segregation during mitosis, and the positioning of the mitotic organizing center in yeast and mammalian cells. They also design computational frameworks to investigate active matter, focusing on collective motion and phase coexistence in systems with complex interactions. In parallel, the group studies passive systems, including domain coarsening in disordered magnets and frustrated magnetic materials. Their models are routinely validated through comparisons with experimental results from collaborating research groups.

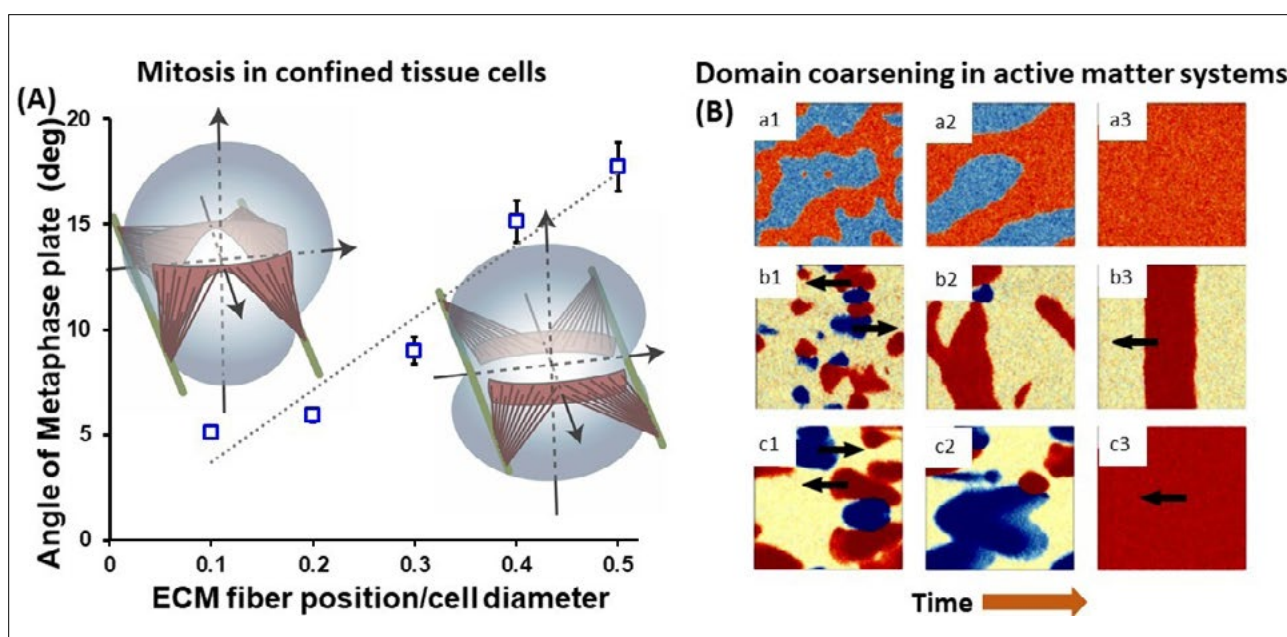


Figure 1: (A) Schematic of metaphase plate orientation during mitosis for cells confined and deformed by ECM fibers (<https://doi.org/10.1101/2024.04.12.5892v1>). (B) Comparative features of domain coarsening in passive (a1-a3) and active matter systems with low (b1-b3) and high (c1-c3) densities. (S Bandyopadhyay et al, *Physical Review E* 109 (6), 064143)

Ph.D. Degree Awarded :

1. Mintu Karmakar (IACS Deemed to be University).

Publications in Journals :

1. Consequence of anisotropy on flocking: the discretized Vicsek model - M Karmakar, S Chatterjee, R Paul, H Rieger, *New Journal of Physics*, **26** (4), 043023 [IF:2.8]

2. Ordering kinetics in the active Ising model, S Bandyopadhyay, S Chatterjee, AK Dutta, M Karmakar, H Rieger, R Paul, *Physical Review E*, **109** (6), 064143 [IF:2.2]

Lectures Delivered :

Invited talk at (1) IC-ETCMP-2025, GGV, Bilaspur, (2) IABS 2025, IACS, Kolkata (two lectures) and (3) TSU, JNCASR.



Rajarshi Ray

Associate Professor

Formal Verification, Model-Checking Cyber-Physical Systems, Explainable Artificial Intelligence.

Associates : (1) Arvind Adimoolam (RAI) (2) Mr. Mir M. Sajid Sarwar (SRF), (3) Mr. Atanu Halder (SRF), (4) Asif Iqbal (JRF), (5) Sauvik Gon (MS student) and (6) Akash Kumar (MS Student) (7) Arkopal Das (MS Student).

Explaining un-solvability of planning problems is of significant research interest in explainable AI planning. We propose to adopt the philosophy of sub-problem identification as an efficient mechanism for analyzing and explaining un-solvability of planning problems in hybrid systems. For a given unsolvable planning problem, we provide an algorithm to identify common waypoints in order, which are universal obstacles to planexistence. Subsequently, we identify the first waypoint that is unreachable from the initial configuration and flag that to the user as the explanation of un-solvability.

In a different thread, we develop a framework for cyber-physical systems (CPS) that (a) connects the falsification problem of CPS with the falsification of deep neural networks (DNNs) and (b) leverages the inherent interpretability of Decision Trees for faster falsification of CPS. We achieve this by: (1) building a surrogate model of the CPS under test, either as a DNN model or a Decision Tree, (2) application of various DNN falsification tools to falsify CPS, and (3) a novel falsification algorithm guided by the explanations of safety violations of the CPS model extracted from its Decision Tree surrogate.

Warehouse automation domain

31	32	33	34	35	36
25	26	27	28	29	30
19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

A robot (Blue cell 5) finds no route to the destination (red cell 19) in a warehouse. The waypoints are marked Wi. The first unreachable waypoint is cross marked cross, detected by our algorithm.

Publications in Journals :

1. The min-move mutual visibility problem for disoriented asynchronous robots - S. Bhagat, K. Mukhopadhyaya, R. Ray, Theoretical Computer Science, **1035** (2025). [IF: 0.9]

Lectures Delivered :

Invited talk at (1) IIT, Hyderabad.



Sayani Bera

Associate Professor

Holomorphic Dynamics, Several complex variables, Potential theory.

Associates : (1) M. Pal, JRF (DST-Inspire) and (2) G. Saha, JRF (Institute).

We study the dynamical properties of automorphisms in $\mathbb{C}^m, m \geq 2$. In particular we investigate iterated dynamical system of an automorphism or dynamics of non-autonomous families of **certain** classes of automorphisms of $\mathbb{C}^m, m \geq 2$. In this context we study Fatou-Bieberbach domains, arising as the basin of attraction of an automorphism corresponding to an attracting fixed point in $\mathbb{C}^m, m \geq 2$. Further, by revising some of the techniques for complex Hénon maps appropriately, we resolve a long-standing open problem, concerning the existence of such domains.

link.springer.com/article/10.1007/s00222-024-01295-9.

Lectures Delivered :

Invited talk at (1) NCM, Behala College (two lectures), (2) IIT Bhubaneswar, (3) NISER Bhubaneswar, (4) TCG CREST, (5) IIT Jammu and (6) VERI Belur.

Sponsored Project:

» SERB MATRICS : Project
Number:NTR/2023/001435

Publications in Journals :

1. Uniform non-autonomous basins of attraction – S. Bera and K. Verma, *Inventiones Mathematicae*, 238, 995–1040, (2024), <https://>



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Professor Narayan Pradhan
School Chair

School Profile

People

Faculty	: 07
Post-doctoral Research Associate	: 15
Ph.D. Students	: 48
Non-Academic Staff	: 02

Extra Mural Funding

Projects (ongoing)	: 16
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Research Achievements

Research papers in Journals	: 61
Ph.D. degree awarded	: 09

Academic Activities

Colloquium Lecture organized	: Nil
Talks delivered by members of School in conferences/symposia	National : 18 Intl : 07



Amitava Patra, FASc, FNASc

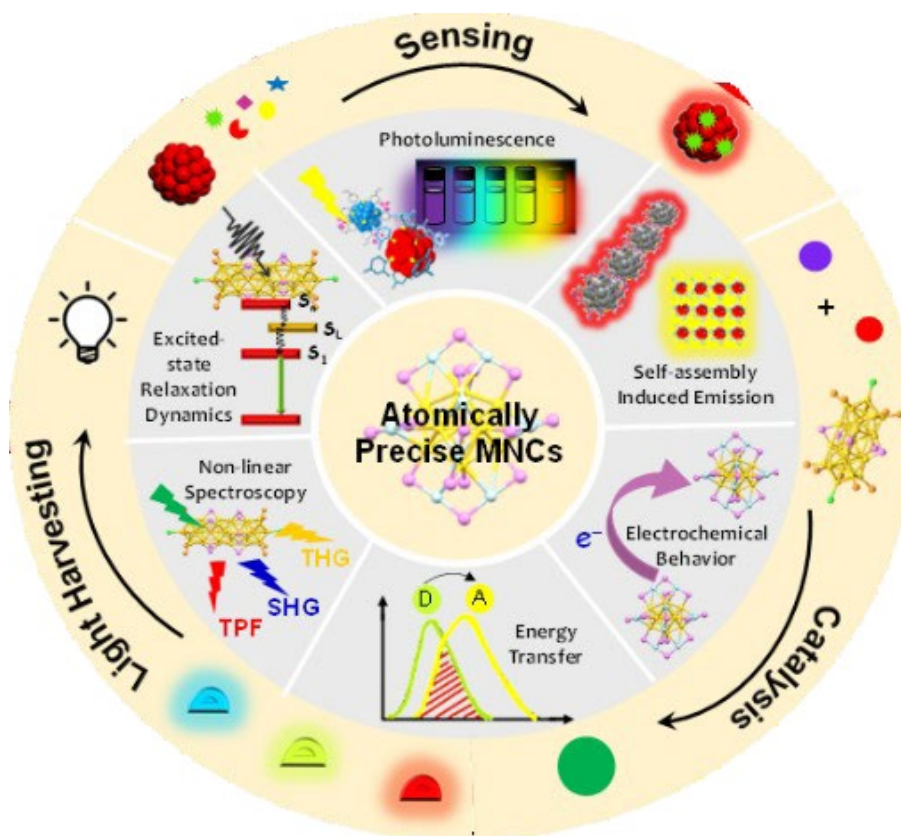
Senior Professor

Our research focuses on understanding the ultrafast dynamics of two-dimensional (2D) semiconductor nanoplatelets (NPLs), quantum dots, metal clusters, perovskite nanocrystals, polymeric nanoparticles, and carbon dots for designing efficient light-harvesting systems.

Associates : (1) Dr. Antika Das, Research Associate-I (TRC), (2) Dr. Goutam Ghosh, Research Associate-I (TRC), (3) Dr. Anusri Medda, RA-I, (4) Dr. Kritiman Marjit, RA-I, (5) Dr. Sarita Kolay, RA-I, (6) Ms. Sikta Chakraborty, SRF (Int PhD), (7) Mr. Soubhik Ghosh, SRF (CSIR) and (8) Ms. Sanchita Paramanik, JRF (Int PhD).

Precisely doped metal nanoclusters (NCs) are emerging nanomaterials for their unique photophysical properties. With the size approaching the Fermi wavelength of the electrons, their energy levels are well-separated, leading to molecule-like properties like discrete single electronic transition, tunable photoluminescence (PL), inherent structural anisotropy, and distinct redox behavior. They have < 2 nm diameter, which introduces

molecular-like behavior such as discrete HOMO-LUMO gaps, intense luminescence, unusual redox behavior, chirality, and intrinsic magnetism. Ligand-protected metal nanoclusters are an emerging class of nanomaterial at the interface of atomic and plasmonic regimes with unique photophysical and electrochemical properties, which leads to diverse applications (Scheme 1).



Scheme 1: Illustration of MNCs' different photophysical and electrochemical behavior with diverse applications.

Our research work aims to design colloidal hybrid nanomaterials based on two-dimensional (2D) perovskite nanocrystals, CdSe nanoplatelets, NPLs, and metal clusters (MNCs) for emerging light-harvesting systems by controlling the energy and charge carrier dynamics. We have tried to investigate into a complex synthesis method of colloidal hybrid nanomaterials, physics, charge carrier dynamics with ultrafast spectroscopy, and theoretical modeling of optical properties.

Award/Recognitions :

- » Senior Editor, 2025, Journal of Physical Chemistry Letters
- » Member of Editorial Advisory Board, ChemNanoMat
- » Member of Editorial Advisory Board, ChemPhysChem
- » Chairperson, Scientific Advisory Council (SAC), IASST, Guwahati
- » Member, Academic Council Committee, Chandigarh University.

Publications in Journals :

1. A comprehensive review of atomically precise metal nanoclusters with emergent photophysical properties towards diverse applications - Subarna Maity, Sarita Kolay, Sikta Chakraborty, Aarti Devi, Rashi, and Amitava Patra, *Chem. Soc. Rev.*, **54**, 1785 – 1844 (2025) [IF:40.4]
2. Ligand-to-Metal Charge Transfer Controls the Photophysical Properties and HER Activity of Ag₁₃ NCs Depends on the Hydrogen Adsorption Energy, Aarti Devi, Harshita Sekhsaria, Rashi, Abir De Sarkar, and Amitava Patra, *J. Phys. Chem. Lett.*, **16**, 2561–2569. (2025).[IF:4.9]
3. Tailoring Förster Resonance Energy Transfer in Copper Nanoclusters-Polymer Nanoparticles Composites through Ligands, Rashi - Srijon Ghosh, Aarti Devi and Amitava Patra, *Chemistry - An Asian Journal*, e202401616. (2025).[IF:3.5]
4. Enhancing Hydrogen Evolution Reaction Activity through Interface Charge Transfer in 2D CdSe/CdS Core/shell Nanoplatelets-2D MoS₂ NSs Composites - Anusri Medda, Rathindranath Biswas, Soubhik Ghosh, Krishna Kanta Halder, and Amitava Patra, *Energy & Fuels*, **39**, 1409–1417. (2025).[IF:5.2]

5. Power-Dependent and Ultrafast Spectroscopic Studies of Ag Ions Doped Colloidal CdSe Nanoplatelets - Soubhik Ghosh, Anusri Medda, Deepesh Kalauni, and Amitava Patra, *Physical Chemistry Chemical Physics*, **27**, 971 – 978. (2025).[IF:2.9]
6. The impact of ligand chain length on HER performance of atomically precise Pt₆(SR)₁₂ nanoclusters - Lipipuspa Sahoo, Supriti Dutta, Aarti Devi, Rashi, Swapan K Pati and Amitava Patra, *Nanoscale*, **17**, 1544–1554. (2025).[IF:5.8]
7. Synthesis of Atomically Precise Ag₁₆ Nanoclusters and Investigating Solvent-Dependent Ultrafast Relaxation Dynamics - Sikta Chakraborty, Sarita Kolay and Amitava Patra, *Nanoscale*, **16**, 16913 – 16918. (2024).[IF:5.8]
8. Laser-synthesized plasmonic HfN-based nanoparticles as a novel multifunctional agent for photothermal therapy - A. I. Pastukhov, M. S. Savinov, I. V. Zelepukin, J. S. Babkova, G. V. Tikhonowski, A. A. Popov, S. M. Klimentov, A. Devi, A. Patra, I. N. Zavestovskaya, S. M. Deyev, A.V. Kabashin, *Nanoscale*, **16**, 17893–17907. (2024).[IF:5.8]
9. Chirality of CsPbBr₃ Nanocrystals with Varying Dimensions in the Presence of Chiral Molecules - Antika Das, Supriya Ghosal, Kritiman Marjit, Swapan K Pati, and Amitava Patra, *J. Phys. Chem. Lett.*, **15**, 7822–7831 (2024).[IF:4.9]
10. Ultrafast Photo-Induced Dynamics of Styryl-Substituted BODIPY Dyes and Their Aggregates - Srijon Ghosh, Soumyaditya Mula, Protap Biswas, and Amitava Patra, *J. Phys. Chem. C*, **128**, 12762–12774. (2024).[IF:3.3]
11. Evidence of Energy and Hole Transfer between 2D CdSe_{0.7}Te_{0.3} Alloy NPLs with Porphyrin Molecules - Parneli Ghosh, Anusri Medda, Soubhik Ghosh, and Amitava Patra, *ChemPhysChem*, e202400267 (1 of 7) (2024). [IF:2.3]
12. Introducing Ag Dopants into CdSe Nanoplatelets (NPLs) Leads to Effective Charge Separation for Better Photodetector Performance - Soubhik Ghosh, Anusri Medda, and Amitava Patra, *Chem. Asian J.*, e202400528 (1 of 8). (2024).[IF:3.5]
13. Effect of A-Site Cations on Carrier Relaxation Dynamics of APbBr₃ (A= Cs/MA/FA) Perovskites

Nanoplatelets - Kritiman Marjit, Antika Das, Debarati Ghosh, and Amitava Patra, *J. Phys. Chem. C*, **128**, 8357–8364. (2024).[IF:3.3]

14. Providing a Review of Hot Carrier (HC) Relaxation Dynamics and Strategies of HC Extraction in Perovskites Nanocrystals - Kritiman Marjit, Antika Das, Debarati Ghosh, and Amitava Patra, *ChemNanoMat* (Invited Review), e202300629 (1 of 19). (2024).[IF:2.6]
15. Cumulative Impact of Ligands on the Optical Properties of Ag₂₁ Nanoclusters: Insight into the Relaxation Dynamics - Sarita Kolay, Sikta Chakraborty, Susmita Pramanik and Amitava Patra, *J. Phys. Chem. C*, **128**, 7643-7651. (2024). [IF:3.3].

Ph.D. Degree Awarded :

(1) Kritiman Marjit (IACS Deemed to be University) and (2) Sarita Kolay (IACS Deemed to be University).

Lectures Delivered :

Invited talk at (1) Keynote address, Guru Nanak Dev University, (2) Gordon Research Conference, Switzerland, (3) ICLO 2024, Petersburg, Russia, (4) Keynote address, MIT World Peace University, Pune, (5) SP Sengupta Memorial Lecture, IACS, (6) Keynote address ICNP-2024, Shenzhen, (7) ICFNA-2024, BITS Pilani Goa, (8) MRS, Boston, (9) UNOOS, IISER-Mohali and (10) JECRC University, Jaipur.



Asim Bhaumik

Senior Professor

Designing nanoporous materials for gas storage, metal ion sensing, water purification, eco-friendly catalysis for the synthesis of organic fine chemicals, CO₂-fixation, electrochemical/ photoelectrochemical water splitting, CO₂ reduction reactions and biomedical applications.

Associates : (1) A Ghosh SRF (CSIR), (2) S Chongdar SRF (Int-PhD), (3) S Bhattacharjee SRF (Institute), (4) R Chatterjee SRF (CSIR), (5) S Paul JRF (CSIR), (6) B Malakar JRF (UGC), (7) S Mondal JRF (UGC), (8) N Maity JRF (UGC) and (9) M Maji JRF (Tata Steel Project).

Presence of nanoscale porosity in the organic, organic-inorganic hybrid and purely inorganic frameworks is highly desirable in enhancing the potential application of the resulting materials in several frontline areas of energy, environmental and biomedical research. We have designed several novel porous organic polymers (POPs), covalent organic frameworks (COFs), metal-organic frameworks (MOFs) through hydrothermal/ solvothermal or condensation/polymerization of molecular building blocks. These materials are thoroughly characterized by using powder XRD, N₂ sorption, SEM/TEM-EDX, FTIR, UV-Vis., photoluminescence spectroscopy, XPS, WDXRF, TPD-NH₃/CO₂, solid state MAS NMR, etc. Eco-friendly liquid and gas phase

organic transformations are carried out using these porous nanomaterials as heterogeneous catalyst under mild conditions. CO₂ storage and sensing potential of these functionalized porous materials as adsorbent as well as heterogeneous catalysts for the CO₂ fixation reactions for the synthesis of value added fine chemicals are explored. Some of these porous nanomaterials showed outstanding catalytic activity in the photo/electrochemical water splitting and CO₂ reduction reactions, and these processes are highly sustainable. Some of these materials are also employed as drug-delivery vehicle for targeted delivery of anti-cancer drugs and thus they are very demanding in biomedical research.

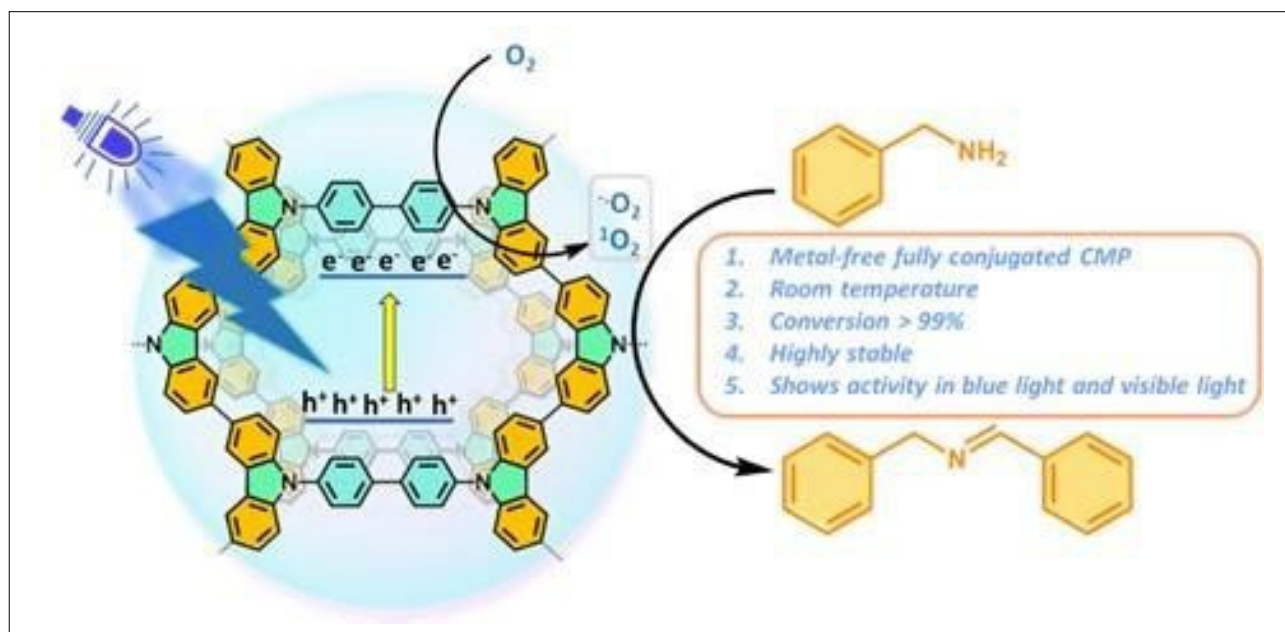


Figure . A new conjugated microporous polymer bearing donor-acceptor moieties with highly porous nanofiber architecture is reported for the photocatalytic C-N coupling reaction under visible light irradiation (*Small* **2024**, *20*, 2406723).

Publications in Journals :

1. Low Potential Electrochemical CO₂ Reduction to Methanol over Nickel-Based Hollow OD Carbon Superstructure - S Chongdar, R Chatterjee, S Reza, S Pal, R Thapa, R Bal, A. Bhaumik, *Advanced Energy Materials*, **15**, 2403809. (2025). [IF:24.4]
2. Graphene-sponges containing multi-walled carbon nanotubes for electrosorption of salt-ions - R Patil, D Jiang, X Xu, N Kumar, S Bhattacharjee, S K Yadav, D Kalyanasundaram, RR Salunkhe, A Bhaumik, N Khaorapapong, Y Yamauchi, S Dutta, *Chemical Engineering Journal*, **506**, 159270 (2025).[IF:13.4]
3. A new microporous organic-inorganic hybrid titanium phosphate for selective acetalization of glycerol - B Malakar, S Bhattacharjee, NQM Tran, TLH Doan, TB Phan, S Chongdar, A Bhaumik, *Chemical Communications*, **61**, 81-84. (2025).[IF:4.3]
4. Ultrasmall Bismuth Nanoparticles Supported Over Nitrogen-Rich Porous Triazine-Piperazine Polymer for Efficient Catalytic Reduction - SK Das, R Chatterjee, A Bhaumik, *Chemistry-An Asian Journal*, **20**, e202401302 (2025).[IF:3.5]
5. Anchoring of Ni (II)-Schiff base complex in surface modified SBA-15: A reusable and efficient heterogeneous catalyst for nitroaromatic reduction - R Mondal, R Ghanta, T Chowdhury, A Bhaumik, T Chattopadhyay, *Journal of Molecular Structure*, **1322**, 140287. (2025).[IF:4.0]
6. Tailored Brønsted Acidic Sites Anchored Over Covalent Organic Framework and Its Potential in Acid-Catalyzed Reactions - S Bhattacharjee, S Ruidas, B Malakar, S Mondal, S Dalapati, A Bhaumik, *Advanced Sustainable Systems*, **9**, 2500069 (2025).[IF:6.5]
7. Advancements in Pd-Based Supported Porous Nanocatalysts for the C-C Cross-Coupling Reactions - D Chakraborty, A Bhaumik, *Catalysts*, **15**, 16 (2025).[IF:3.9]
8. Hydrodeoxygenation of Glycerol to Propene over Molybdenum and Niobium Phosphate Catalysts - W Enam, A Chowdhury, K Laichter, K L Lin, A Mandal, B Malakar, A Bhaumik, TE Müller, B Chowdhury, *ChemCatChem*, **17**, e202401281 (2025).[IF:3.8]
9. Elucidating the role of cobalt nanoparticles and Mn-phosphate in etched ZIF-67/phthalimide-NC and phthalimene oxide for supercapacitor

- and electrochemical oxygen evolution reaction applications - T Dey, N Kumar, R Patil, PK Pathak, S Bhattacharjee, P Yadav, A Bhaumik, RR Salunkhe, S Dutta, *Sustainable Energy & Fuels*, **9**, 1173-1182 (2025).[IF:5.0]
10. Rational Design of Highly Porous Donor-Acceptor Based Conjugated Microporous Polymer for Photocatalytic Benzylamine Coupling Reaction - S Bhattacharjee, S Mondal, A Ghosh, S Banerjee, AK Das, A Bhaumik, *Small*, **20**, 2406723 (2024).[IF:13.0]
 11. Small Organic Molecule-Assisted Mesoscopic Self-Assembly of SnO₂ Nanoparticles: An Efficient Catalyst for the Synthesis of α -Nitroaldol - SK Das, I Abdul Matheen, A Kathiravan, MA Jhonsi, A Bhaumik, *ChemCatChem*, **16**, e202400439 (2024).[IF:3.8]
 12. Conformational switch of a peptide provides a novel strategy to design peptide loaded porous organic polymer for Pyroptosis pathway mediated cancer therapy - S Mishra, A Sannigrahi, S Ruidas, S Chatterjee, K Roy, D Misra, BK Maity, R Paul, CK Ghosh, KD Saha, A Bhaumik, K Chattopadhyay, *Small*, **20**, 2402953 (2024).[IF:13.0]
 13. Fluorometric and naked eye detection of cadmium ion by reduced Schiff base zinc-based probe in potable water: Theoretical and experimental approach - A Dhar, T Chowdhury, S Banerjee, S Saha, A K Das, A Bhaumik, D Das, *Inorganica Chimica Acta*, **570**, 122162.[IF:2.7]
 14. Highly Asymmetric Cu_{SA}-O_v-Ti_{3c} Atomic Sites Catalyst for Unprecedented Solar Hydrogen Generation - D Kumar, A Mishra, Shubham, Hemant, S Bhattacharjee, R R Urkude, B Ghosh, A Bhaumik, AK Sinha, ASK Sinha, V Amoli, *Advanced Energy Materials*, **14**, 2401964 (2024).[IF:24.4]
 15. Sustainable Porous Heterogeneous Catalysts for the Conversion of Biomass into Renewable Energy Products - S Mondal, S Ruidas, S Chongdar, B Saha, A Bhaumik, *ACS Sustainable Resource Management*, **1**, 1672-1704 (2024).[IF:]
 16. CO₂-Philic Fluorinated Porous Organic Polyaminal in Photocatalytic Thiol-Ene Chemistry: Decoding the Effect of F-Atoms - R Chatterjee, S Bhattacharjee, A Bhaumik, *ACS Applied Polymer Materials*, **6**, 8514-8522 (2024).[IF:4.5]
 17. z Nanoarchitectonics of catalytic tubular nanomotors based on Cu/Fe@ SBA-15 for lung cancer treatment - MS El-Okaily, AMA El-Seidy, EH Ismail, RM Allam, AA Saeed, A Bhaumik, AA Mostafa, *Journal of Materials Research*, **39**, 1741-1757 (2024).[IF:2.7]
 18. Nafion/multiwalled carbon nanotubes/mesoporous silica composite modified glassy carbon electrode for the simultaneous electrochemical determination of indigo carmine - S G Fogang, G Deffo, LS Guenang, RCT Temgoua, E Njanja, IK Tonle, A Bhaumik, E Ngameni, *Analytical Letters*, **57**, 1241-1256 (2024).[IF:2.2]
 19. Integration of a Bismuth-Based Tris-Mononuclear Complex with 2D Functional Materials for Highly Efficient and Durable Aqueous Electrocatalytic Hydrogen Evolution - D Kundu, A Hazra, S Bhattacharjee, J Dutta, NC Murmu, A Bhaumik, P Banerjee, *ACS Applied Materials & Interfaces*, **16**, 28423-28434 (2024).[IF:8.5]
 20. Purification of Waste-Generated Biogas Mixtures Using Covalent Organic Framework's High CO₂ Selectivity - R Paul, A Maibam, R Chatterjee, W Wang, T Mukherjee, N Das, M Yellappa, T Banerjee, A Bhaumik, SV Mohan, R Babarao, J Mondal, *ACS Applied Materials & Interfaces*, **16**, 22066-22078 (2024).[IF:8.5]
 21. Construction of a series of pH stable Ca-based MOFs, their CO₂ adsorption and catalytic activity - S Bhattacharjee, T Chakraborty, S Banerjee, AK Das, A Bhaumik, *Dalton Transactions*, **53**, 11120-11132. (2024).[IF:3.5]
 22. Advanced electrocatalysts for NRR and HER: Experimental and computational design and development - R Thapa, A Bhaumik, UK Ghorai, P Jena, *Catalysis Today*, **425**, 114295 (2024).[IF:4.6]
- Publication in Book Chapter :**
1. Bifunctional Electrocatalysts for Water Splitting. S Chongdar, S Pal, A Bhaumik, *RSC Book Chapter*, 3, DOI:10.1039/9781837674497-00045 (2024)
- Ph.D. Degree Awarded :**
- (1) A. Ghosh (IACS Deemed to be University).

Sponsored Project :

- » Synthesis of Highly Water Splitting (TARE, SERB)
- » Development of nano-biosensor health and education (British Council Going Global)

- » Development of Catalysts DME Conversion (Tata Steel)
- » Design and synthesis of Fixation of CO₂ (DST-SERB-CRG)

Lecture Delivered :

- » Invited lecture at (I) SRM University, AP



Narayan Pradhan, FASc, FNAsc

Senior Professor and School Chair

Chemistry of Physics of Semiconductor Nanocrystals

Associates : (1) Diptam Nasipuri, SRF (CSIR), (2) Souvik Banerjee, SRF (Institute), (3) Rajdeep Das, SRF (CSIR), (4) Anubhab Das, JRF (CSIR), (5) Sanjib Shyamal (NPDF), (6) Nilesh Manohar Sethi, JRF, (7) Ranjit pandit, JRF (CSIR)

Narayan Pradhan and his research group works on semiconductor nanocrystals which includes both chalcogenides and perovskites nanostructures. The major focus remains with the study of reaction chemistry for understanding the growth of these nanocrystals and tuning the optical properties. The group developed a series of doped semiconductor nanocrystals and also studied the

chemistry of doping foreign ions inside the crystal lattice of the host semiconductor. In addition, the group also works on developing multinary and heterostructures for solar light harvesting and water splitting. Last few years, the group focused mostly on understanding the chemistry of different halide perovskite and chalcogenide nanostructures. One of the representative figure is shown below.

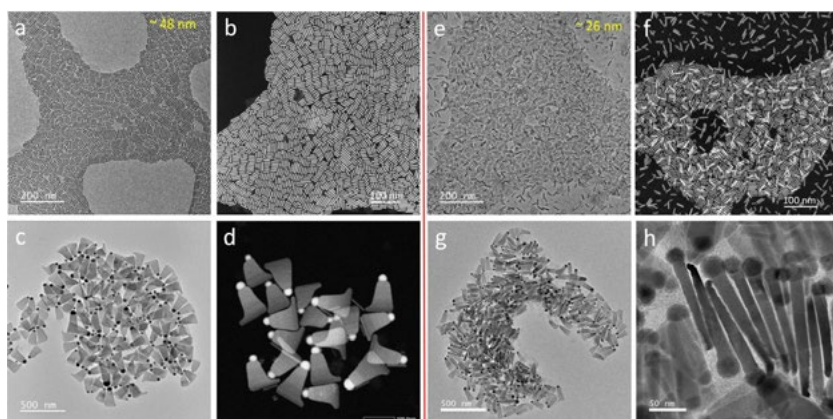


Figure. (a) TEM and (b) HAADF-STEM images of ~ 48 nm length Bi₉S₂₇Br₃ nanorods synthesized after 10 sec of the reaction. (e) TEM and (f) HAADF-STEM images of ~26 nm nanorods obtained in similar reaction after 5 sec of introduction of S-Br precursor. (c) TEM and (d) HAADF-STEM images of Bi₉S₂₇Br₃-Bi nanocrystal heterostructure in different resolutions synthesized by injecting 10 sec Bi₉S₂₇Br₃ nanorods solution. (g) TEM and (h) magnified TEM images of Bi₉S₂₇Br₃-Bi nanocrystal heterostructure with two different orientations synthesized by injecting 5 sec Bi₉S₂₇Br₃ nanorods solution.

Awards/Recognition :

- » GD Birla Award for Scientific Research in material sciences.

Publications in Journals :

1. Epitaxially Connected CsPbBr₃-PbTe Perovskite-Chalcogenide Nanocrystal Heterostructures - Rajdeep Das, Souvik Banerjee, Diptam Nasipuri, and Narayan Pradhan, *Chem. Mater*, Articles ASAP (2025)
2. CsPbBr₃ Perovskite Nanocrystals: Linking Orthorhombic Structure to Cubic Geometry through Atomic Models and HRTEM Analysis - Narayan Pradhan, *ACS Energy Lett.*, 10, **2**, 1057-1061 (2025).[IF:]
3. Limiting Halide Exchange and Doping Mn(II) in Vertex-Oriented Cube-Connected Patterned Lead Halide Perovskite Nanorods - Harsh Mohata, Diptam Nasipuri, Sumit Kumar Dutta, and Narayan Pradhan, *Chem. Mater*, **37**, 1, 497-506 (2025).[IF:]
4. Deriving Chiroptical Properties from Intrinsically Achiral Building Blocks of One-Dimensional CsPbBr₃ Perovskite Nanowires - Shramana Guha, Suman Bera, Arghyadeep Garai, D. D. Sarma, Narayan Pradhan, and Somobrata Acharya, *J. Am. Chem. Soc.*, 146, **49**, 33883-33892 (2024).[IF:]
5. CsPbBr₃-PbSe Perovskite-Chalcogenide Epitaxial Nanocrystal Heterostructures and Their Charge Carrier Dynamics - Rakesh Kumar Behera, Souvik Banerjee, Nitika Kharbanda, Manvi Sachdeva, Diptam Nasipuri, Hirendra N. Ghosh, and Narayan Pradhan, *J. Am. Chem. Soc.*, **146**, 45, 31177-31185 (2024).[IF:]
6. Biexciton Emission in CsPbBr₃ Nanocrystals: Polar Facet Matters - Timi Titus, E. Krishnan Vishnu, Arghyadeep Garai, Sumit Kumar Dutta, Kuttysankaran Sandeep, Ankita Shelke, Thalasseril G. Ajithkumar, Anil Shaji, Narayan

Pradhan, and K. George Thomas, *Nano Lett.*, **24**, 34, 10434-10442 (2024).[IF:]

7. Halide Perovskite Nanocrystals for Shaping Pt Nanostructures - Rajdeep Das, Avijit Patra, Sumit Kumar Dutta, and Narayan Pradhan, *Chem. Mater*, **36**, 15, 7406-7417. (2024).[IF:]
8. CsPbBr₃ Perovskite Crack Platelet Nanocrystals and Their Biexciton Generation - Suman Bera, Akash Tripathi, Timi Titus, Nilesh Monohar Sethi, Rajdeep Das, Afreen, K. V. Adarsh, K. George Thomas, and Narayan Pradhan, *J. Am. Chem. Soc.*, **146**, 29, 20300-20311 (2024).[IF:]
9. Synthesis Innovations and Applications of Dual Plasmonic Heteronanostructures: Fundamentals to Future Horizons - Suvodeep Sen, Niladri Sekhar Karan, and Narayan Pradhan, *Chem. Mater*, **36**, 14, 6696-6719 (2024).[IF:]
10. Design Strategies for Epitaxial Metal(0)-Halide Perovskite Nanocrystal Heterostructures - Narayan Pradhan, *ACS Energy Lett.*, **9**, 5, 2378-2386 (2024).[IF:]
11. Perovskite-Chalcogenide Epitaxial Heterostructures: Possibility of Multiple Axial Orientations of CsPbBr₃ Nanocrystals on PbBi₂S₄ Nanorods - Avijit Patra, Koushik Jagadish, Sanjib Shyamal, Narayanan Ravishankar, and Narayan Pradhan, *Chem. Mater*, **36**, 8, 3803-3811 (2024).[IF:]

Ph.D. Degree Awarded :

- » (I) Avijit Patra (IACS Deemed to be University)

Sponsored Project :

- » New Facets Halide Perovskites..... Heterostructures



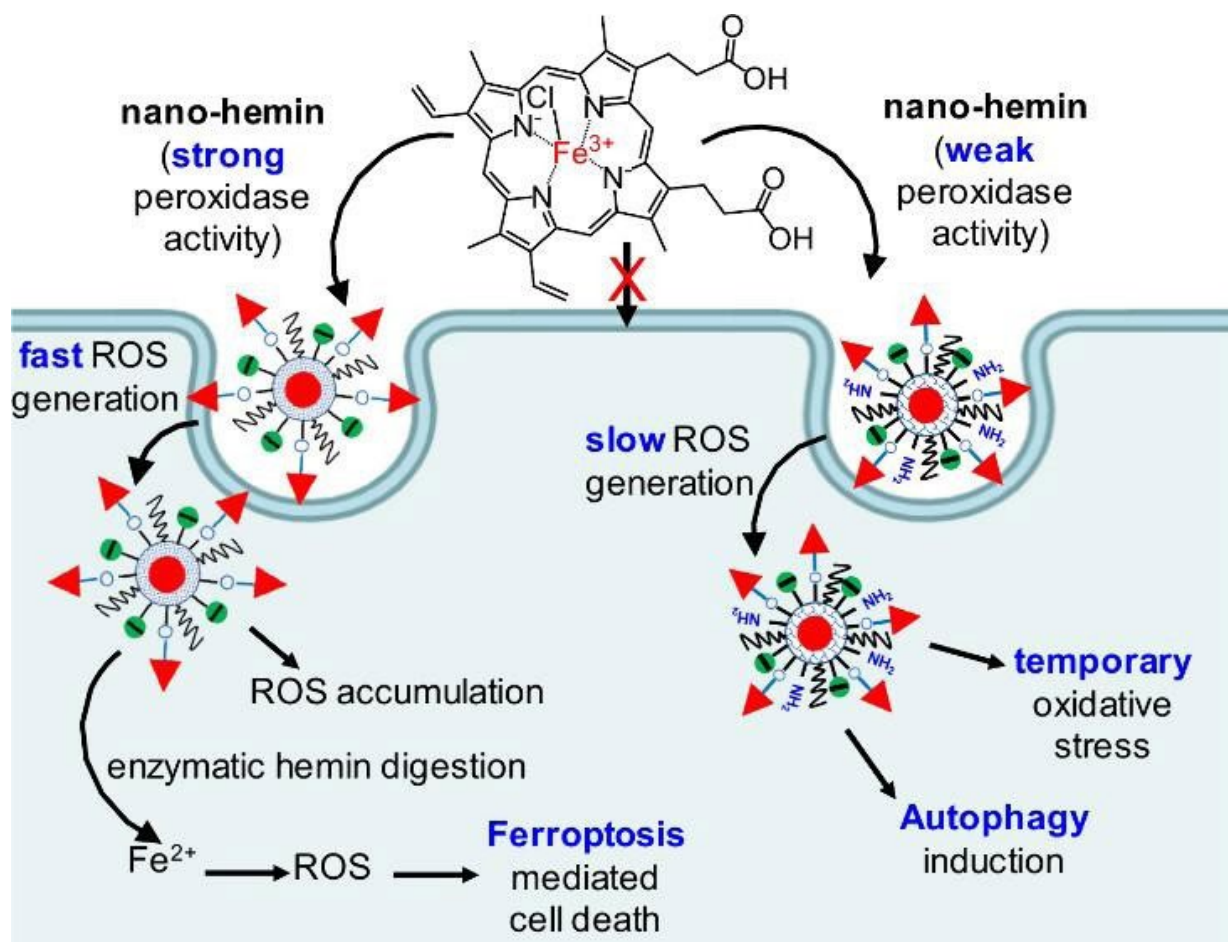
Nikhil Ranjan Jana

Senior Professor

Biomedical application of functional nanoparticle

Associates : (1) Dr Debiprasad Roy, RA-I (TRC project), (2) Dr Kuheli Mondal, RA- (TRC project), (3) Reeddi Ray, RA (DST-SUPRA), (4) Jayanta Dolai, RA (Institute), (5) Ankan Kumar Sarkar, RA (Institute), (6) Abu Raihan Sarkar, SRF (CSIR), (7) Santanu Shaw, SRF (UGC), (8) Nayana Mukherjee, SRF (Institute), (9) Puja Garai, SRF (UGC), (10) Rajkumar Sahoo, SRF (SERB project), (11) Soumi Das, JRF (Institute), (12) Buddhadev Mukherjee, JRF (UGC), (13) Sutirtha Panda, JRF (UGC), (14) Saikat Kumar Pandit, JRF (CSIR), (15) Riya Hazra, JRF (CSIR) and (16) Ilora Maiti (MS project).

- i) Molecular hemin is transformed into nano-hemin for cell therapy
- ii) Colloidal nanodrug is designed for ultrasonic removal of toxic polyglutamine aggregates from neuron cells
- iii) Nanoporous silica nanoparticle is transformed into Janus nanoparticle via anisotropic functionalization
- iv) Vegetable oil-based pickering nanoemulsions has been designed as carrier for cytosolic drug delivery



Representative Figure: Design of nano-hemin for Ferroptosis-mediated cell death via enzymatic hemin digestion.

Publications in Journals :

1. Designing Nano-Hemin for Ferroptosis Mediated Cell Death via Enzymatic Hemin Digestion - Abu Raihan Sarkar, Nayana Mukherjee, Ankan Kumar Sarkar and Nikhil R. Jana, *ACS Appl. Mater. Interfaces*, **16**, 64628–64637 (2024).[IF:8.5]
2. Sugar Derived Carbon Dots with Variable Fluorescent Blinking Property as Super-resolution Imaging Probe - Buddhadev Mukherjee, Neeraj Pant, Jayanta Dolai, Prakash Joshi, Debiprasad Roy, Anupam Maity, and Nikhil R. Jana, *J. Phys Chem. C*, **128**, 19260–19269 (2024).[IF:3.3]
3. Designed Nanodrugs for Ultrasonic Removal of Toxic Polyglutamine Aggregates from Neuron Cells - Ankan Kumar Sarkar, Abu Raihan Sarkar, Rajkumar Sahoo, Nihar R. Jana, Nikhil R. Jana, *Nano Lett.*, **43**, 13473–13480 (2024).[IF:9.6]
4. Northiosquaraine-Based Nanoparticles for Red-Light-Induced Photodynamic Therapy via Singlet Oxygen Generation - Saily Sriwastav, Abu Raihan Sarkar, Ayan Datta, Nikhil R. Jana, Sudip Malik. *ACS Appl. Nano Mater.*, **7**, 21674–21682 (2024).[IF:5.3]
5. Nanoporous Silica Nanoparticles with Janus Functionalization for Enhanced Cell Uptake and Drug Delivery - Puja Garai, Santu Ghosh, and Nikhil R. Jana, *ACS Appl. Nano Mater.*, **7**, 12207–12213 (2024).[IF: 5.3]

6. Vegetable Oil-Based Pickering Nanoemulsions As Carriers for Cytosolic Drug Delivery - Rajkumar Sahoo, Nayana Mukherjee, Sanchita Paramanik, and Nikhil R. Jana. *ACS Appl. Nano Mater.*, **7**, 15702–15709 (2024).[IF: 5.3]

Ph.D. Degree Awarded :

(1) Reeddhi Ray (IACS Deemed to be University), (2) Jyanta Dolai (IACS Deemed to be University) and (3) Ankan Kumar Sarkar (IACS Deemed to be University).

Sponsored Project :

- » Designed nanoparticle Therapeutic Performance
- » Designed Colloidal Nanodrug Barrier Crossing
- » Piezocatalytic nanocomposite-based water purification
- » Design Sound-responsive for Cell Therapy
- » In-Vitro Bioimaging Application Quantum Dots

Lectures Delivered:

Invited talk at (1) IIT Jodhpur, (2) IIT Mandi, (3) Three talks in ACS Fall Meeting, Denver, (4) North Bengal University, (5) Pontedera, Pisa, Italy and (6) Università di Pisa, Pisa, Italy.



Praveen Kumar

Professor

III-V Semiconductors, 2D-Materials/MXenes, Carbon Nanostructures, Oxides, Photodetectors, Supercapacitors and Green H₂ Generation.

Associates : (1) Krishendu Roy SRF (Institute), (2) Sukhendu Maity, SRF (CSIR), (3) Shuvojit Mandal, SRF (Institute) and (4) Abhijit Dutta, JRF (UGC).

We are working on understanding spin-manipulated photoelectrochemical (PEC) systems to address inefficiencies in green hydrogen production, a critical challenge for sustainable energy. By leveraging magnetic field-induced spin modulation, the team developed innovative heterostructures using 2D materials, such as transition metal dichalcogenides (TMDCs) and III-V semiconductors, to enhance catalytic efficiency in hydrogen evolution reactions (HER). A key study published in *ACS Nano* 18 (2024) 24569 as shown in Figure 1 as well, explored dimensionality-tailored ferromagnetism in quasi-two-dimensional MnSe₂, demonstrating improved magneto-electrochemical HER in alkaline media. This work tackled low charge transfer rates by engineering spin-polarized interfaces, facilitating faster electron

transport and reducing energy barriers for water splitting. Another manuscript under revision investigated Co/N co-doped TiO₂ under external magnetic fields, addressing limitations in oxygen evolution reaction (OER) efficiency by modulating spin states to enhance photoelectrocatalytic performance. Efforts focused on optimizing electronic and structural properties of asymmetric 2D heterostructures, such as MoSSe-GaN, to mitigate recombination losses and improve PEC stability. We are also exploring CO₂ reduction, by demonstrating facet-engineered 2D CuInS₂ for efficient CO₂ conversion, addressing high overpotential challenges. These developments contribute to scalable, high-yield hydrogen production and carbon-neutral technologies, aligning with global clean energy goals.

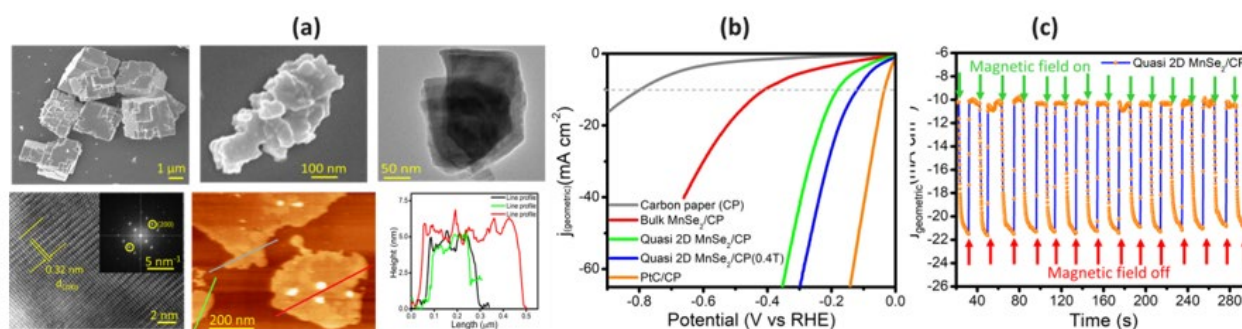
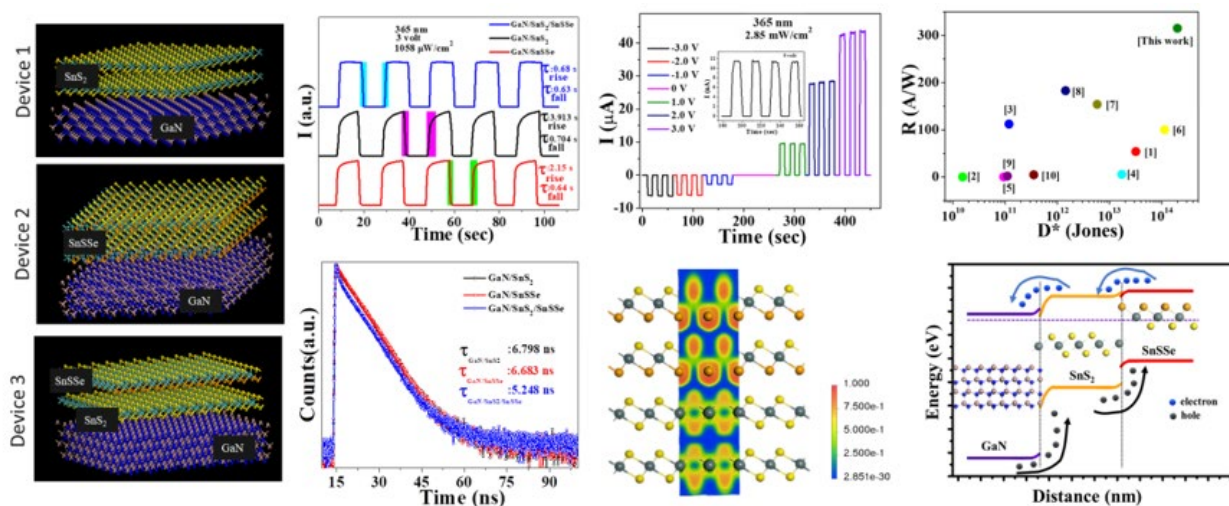


Figure. (a) Morphological view of the transformation of 3D MnSe₂ to quasi-2D MnSe₂, (b) LSV for HER and (c) magnetic response of quasi-2D MnSe₂ as cathode for HER (*ACS Nano* 18 (2024) 24569).

Development of Broadband Photodetectors:

The development of broadband photodetectors addressed the challenge of limited spectral response in conventional devices for applications in sensing, imaging, and communication. The team engineered advanced heterostructures combining 2D TMDCs, carbon nanostructures, and III-V semiconductors to achieve self-powered, broadband detection from UV to near-infrared. A significant publication in *Nanoscale Horizons* (2024) detailed synergistic $\text{SnS}_2/\text{SnSSe}$ nanosheets on GaN as shown in Figure 2, showcasing enhanced photodetection across 254 nm to 940 nm. This work resolved issues of low responsivity and slow response times by optimizing heterojunction interfaces for efficient charge separation. Another

study in *Carbon* (2024) provided a roadmap for nanostructured carbon heterojunctions, tackling scalability and integration challenges for next-generation photodetectors. Research incorporated defect-engineered 2D materials and GaN-based platforms to address spectral selectivity and device stability under ambient conditions. Patents on facile TMDC synthesis (Indian Patent, 2021) and TMDC alloy production (Indian Patent, 2022) resolved fabrication challenges, enabling cost-effective, large-scale production of photodetector components. These advancements position the research at the forefront of optoelectronic innovation, with potential applications in autonomous systems, environmental monitoring, and quantum communication.



Publications in Journals :

1. Dimensionality Tailored Ferromagnetism in Quasi Two-Dimensional MnSe₂ for Magneto-Electrochemical Hydrogen Evolution Reaction in Alkaline Media - K. Roy, R. Datta, S. Maitra and Praveen Kumar, *ACS Nano*, **18** 24569 (2024). [IF:17.1]
2. Synergistic Heterojunction of SnS₂/SnSSe Nanosheets on GaN for Advanced Self-powered Photodetectors - S. Maity and Praveen Kumar, *Nanoscale Horizons*, **9** 1318 (2024). [IF:09.7]

3. Nanostructured carbon heterojunctions for broadband photodetection: Development roadmap, emerging technologies, and future perspectives - K. Sarkar and Praveen Kumar, *Carbon*, **219** 118842 (2024). [IF:10.9]

Sponsored Project :

- » Exploring the role applications
- » Unravelling spin-manipulate Photodetectors (CRG Project).
- » Wafer-scale Emitter Quantum Technologies



Sugata Ray

Senior Professor & HoD, CSS

Experimental material science: Structure property relationship, magnetic and dielectric studies of single and polycrystalline materials and water purification.

Associates : (1) Dr. Shuvajit Halder, (2) Dr. Sanjit Das, (3) Biplab Pakhuria (Institute), (4) Siddhartha Soren (IACS int-PhD fellow), (5) Debu Das (INSPIRE fellow), (6) Manishankar Das (IACS int-PhD fellow), (7) Shamitava Roy (IACS MS-PhD, SMS), (8) Aditya Patra (IACS MS-PhD, SMS) (9) Shruti Kundu (IACS MS-PhD, SPS), (10) Dr. Amit Naiya, RA-I (TRC), (11) Dr. Susanta Kundu and (12) Dr. Madhuri Mandal Goswami DST WOS-A – Synthesis of magnetic nano materials and their use in drug delivery.

We are working on understanding spin-manipulated photoelectrochemical (PEC) systems to address inefficiencies in green hydrogen production, a critical challenge for sustainable energy. By leveraging magnetic field-induced spin modulation, the team developed innovative heterostructures using 2D materials, such as transition metal dichalcogenides (TMDCs) and III-V semiconductors, to enhance catalytic efficiency in hydrogen evolution reactions (HER). A key study published in *ACS Nano* **18** (2024) 24569 as shown in Figure 1 as well, explored dimensionality-tailored ferromagnetism in quasi-two-dimensional MnSe₂, demonstrating improved magneto-electrochemical HER in alkaline media. This work tackled low charge transfer rates by engineering spin-polarized interfaces, facilitating faster electron

transport and reducing energy barriers for water splitting. Another manuscript under revision investigated Co/N co-doped TiO₂ under external magnetic fields, addressing limitations in oxygen evolution reaction (OER) efficiency by modulating spin states to enhance photoelectrocatalytic performance. Efforts focused on optimizing electronic and structural properties of asymmetric 2D heterostructures, such as MoSSe-GaN, to mitigate recombination losses and improve PEC stability. We are also exploring CO₂ reduction, by demonstrating facet-engineered 2D CuInS₂ for efficient CO₂ conversion, addressing high overpotential challenges. These developments contribute to scalable, high-yield hydrogen production and carbon-neutral technologies, aligning with global clean energy goals.

Spin-orbit coupling offers a large variety of novel and extraordinary magnetic and electronic properties in otherwise 'ordinary pool' of heavy ion oxides. Here we present a detailed study on an apparently isolated hexagonal 2H spin-chain d^4 iridate $\text{Sr}_3\text{LiIrO}_6$ with geometric frustration. Our structural studies reveal Li-Ir chemical order with desired stoichiometry in this compound, while x-ray absorption together with x-ray photoemission spectroscopic characterizations establish pure 5+ valence of Ir. We have established a magnetic ground state with finite Ir^{5+} magnetic moments in this compound, contrary to the anticipated nonmagnetic $J_{\text{eff}} = 0$ state, through combined dc susceptibility, ^7Li nuclear magnetic resonance (NMR), muon spin relaxation (μSR) and ab-initio electronic structure studies. These investigations together with ac magnetic susceptibility and specific heat measurements reveal that despite having noticeable antiferromagnetic correlation among the Ir^{5+} local moments, this system does not magnetically order down to at least 0.05 K, possibly due to geometrical exchange frustration, arising from the comparable nearest- and next-nearest-neighbor interchain Ir–O–O–Ir superexchange interaction strengths with opposite signs. However, the zero-field μSR analysis shows emergence of a considerable proportion of spin-freezing on top of a spin-fluctuating dynamic magnetic background down to the lowest measured temperature of 1.7 K, possibly due to some inhomogeneity and/or the much stronger intra-column Ir–Ir magnetic exchange interaction strength relative to the inter-column Ir–Ir ones. The linear temperature

dependence of the magnetic specific heat (C_m) in both zero and applied magnetic fields, plus the power-law behavior of the NMR spin-lattice relaxation rate suggest a gapless spinon density of states in this charge gapped disordered magnetic ground state of $\text{Sr}_3\text{LiIrO}_6$.

In this study, we investigate the presence of the Griffiths-like anomaly in the geometrically frustrated antiferromagnet $\text{HoBaCo}_4\text{O}_{7+\delta}$ and globally its absence in $\text{ErBaCo}_4\text{O}_{7+\delta}$, despite only small differences in the ionic radii, f -electron occupancy, and the corresponding crystal structures of the Ho^{3+} and Er^{3+} -members. Previous studies have identified the Griffiths phase in the Dy-analogue, $\text{DyBaCo}_4\text{O}_{7+\delta}$, suggesting certain inherent features of this class of materials that regularly give rise to such anomalies. To explore the curious disappearance of such anomalous feature in $\text{ErBaCo}_4\text{O}_{7+\delta}$, we prepared a series of compounds with varying compositions $\text{Ho}_{1-x}\text{Er}_x\text{BaCo}_4\text{O}_{7+\delta}$ ($0 \leq x \leq 1$) and systematically studied the evolution of various physical properties with Er-doping. Our experimental studies, including x-ray diffraction (XRD), magnetic, x-ray absorption spectroscopy (XAS), x-ray photoelectron spectroscopy (XPS), heat capacity, and muon spin relaxation spectroscopy (μSR spectroscopy), revealed that while the Griffiths-like anomaly indeed disappears with doping at the macroscopic level, signatures of inhomogeneity is retained in $\text{ErBaCo}_4\text{O}_{7+\delta}$ too, at least at the local level. Overall, our results highlight the significant role of ionic radius and local structural distortions in stabilizing the Griffiths phase in this class of systems.

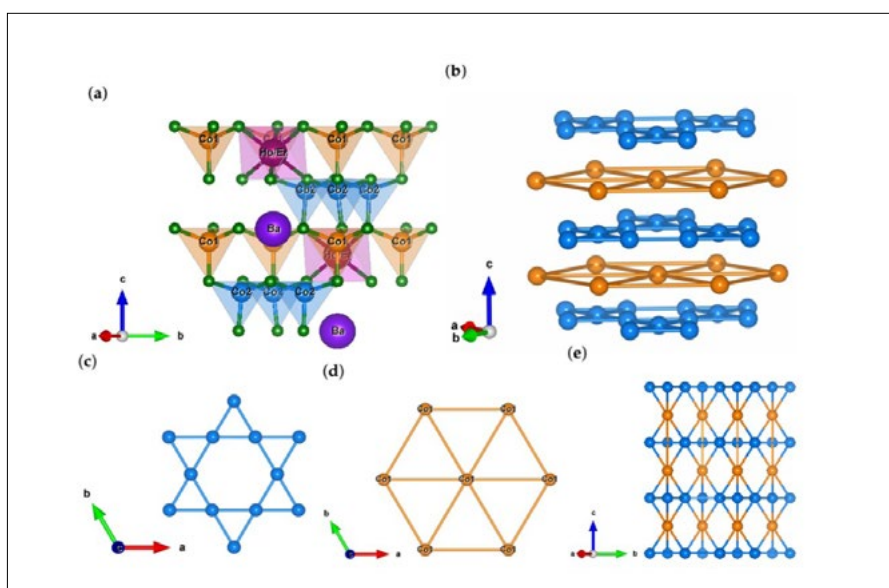


Figure. (a) Refined crystal structure of HEBiO. (b) Co1 network (light orange network) form triangular layer, while three Co2 form kagome network (blue network). (c), (d) panels show Kagome and triangular layer respectively, while panel (e) shows one Co1 and three Co2 forming tetrahedra where two tetrahedra are connected with single Co1.

Patent Filed/Awarded :

- » 1 Submitted to TIFAC

Ph.D. Degree awarded :

- (1) Sanjit Das (IACS Deemed to be University) and
- (2) Shuvajit Halder (IACS Deemed to be University).

Publications in Journals :

1. Hybridization effects on the magnetic ground state of ruthenium in double perovskite $\text{La}_2\text{ZnRu}_{1-x}\text{Ti}_x\text{O}_6$ - Shuvajit Halder, Carlo Meneghini and Sugata Ray, *J. Phys.: Condensed Matter*, **37**, 115804 (2025).[IF:]
2. Breaking down of the Ir-Ir singlets with Sb-doping and consequent growth of magnetization with further dilution of Ir^{5+} ions in $\text{Ba}_2\text{YIr}_{1-y}\text{Sb}_y\text{O}_6$ - Shuvajit Halder, Md Salman Khan, Fabrice Bert, Carlo Meneghini, Payel Aich, and Sugata Ray, *Materials*, **17**, 1766 (2024).[IF:]

3. Disordered magnetic ground state in a quasi-1-D d^4 columnar iridate $\text{Sr}_3\text{LiIrO}_6$ - Abhisek Bandyopadhyay, Debu Das, A Chakraborty, S Bhowal, Vinod Kumar, G B G Stenning, C Ritter, D T Adroja, M Moretti Sala, A Efimenko, C Meneghini, F Bert, P K Biswas, I Dasgupta, T Saha Dasgupta, A V Mahajan and Sugata Ray, *J. Phys.: Condensed Matter*, **36**, 425804 (2024).[IF:]

Sponsored Project :

- » Probing the unusual Colossal Hollandites
- » Unusual absence of Co magnetic Griffiths Phase System

Lectures Delivered:

- » Invited talk at (1) IIT Kharagpur, (2) TCG-CREST, Kolkata, (3) HSNC University, Worli, Mumbai, (4) Pune, Maharashtra, (5) SNBNCBS, Kolkata, (6) VIT-AP and (7) Keynote lecture in NCES-24, SRM-AP.



Urmimala Maitra

Assistant Professor

Cathode materials and Solid electrolytes for high voltage and high energy density batteries.

Associates : (1) Amit Ghosal, JRF (Inspire), (2) Sayandeep Guin, SRF (Institute Fellow, Int PhD), (3) Sushim Sabuj Sarkar, JRF (Inspire), (4) Kheyali Dey, JRF (Inspire), and (5) Susmita Pramanik, JRF (Institute fellow, Int. PhD).

Structurally stable Fe, Mn based sustainable cathodes: P2-type Fe, Mn based Na-layered oxides cathodes exhibit dual advantage of sustainability and high energy density. In Fe-Mn oxides e.g. $\text{Na}_{0.67}\text{Fe}_{0.5}\text{Mn}_{0.5}\text{O}_2$, Fe^{4+} ions migrate to the O-type Na-layer and some of them get trapped leading to voltage fade. We doped Li^+ in the Fe^{3+} and Mn^{4+} site to a) create disorder in the TM-layer by introduction of Li and thereby prevent tendency of TM migrations and b) initiate reversible migration of Li into the empty Na-layer in the state of high degree of desodiation thereby preventing P2-

O2 transition. The result is a cathode with no evidence of structural transition and this directly reflects as high-capacity retention. With low-cost compared to current commercial cathodes, high-capacity and good retention compared to other alternatives, the material therefore presents the perfect set of properties making it most suitable for further studies aimed at commercialisation (Patent Application No. 202531045627).

Cathodes with facile kinetics and high energy density: Layered oxide cathodes with disordered TM-layer were prepared. The disordered nature

of the TM-layer successfully prevents structural degradation associated with O-redox. As a result, we achieve for the first time O-redox cathode material which shows >95% capacity after 250 cycles with high energy density > 500 Wh/Kg for Na-cathodes

and > 1000 Wh/kg for Li-cathodes. High-entropy of TM-layer helps improve kinetics of Na⁺-migration, resulting in cathodes that attain 100% state of charge in 12 mins with more than 24h discharge time and >80% capacity retention over 100 cycles.

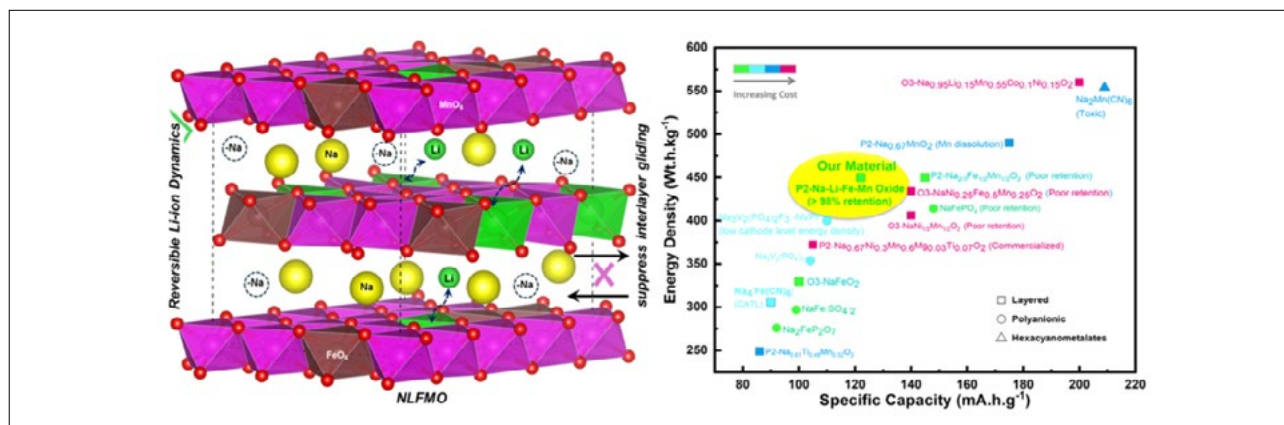


Figure: Left: Design strategy of dynamic-Li as a dopant to eliminate structural phase transitions. The result is a general approach to developing Fe, Mn-rich disordered (high-entropy) cathodes that show high capacity, high energy density, reversible O-redox at a fraction of the cost of current cathodes that require Co and Ni for the stabilisation of the cathode structure. Right: The performance comparison of our Li-doped Fe-Mn-based Na-ion cathode demonstrating the same principle's utilisation.

Publications in Journals :

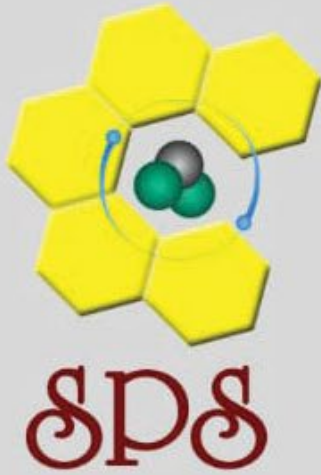
1. Reviewing Li-Rich Disordered Rocksalts as Next-Generation High-Energy Cathode Material - S. Guin, S. Ghosh, S. S. Sarkar, U. Maitra, *Chem. Mater.*, **36**, 10421 (2024). [IF:7.2]

Lectures Delivered:

Invited talk at (1) AEMI 24, (2) IITB & Berkley Lab, (3) MAX IV Laboratory in Lund, Sweden, (4) JNCASR, Bangalore, (5) National Meeting on Sodium (-ion) Batteries and (6) CRSI-Kolkata Chapter.

Sponsored Project :

- » Structurally stable reversible Na-ion Cathodes



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Professor Durga Basak
School Chair

School Profile

People

Faculty	: 18
Post-doctoral Research Associate	: 15
Ph.D. Students	: 80
Non-Academic Staff	: 07

Extra Mural Funding

Projects (ongoing)	: 15
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Research Achievements

Research papers in Journals	: 68
Ph.D. degree awarded	: 11

Academic Activities

Colloquium Lecture/Conference organized	: 03
Talks delivered by members (virtual)	National : 62
of School in conferences/symposia	Intl. : 16



Arnab Das

Professor

Quantum Condensed Matter and Statistical Physics, with an emphasis on Non-Equilibrium Dynamics and Phases of Quantum Matter and related areas in Adiabatic Quantum Computation.

Associates : (1) Anirban Das, (2) Sagnik Chowdhuri, (3) Anupam Banerjee, (4) Dipayan Singha and (5) Moumita Patra (NPDF).

Collaborators (in projects ongoing/winded up within the year concerned):

(1) Prof. Vedika Khemani (Stanford University, USA), (2) Prof Frank Pollmann (TU, Munich, Germany), (3) Dr Roderich Moessner (MPI PKS, Dresden, Germany), (4) Dr Alexander Wietek (MPI PKS, Dresden, Germany), (5) Prof. Krishanu Roychowdhury (SINP, Kolkata), (6) Prof. Diptiman Sen (IISc, Bangalore), (7) Dr Marin Bukov (MPI PKS, Germany), (8) Dr Pranay Patil (Rieken, Japan), (9) Dr Asmi Halder (Paul Sabatier Univ. Toulouse, France)

1. Dynamical Freezing and absence of thermalization in Infinite Many-body Floquet Systems:

We investigate the stability of non-equilibrium phases of interacting quantum matter under periodic disturbances (in collaboration with the Max-Planck Institute for the Physics of Complex Systems, Dresden, Germany (MPI-PKS), and Technical Univ. Munich).

(2) Disorder-free time crystals in the thermodynamic limit:

We show the first example of a many-body time crystal in the thermodynamic limit stabilized by Dynamical Freezing (in collaboration with MPI-PKS, SINP (Kolkata)).

(3) Experimental Realization Dynamical Freezing in an Ion-Trap Quantum Simulator:

(in collaboration with IQC, Univ. of Waterloo).

(4) Generation of Macroscopic Entanglement by Virtual Symmetry-Breaking:

We provide a general framework for producing macroscopically entangled states via quantum

annealing by employing “virtual symmetry-breaking”. This endows us with the capability of generating various states which are invaluable for a wide range of quantum technologies in a single set-up.

(5) Coarsening in Closed Quantum Matter:

Coarsening is the mechanism of formation of a phase after crossing a phase transition point. This entails processes of fundamental importance like the formation of topological defects. While this is much studied in the context of classical phase transition, almost nothing is known when the dynamics are purely quantum mechanical. Here we employ cutting-edge tensor-network techniques to study this problem.

(6) Stabilizing Many-Body Localized Phases by Dynamical Freezing:

Many-Body Localized phases are characterized by Local Integrals of Motions (LIOMS). While the perpetual stability of those within equilibrium settings is under serious debate, we show they can be stabilized under periodic drives by the mechanism of dynamical freezing.

Publications in Journals :

1. Stretched-exponential Melting of a Dynamically Frozen State Under Imprinted Phase Noise in the Ising Chain in a Transverse Field - K Roychowdhury (SINP, India), Arnab Das, *The European Physical Journal B*, **97** (9), 134 (2024). [IF:1.6]

2. Dynamical Freezing in the Thermodynamic Limit: The Strongly Driven Ensemble - A Haldar (Paul Sabatier Univ. Toulouse, France), A. Das (IACS), S Chaudhuri (IACS), L Staszewski (MPI-PKS, Dresden, Germany), A Wietek (MPI-PKS, Germany), F Pollmann (TU Munich, Germany), R. Moessner (MPI-PKS, Germany), Arnab Das, arXiv preprint arXiv:2410.11050 (2024).[IF:]
3. Light Induced Half-Metallic Phase in Insulator and Correlated Metals – S. Kusari (SINP), A. Das

(IACS), H.R. Krishnamurthy (IISc & ICTS) and Arti Garg (SINP), arXiv: 2507.05935v2 (2025)

Lectures Delivered:

Invited talk at (1) Max Planck Institute for the Physics of Complex System, Dresden Germany (CMD Seminar Series), (2) Dresden, Germany, (3) IIT Guwahati, (4) NIT Meghalaya and (5) Google Quantum AI (USA) NISQ Seminar.



Arnab Sen

Professor

Statistical and Condensed Matter physics; spin liquids, phase transitions, entanglement in many-body systems, Monte-Carlo methods, anomalous thermalization in interacting models including lattice gauge theories.

Associates : (1) S. Roy, JRF and (2) M. Pal, SRF, Int-PPS.

My research has been in the fields of strongly correlated systems, statistical mechanics and thermalization and transitions in certain lattice gauge theories. Some recent focus areas include frustrated magnets and spin liquids, confinement-deconfinement phase transitions in certain Z(2) lattice gauge theories, entanglement dynamics and nonequilibrium steady states of driven many-body systems and anomalous thermalization in interacting theories. In particular, we have explored the fate of many-body localization in an Abelian lattice gauge theory as well as discussed the nature of dynamical phases and phase transitions in a classical anisotropic XY model on the square lattice using both numerical and analytic techniques.

Publications in Journals :

1. Dynamical phase transitions in XY model: a Monte Carlo and mean-field theory study - Mainak Pal, William D. Baez, Pushan Majumdar, Arnab Sen and Trinanjan Datta Phys. Rev. E, 110, 054109 (2024).[IF:2.4]

Ph.D. Degree Awarded :

(1) Indrajit Sau (IACS Deemed to be University)

Lectures Delivered :

Invited talk at (1) QMAT 2024, IIT Guwahati, (2) IACS Kolkata, (3) SNBNCBS, Kolkata, (4) TIFR Mumbai, (5) Ludwig Maximilian University, Munich, Germany, (6) Toulouse, France, (7) TIFR Mumbai and (8) IoP Bhubaneswar.



Bimalendu Deb

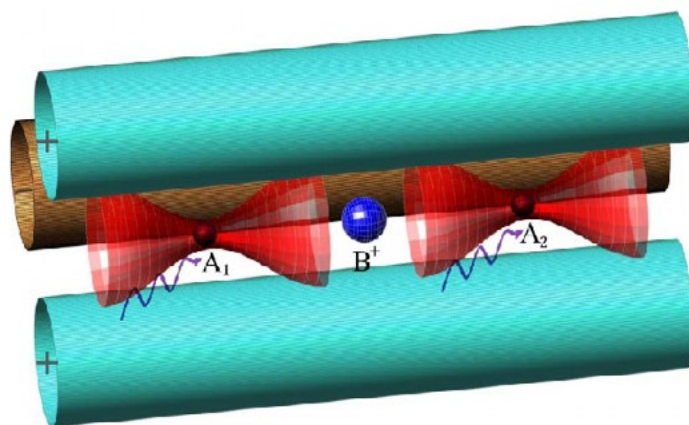
Senior Professor

Theoretical Quantum Optics, Quantum Information Science, Atomic, Molecular and Optical Physics.

Associates : (1) Anushree Dey, RA-I (Institute), (2) Shubhra Mudli, JRF (INSPIRE); (3) Sinchan Snigdha Rej, JRF (Institute), (4) Nabaneet Sharma, JRF (NET-UGC), and (5) Sarbarish Sen (Integrated PhD student).

An ion-atom hybrid quantum computing platform has been proposed [S. Mudli *et. al.*, Phys. Rev. A **110**, 062618 (2024)]. Leveraging ion-mediated atom-atom interaction, a two-qubit control phase gate operation between two distant neutral atomic qubits (more than 20 micron separated) with 97% fidelity has been demonstrated. This is probably the largest distance at which two-qubit control phase gate without using any photonic channel has been demonstrated, and probably first proposal of its

kind for hybrid ion-atom quantum computing. In our current work under progress, we have already found new schemes for making ion-atom two-qubit CNOT and atom-ion-atom three-qubit Toffoli gate. Our goal is to develop ion-atom hybrid system as a fault-tolerant quantum computing platform. We have also made progress in making three- and multi-qubit CNOT gates in neutral atom systems using Rydberg coupling and electromagnetically induced transparency.



A schematic diagram of an atom-ion-atom hybrid toy model for quantum computing. Two atoms A_1 and A_2 trapped in two optical tweezers interact with the ion B^+ in a linear Paul trap through Rydberg excitation of the atoms.

Publications in Journals :

1. Ion-mediated interaction and controlled-phase-gate operation between two atomic qubits - S. Mudli, S. Mal, S. S. Rej, A. Dey and B. Deb, Phys. Rev. A, **110**, 062618 (2024).[IF:]

Ph.D. Degree Awarded :

- (1) Anushree Dey (IACS Deemed to be University).

Lectures Delivered :

- Invited talk at (1) IIT Kharagpur, (2) CDAC, Salt Lake, Kolkata and (3) IIT Ropar.



Devajyoti Mukherjee

Associate Professor

Experimental condensed matter physics and device physics of multiferroic thin film heterostructures; Interface effects in magnetocaloric and electrocaloric thin films; Surface magnetic properties of magnetic thin films using magneto-optic Kerr effect (MOKE), Ferroelectric thin films, Pulsed laser deposition of epitaxial thin films of complex oxides.

Associates : (1) Dr. Dilruba Hasina, RA-1 (Institute), (2) Dr. Kalyan Sarkar, RA-1 (Institute), (3) S. Chatterjee, SRF (DST-INSPIRE), (4) N. Mondal, SRF (Institute), (5) K. Yadav, SRF (Institute), (6) D. Sarkar, JRF (CSIR) and (7) C. Kennao, JRF (Project).

Collaborators: (1) Dr. Roman Burkovsky, Peter the Great Saint-Petersburg Polytechnic University, 29 Politekhnikeskaya, St. Petersburg, Russia, (2) Dipten Bhattacharya (CSIR-Central Glass and Ceramic Research Institute, Kolkata).

Interfacial strain-driven large topological Hall effects in supermalloy thin films with noncoplanar spin textures : Materials exhibiting topological transport properties, such as large topological Hall resistivity, are crucial for next-generation spintronic devices. We reported large topological Hall resistivities in epitaxial supermalloy (NiFeMo) thin films with [100] and [111] orientations grown on single-crystal MgO (100) and Al_2O_3 (0001) substrates, respectively. While X-ray reciprocal maps confirmed the epitaxial growth of the films, X-ray stress analyses revealed large residual strains in the films, inducing tetragonal distortions of the cubic NiFeMo unit cells. Magnetic force microscopy showed the presence of skyrmion-like features

which may arise from strain-induced spin texturing in the films. Magneto-optic Kerr effect confirmed a 4-fold magnetic anisotropy in the NiFeMo/MgO (100) film which exhibited a more pronounced topological Hall effect compared to that in the NiFeMo/ Al_2O_3 (0001) film. We envisage that the strain-induced disruption of the centrosymmetry in the NiFeMo films possibly lead to the Dzyaloshinskii-Moriya (DM) interactions within the spins. This gives rise to the skyrmion-like spin textures and hitherto unobserved large topological Hall effects near room temperature in the NiFeMo thin films. Theoretical simulations based on DM interactions strongly correlate the experimental results and corroborate with the presence of skyrmion-like spin textures in the films. The modulation of topology and magnetism in NiFeMo thin films through strain engineering may provide useful direction for the pursuit of quantum Hall effect based spintronic devices.

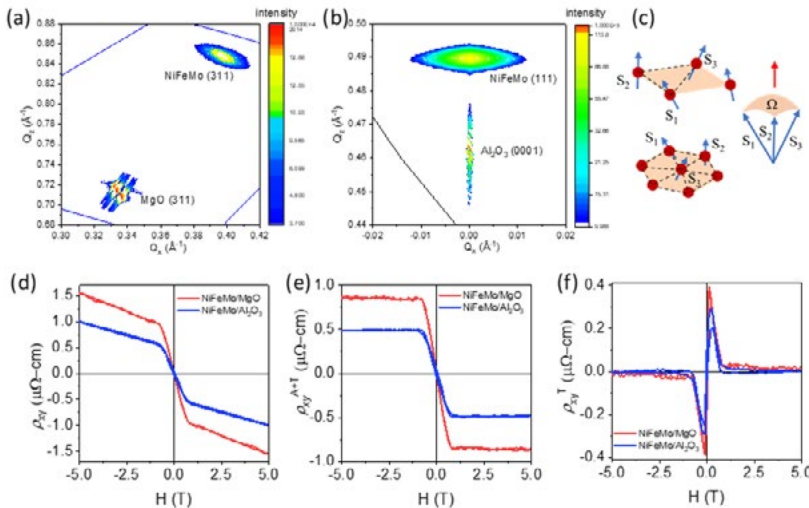


Figure 1. (a) XRD Reciprocal space maps (RSMs) of (a) NiFeMo/MgO (100) film around the (311) asymmetric plane of MgO (100) substrate and (b) NiFeMo/ Al_2O_3 (0001) film around the symmetric (0001) plane of Al_2O_3 substrate. (c) Schematic diagram of non-coplanar spins in NiFeMo thin films under epitaxial strain. Plots of (d) Total Hall resistivity ρ_{xy}^T , (e) sum of anomalous Hall resistivity and topological Hall resistivity ρ_{xy}^{A+T} , and (f) topological Hall resistivity ρ_{xy}^T with the magnetic field (H) at 300 K for NiFeMo/MgO (100) and NiFeMo/ Al_2O_3 (0001) thin films, respectively.

Compliance-Free and Forming-Free Digital and Analog Resistive Switching in a Perovskite-based Artificial Synaptic Device: Mimicking classical Pavlovian Learning :

Given the swift advancement of artificial intelligence, the fusion of biological capabilities within electronic devices has become imperative for executing intricate tasks and adjusting to diverse work settings. In this context, memristive synaptic devices have emerged as crucial components in the field of bio-inspired electronics, playing a pivotal role in advancing computational applications. However, limited reports are available on the realization of a multifunctional switching behaviour, combining digital and analog switching capabilities in a single perovskite oxide-based device. In this work, to the best of our knowledge, we demonstrate analog resistive switching behaviour and all fundamental synaptic functionalities including classical Pavlovian learning for the first time in a $\text{La}_{0.8}\text{Sr}_{0.2}\text{MnO}_{3-\delta}\text{La}_1$.

$\text{Sr}_x\text{MnO}_{3-6}$ (LSMO)-based memristor. Notably, both compliance-free and forming-free digital and analog resistive switching behaviours are observed in a single LSMO-based memristor fabricated using the pulsed laser deposition. Also note that, the LSMO-based memristor, with the metal-insulator transition (MIT) lying close to room temperature, exhibits a notable improvement in the RS parameters, as well as promising artificial synaptic behaviour. Remarkably, fundamental bio-synaptic features such as potentiation, depression, spike-time-dependent plasticity, paired-pulse facilitation, transition from short-term memory to long-term memory, and learning-forgetting-relearning behaviours are successfully emulated based on the change in device response. Hence, the integration of memory and complex learning rules in a single perovskite-based thin film device, opening up new possibilities for in-memory computing applications.

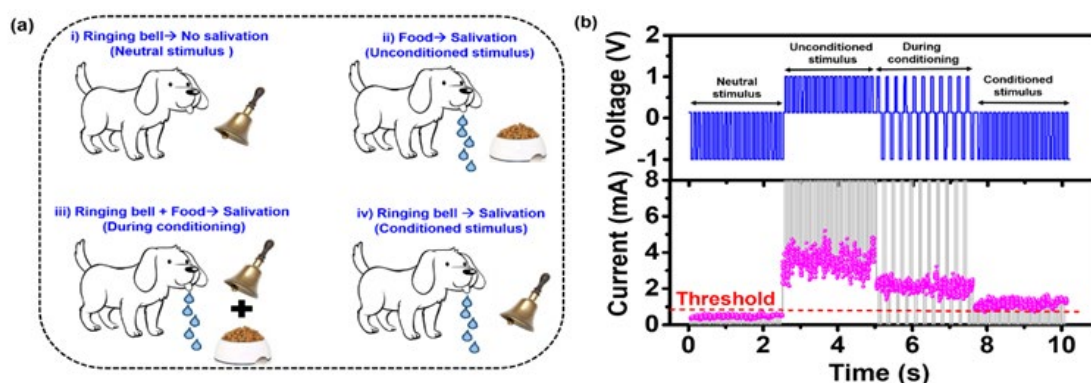


Figure 2. Experimental demonstration of classical Pavlov's dog learning and extinction on LSMO-1-based memristor. (a) Schematic illustration of classical Pavlovian learning experiment; i) the first bell ringing with no salivation is natural stimulus (NS). The 2nd condition (ii), the presence of food [unconditioned stimulus (US)] led to salivation. In the 3rd condition (iii), the training process with NS and US stimuli sequentially [During conditioning (DC)] led to salivation. The 4th condition (iv) is a ringing bell [conditioned Stimulus (CS)], which generates salivation. (b) Upper panel represent the input pulse stimuli to the memristor. Here, the 1st set of -ve voltage pulses is comparable with ringing bell (NS), 2nd set of +ve voltage pulses is comparable with food (US), 3rd set of voltage pulses is comparable with mixture of NS and US signals for training (DC), and 4th set of negative voltage pulses is comparable with CS. Lower panel represent the output current response recorded from the device under NS, US, DC, and CS. In the present memristor, 0.8 mA is the threshold current for salivation and below that threshold there is no salivation.

Publications in Journals :

1. Effect of Co-Mn Ordering on Defect-Induced Modulation of Complex Magnetic, Metamagnetic, Griffiths Phase, and Exchange Bias-like Behavior of $\text{Eu}_2\text{CoMnO}_6$ - A. Nayak, D. Bala, A. P. K. Yadav, N. Mondal, P. Mandal, V. Adyam, D. Mukherjee, B. L. Chittari, K. Jyothinagaram, *The Journal of Physical Chemistry C* **129**, 14 (2025).[IF:3.0]
2. On-receptor computing utilizing ZnO-based flexible memristor for wearable electronics - D Hasina, D Mukherjee, *Applied Materials Today*, **44**, 102664 (2025).[IF:6.9]
3. Interfacial Strain-Driven Large Topological Hall Effects in Supermalloy Thin Films with Noncoplanar Spin Textures - N Mondal, K Yadav, D Hasina, D Mukherjee, *ACS Applied Materials & Interfaces*, **17**, 5 (2025).[IF:8.2]
4. Exploring spin reorientation-induced magnetization reversal with inverse exchange bias effect and ab-initio DFT calculations on ferrimagnetic $\text{Gd}_2\text{NiIrO}_6$ iridates - D. Bala, C. Prashanth, A. Nayak, I. R. Reddy, N. Mondal, B. L. Chittari, V. Adyam, D. Mukherjee, K. Jyothinagaram, *Journal of Alloys and Compounds*, **1010**, 177452 (2025).[IF:6.3]
5. Evidence of spin reorientation transition below 150 K from magnetic force microscopy in a ferromagnetic BiFeO_3 thin film - S. Goswami, S. Mishra, K. K. Sahoo, K. Brajesh, M. R. Sahoo, S. Chatterjee, D. Mukherjee, K. Pradhan, A. Garg, C. K. Ghosh, D. Bhattacharya, *Physical Review B*, **110**, 214401 (2025).[IF:3.7]
6. Large reversible magnetocaloric effect in rare-earth molybdate $\text{RE}_2(\text{MoO}_4)_3$ (RE: Gd and Tb) compounds - P. Athira, C. H. Prashanth, D. Bala, A. Nayak, N. Thota, N. Mondal, V. Adyam, D. Mukherjee, K. Jyothinagara, *Journal of Magnetism and Magnetic Materials*, **610**, 172587 (2024).[IF:3.2]
7. Interplay of c-and a-domains on the anomalous electrocaloric effect in BaTiO_3 (001) single crystals - S. Chatterjee, K. Yadav, S. Barman, D. Hasina, D. Mukherjee, *Journal of Applied Physics*, **136**, 18 (2024).
8. Large electrocaloric effect across the non-hysteretic electrostructural phase transition in lead-free $(\text{Ba}_{0.88}\text{Ca}_{0.12})(\text{Ti}_{0.94}\text{Sn}_{0.06})\text{O}_3$ ceramics - Chitra, S. Chatterjee, S. Barman, S. Rawat, K. C. Singh, D. Mukherjee, *Materials Research Bulletin*, **178**, 112894 (2024).[IF:5.7]
9. Interfacial strain induced giant magnetoresistance and magnetodielectric effects in multiferroic BCZT/LSMO thin film heterostructures - S. Chatterjee, K. Yadav, N. Mondal, G. S. Kumar, D. Bhattacharya, D. Mukherjee, *Journal of Applied Physics* **135** (18), 184101 (2024).[IF:2.4]
10. Compliance-Free and Forming-Free Digital and Analog Resistive Switching in a Perovskite-Based Artificial Synaptic Device: Mimicking Classical Pavlovian Learning - D Hasina, K Yadav, D Mukherjee, *ACS Applied Electronic Materials*, **6** (5), 3676-3687 (2024).[IF:4.7]

Ph.D. Degree Awarded :

(I) Subhashree Chatterjee (IACS Deemed to be University)

Sponsored Project :

- » Utilizing antiferroelectric Cooling applications



Dilip Kumar Ghosh

Senior Professor

Higgs Physics, Dark Matter Physics, Electroweak Phase Transition and Gravitational Wave, Astro-particle Physics, Standard Model Effective Theory.

Associates : (1) Sk Jeusun, (2) Nandini Das, SRR (CSIR), (3) Mr. Koustav Mukherjee (IACS IntPhD) and (4) Debadrita Mukherjee (IACS IntPhD).

Collaborators : (i) S.K. Rai (HRI), (ii) N. Ghosh (IPMU, Japan), (iii) J. Dutta (IMSc), (iv) S. Mukherjee (Univ. of Maryland), (v) P. Ghosh (IMSc), (vi) U. Chattopadhyay (IACS), (v) K. Huitu (Univ. of Helsinki), (vi) R. Srivastava (IISER Bhupal), (vii) R.K. Singh (IISER Kol), (viii) B. Mukhopadhyay (IISER Kol), (ix) P. Majumdar (SINP), (x) D. Choudhury (DU), (xi) T. Gupta (Univ. of Helsinki), (xii) M. Heikinheimo (Univ. of Helsinki).

i) Hubble tension and cosmological imprints of $U(1)_X$ gauge symmetry: $U(1)_{(b_3-3L)}$ as a case study : Planck 2018's limit on neutrino species tightly constrains beyond-standard-model theories affecting neutrino decoupling. We study a light gauge boson from $U(1)_X$ symmetry, analyzing general models and two specific ones: $U(1)_{B_3-3Le}$ and $U(1)_{B_3-3L\mu}$. For low-mass bosons, Planck's limit is stricter than experimental bounds from Borexino, Xenon 1T, and others. Some parameter regions may also reduce the Hubble constant tension.

(With P. Ghosh, Sk. Jeusun, R. Srivastava, Published in EPJC)

ii) N_{eff} at CMB challenges $U(1)_X$ light gauge boson scenarios : The Planck 2018 upper limit on the effective number of neutrino species (N_{eff}) at the cosmic microwave background (CMB) era constrains beyond-Standard-Model (BSM) theories with interactions affecting neutrino decoupling. This study investigates the impact of a light gauge boson (Z') from local $U(1)_X$ symmetry on N_{eff} . Generic $U(1)_X$ models are classified into two types based on first-generation lepton charge assignments. Detailed analysis of two specific models, $U(1)_{B_3-3Le}$ and $U(1)_{B_3-3L\mu}$, examines Z'

contributions to N_{eff} . Compared to constraints from experiments like Borexino, Xenon 1T, and neutrino trident, N_{eff} bounds are stricter for low-mass Z' . Additionally, certain parameter regions may alleviate the Hubble constant (H_0) tension.

(With P. Ghosh, Sk. Jeusun, R. Srivastava, Published in PRD)

iii) Electroweak phase transition in two scalar singlet model with pNGB dark matter : We study the electroweak phase transition in an extended Standard Model with a real scalar (Φ) and a complex scalar (S), both SM gauge singlets, where a global $U(1)$ symmetry is softly broken to Z_3 , making the imaginary part of S a pseudo-Nambu-Goldstone boson dark matter candidate stabilized by Z_2 symmetry. The $U(1)$ breaking introduces cubic terms in the scalar potential, enabling a strong first-order phase transition. We identify parameter spaces meeting dark matter relic density and experimental constraints while supporting single- or multi-step phase transitions, often yielding underabundant relic density. Gravitational wave signatures from this framework complement traditional dark matter detection methods.

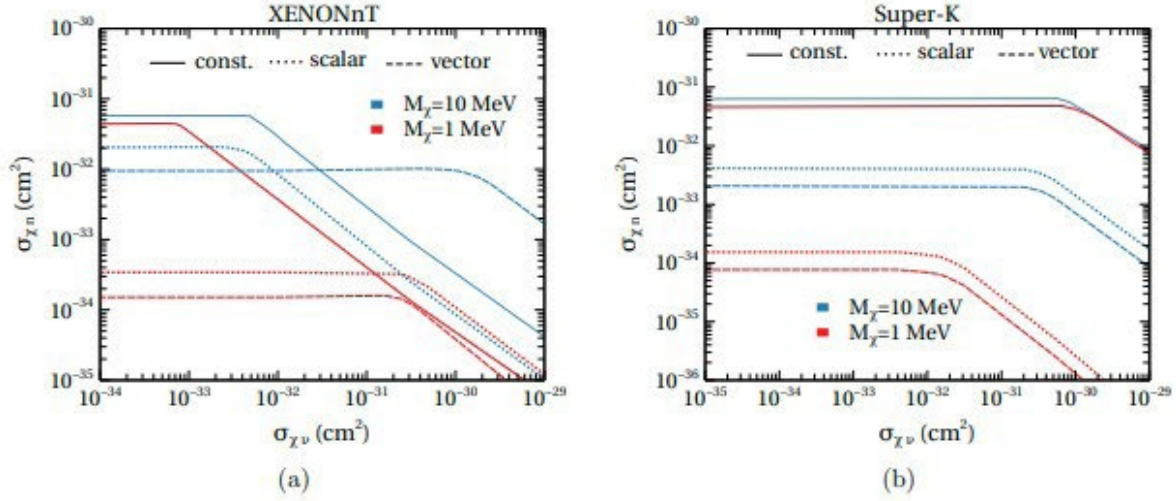
(With K. Mukherjee and S. Mukherjee, Published in JHEP)

iv) Boosted dark matter driven by cosmic rays and diffuse supernova neutrinos : We investigate boosted dark matter from upscattering with cosmic particles like supernova neutrinos

or cosmic rays, reaching kinetic energies up to tens of MeV. This scenario requires dark matter interactions with nucleons or electrons for detection in experiments like XENONnT or Super-Kamiokande, with scattering cross

sections (energy-dependent or independent) constraining the model.

(With K. Huitu, Sk. Jeusun, M. Heikinheimo, T. Gupta, Published in PRD)



Contour lines of 90% C.L. constraints on the $\sigma_{\chi \nu}$ vs. $\sigma_{\chi n}$ plane for different values of M_χ from (a) XENONnT and (b) Super Kamiokande. The solid, dashed, and dotted lines represent constant, vector, and scalar cross-sections. The constraints corresponding to different $M_\chi \in \{1, 10\}$ MeV are shown by red and light blue colour, respectively. The regions above the contour lines are

v) Constraints on lepton flavor universal and non-universal New Physics in $b \rightarrow s \ell^+ \ell^-$ -decays: a global SMEFT survey : The Flavor Changing Neutral Current (FCNC) semileptonic decays of B-mesons provide an excellent platform for indirectly probing New Physics (NP) beyond the Standard Model (SM). Although precise tests of lepton flavor universality (LFU), such as the ratios R_K and R_{K^*} , are consistent with the SM predictions, other observables in $b \rightarrow s \ell^+ \ell^-$ transitions show significant deviations. Using various limits from LHCb, Belle-II etc. for various relevant measurements, we perform

a global analysis of dimension-6 Standard Model Effective Field Theory (SMEFT) operators, considering the possibility of new physics contributions not only in $b \rightarrow s \mu^+ \mu^-$ transitions but also in $b \rightarrow s e^+ e^-$ transitions.

(With, I. Ali, N. Rajeev, U. Chattopadhyay, in communication with Phys. Rev. D.)

Publications in Journals :

1. Axion-like particle (ALP) portal freeze-in dark matter confronting ALP search experiments - D. K. Ghosh, A. Ghoshal and S. Jeusun, *JHEP*, **01**, 026 (2024), [IF:5.4]



Durga Basak, FNASc

Senior Professor & Dean (Finance)

Carrier dynamics, opto-electronics of 2D van Der Waals and 3D sulfide and oxide thin films.

Associates : (1) Santanu Pal, SRF (Inspire), (2) Sourav Mondal, SRF (CSIR), (3) Santanu Jana, JRF (UGC), (4) Barnali Patra, JRF (UGC), (5) Soumik Bhattacharya, JRF (UGC), (6) Sujoy Sadhukhan, JRF (UGC), (7) Anshuman Jana, JRF (Institute), (8) Sukanya Panja (BS-MS project student) and (9) Arijit Mondal (MS Project Student).

During 2024–2025, our research explored advanced defect engineering and substrate interactions in metal oxide and 2D van Der Waals systems for optoelectronic applications. We investigated how substrate-induced strain significantly alters the optical and optoelectronic properties of trilayer MoS_2 , revealing strain-modulated excitonic and transport behavior. In another study, Li ion implantation in TiO_2 films was shown to influence structural disorder and defect-mediated photophysical responses. We also demonstrated high-performance all-transparent and flexible UV photodetectors based on ultrathin oxide/metal/oxide trilayer transparent conducting electrodes. In ZnO systems, we tailored electrical and magneto-electric transport properties through Ti ion implantation and further unveiled defect transformations using Raman and photoluminescence studies supported by SRIM simulations in vertically grown ZnO nanorods. These studies collectively highlight the critical role of defect modulation and material architecture in enhancing functionalities for next-generation optoelectronic and sensing devices.

Publications in Journals :

1. Substrate-Induced Strain Upshot on the Optical and Optoelectronic Properties of Trilayer MoS_2 - S Mondal, D Basak, *ChemPhysChem*, **26** (4), e202400829 (2025).[IF:2.37]
2. Impact on the structural and photophysical properties of TiO_2 films owing to Li implantation - S Mondal, A Das, D Basak; *Journal of Materials Science: Materials in Electronics*, **35** (34), 2168 (2024).[IF:2.6]

3. Ultrathin Oxide/Metal/Oxide Trilayer Transparent Conducting Electrodes for an All-Transparent Flexible UV Photodetecting Device - S Pal, D Basak; *ACS Applied Electronic Materials*, **6** (9), 7035-7045 (2024).[IF:4.3]
4. Tailoring the electrical and magneto-electric transport properties of ZnO films via Ti ion implantation - S Pal, A Das, D Basak, *Journal of Applied Physics*, **135** (14) (2024).[IF:2.6]
5. Significant transformation in the point defects evidenced via theoretical simulations supported by Raman and photoluminescence studies in vertically grown 1D ZnO nanorods triggered by titanium ion implantation - Barnali Patra, Amaresh Das, and Durga Basak, *Physica B: Condensed Matter*, **678**, 415745 (2024).[IF:3.0]

Ph.D. Degree Awarded :

(1) Sulakshana Mondal (Jadavpur University)

Sponsored Project :

- » A critical look at post-transition photophysical processes
- » Targetting broadband Mxene based materials.



Indra Dasgupta

Senior Professor, Dean (Faculty Affairs & R&D)
Electronic structure of Quantum Matter.

Associates : (1) Mr. Ritwik Das, SRF (CSIR), (2) Mr. Kunal Dutta, SRF (CSIR), (3) Mr. Rounak Das, SRF (Institute), (4) Mr. Akram Hossain Sarkar, SRF (UGC), (5) Mr. Anupam Mondal, JRF (CSIR), (6) Mr. Arkamitra Sen, JRF (Institute), (7) Mr. Soumik Chakraborty, JRF (Institute), (8) Dr. Mohammad Rezwan Habib, RA-1 (TRC) (till December 2024), (9) Dr. Vijeta Singh, RA-1 (TRC) and (10) Dr. Arpita Paul, RA-1 (TRC).

Collaborators : (1) Prof. A.V. Mahajan, and Prof. Sumiram Pujari, IIT Bombay, (2) Prof. Sugata Ray, IACS, Kolkata, (3) Prof. T. Saha-Dasgupta, SNBNCBS, Kolkata (4) Prof. Olle Erikson, Uppsala University, and (5) I Das (SINP).

Research in our group in the past year was devoted to the calculation of electronic structure of non-centrosymmetric systems and strongly correlated systems in the presence of spin-orbit coupling, study of topological phase transition in 2D ferromagnets.

We have proposed a route for the realization of persistent spin texture (PST) in non-centrosymmetric systems in the presence of spin-orbit coupling. We have shown from symmetry considerations that in non-polar chiral systems, bands with specific orbital characters around a high-symmetry point with D_2 little group may admit a single spin-dependent term in the low-energy $k \cdot p$ model Hamiltonian that naturally leads to PST. Considering a two-dimensional plane in the Brillouin zone, we have further argued that in such chiral systems, the PST is transpired due to the comparable strengths of the Dresselhaus and Weyl (radial) interaction parameters where the presence of these two terms is allowed by the D_2 symmetry. Finally, using first-principles density functional theory calculations, we have identified that the nonpolar chiral compounds Y_3TaO_7 and $AsBr_3$ displays PST for the conduction band and valence band, respectively, around the Γ point having D_2 little group and predominantly Ta-dxz orbital character for Y_3TaO_7 and Br-px orbital character for $AsBr_3$, corroborating our general strategy. Our results for the realization of PST in nonpolar chiral systems

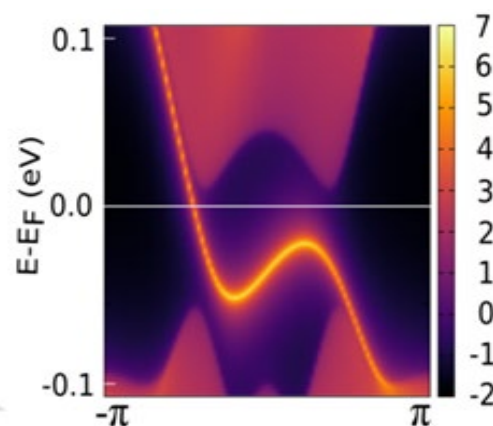
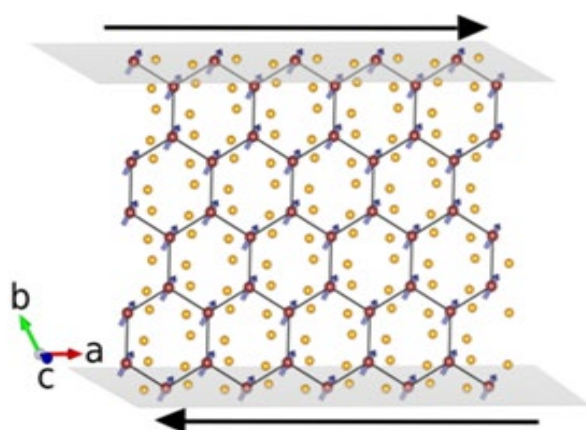
thereby broaden the class of materials displaying PST that can be employed for application in spin orbitronics.

The theoretically predicted Chern insulators have highlighted the potential of easy-axis 2D ferromagnets to host the quantum anomalous Hall effect. This phenomenon can also emerge from in-plane ferromagnetism in such systems via the breaking of both out-of-plane and in-plane mirror symmetries. In a series of work we have demonstrated that the interplay between magnetism and mirror symmetries makes ferromagnetic 2D systems a versatile platform for realizing nontrivial topological phases, with the orientation of magnetic moments at lattice sites serving as a key tuning parameter. We show that the Rashba spin-orbit coupling (SOC) induced by broken out-of-plane mirror symmetry together with the intrinsic SOC incorporated in a tight-binding model captures the rich topological phase diagram of these systems as a function of in-plane magnetization. In particular, the restoration of in-plane mirror symmetry upon orientation of the moments promotes topological phase transition. Our model calculations are corroborated with first principles electronic structure calculations for the ferromagnetic kagome monolayer Co_3Pb_3S and 2D honeycomb system $OsCl_3$.

Realization of non-centrosymmetric magnetic Weyl metals is expected to exhibit anomalous transport properties stemming from the interplay of unusual bulk electronic topology and magnetism. Recently our experimental collaborators from SINP demonstrated spin-valve-like magnetoresistance at room temperature and anomalous Hall

conductivity in ferrimagnetic Weyl metal Mn_2PdSn that crystallizes in the inverse Heusler structure. First principles electronic structure calculations confirmed the topologically nontrivial nature of the band structure, with Weyl nodes proximate to Fermi energy, providing deeper insights into the observed intrinsic Berry curvature mediated

substantial anomalous Hall conductivity. Our results underscore the inverse Heusler compounds as promising platform to realize magnetic Weyl metals/semimetals with emergent transport properties for electronic functionalities.



Interplay between magnetism and mirror symmetries in tuning Chern numbers in 2D ferromagnets. (See **Electron. Struct. 6 (2), 025005 (2024)**)

Award/Recognitions :

- » Fellow, Indian Academy of Sciences, Bengaluru.
- » Associate Fellow, Asia Pacific Center for Theoretical Physics (APCTP) (2024-2029), APCTP, Pohang, Korea

Special Achievement :

Organised 15th APCTP-IACS-KIAS Joint Conference on Emergent Phenomena in Novel Oxide Materials and Low Dimensional Systems in Seoul, Korea

Publications in Journals :

1. Persistent spin textures in nonpolar chiral systems - K Dutta, I Dasgupta *Physical Review B*, **110**, 235162 (2024).[IF:3.2]
2. Spin-Valve-Like Magnetoresistance and Anomalous Hall Effect in Magnetic Weyl Metal MnPdSn - A Bhattacharya, MR Habib, A Ahmed, B Satpati, S Dutta Gupta, I Dasgupta, I. Das, *Phys Rev B*, **110**, 014417 (2024).[IF:3.2]
3. Gapless Edge-Modes and Topology in the Qi-Wu-Zhang Model: A Real-Space Analysis - A Dasgupta, I Dasgupta, *Physica Scripta* **99**, 095928 (2024).[IF:2.6]
4. Disordered magnetic ground state in a quasi-1D d⁴ columnar iridate $\text{Sr}_3\text{LiIrO}_6$

5. Abhisek Bandyopadhyay, A Chakraborty, S Bhowal, Vinod Kumar, MM Sala, A Efimenko, C Meneghini, I Dasgupta, T Saha Dasgupta, AV Mahajan, Sugata Ray - *Journal of Physics: Condensed Matter*, **36**, 425804 (2024).[IF:2.3]
6. In-plane magnetization orientation driven topological phase transition in OsCl_3 monolayer - Ritwik Das, Subhadeep Bandyopadhyay and Indra Dasgupta *Electron. Struct.*, **6**, 025005 (2024).[IF:2.9]

Lectures Delivered :

Invited talk at (1) Prof. K.C. Kar Memorial Lecture, Calcutta Institute of Theoretical Physics, Kolkata, (2) IIT Mandi, (3) EMRS Fall Meeting, Warsaw Poland, (4) IISc, Bangalore, (5) IIT Bombay, Mumbai, (6) Indo-Swedish Conference, Evolve Back Resort, Coorg, (7) 15th APCTP IACS KIAS Jt. Conference, Seoul Korea, (8) Q-MAT, IIT Guwahati, (9) PCAMC-2024, IISER, Kolkata, (10) EESTER SRM University and IIT Madras, (11) Colloquium, IIT Bombay, (12) SNBNCBS, Kolkata.

Sponsored Project

- » Search for Novel Spin-Liquid experiment and theory

**Koushik Ray**

Professor

String Theory and Mathematical Physics

Associates : (1) A. Pal, SRF.**Publications in Journals :**

1. Conformal integrals in all dimensions as generalized hypergeometric functions and Clifford Groups – A. Pal and K. Ray, *J. Math. Phys.*, **66**, 043504 (2025).
2. On entropy and complexity of coherent states – K. Ray, arXiv:2407.13327[hep-th].
3. Topology Behind Topological Insulators – K. Ray and S. Sen, *Reports on Mathematical Phys.*, **95**, 11 (2025).

**Krishnendu Sengupta, FNA, FASc, FNASc**

Senior Professor

Quantum condensed matter, conformal field theory, Out-of-equilibrium dynamics

Associates : (1) Krishanu Ghosh, JRF (2) T Banerjee, SRF-Int-PPS; (3) S. Ghosh, SRF (CSIR).

I and my group members have worked on several aspects of quantum condensed matter and conformal field theory. Our work has focussed on out-of-equilibrium dynamics of these systems. This work has led to several publications whose details are given along with.

Publications in Journals:

1. Emergence of a quasi-ergodic steady state in a dissipative Tavis-Cummings array - D. Mondal, K. Sengupta, and S. Sinha, *Phys. Rev. A*, **110**, 042207 (2024).

2. Exactly solvable Floquet dynamics for conformal field theories in dimensions greater than two - D. Das, S. R. Das, A. Kundu, and K. Sengupta, *JHEP*, **09**, 095 (2024).
3. Signatures of fragmentation for periodically driven fermions - S. Ghosh, I. Paul, and K. Sengupta, *Phys. Rev. B*, **109**, 214304 (2024) [selected as Editor's suggestion].
4. Emergent symmetries in prethermal phases of periodically driven quantum systems, T. Banerjee and K. Sengupta, *J. Phys.: Cond. Mat.*, **37**, 133002 (2025).

Publications in Books :

5. Introduction to Quantum Mechanics, Krishnendu Sengupta and Palash B Pal, Cambridge University Press, April 2023.

Ph.D. Degree Awarded :

- (1) Somsubhra Ghosh (IACS Deemed to be University)

Sponsored Project

- » JC Bose National Fellowship

Lectures Delivered :

Invited talk at (1) QMAT-23, NISER, (2) ICTP, Italy and ETQT-2023, (3) IIT, Palakkad.



Mintu Mondal

Associate Professor

Spectroscopy of Functional and Quantum Materials

Associates : (1) Arnab Bera, SRF, (2) Sk Kalimuddin, SRF, (3) Deep Singha Roy, SRF, (4) Tuhin Debnath, SRF, (5) Soham Das, SRF, (6) Ankan Bag, JRF, (7) Souvik Pramanik, JRF and (8) Dr. Sovan Kumar Panda, ANRF-TARE Fellow.

Our research is primarily centered around investigating the intriguing quantum phenomena exhibited by low-dimensional quantum materials with a layered structure. Specifically, we are interested in studying emerging phenomena arising from the interplay of electronic state topology and collective order in vdW quantum materials. The families of (a) Quasi-2D vdW ferromagnets and topological materials, and (b) Quasi-1D vdW materials serve as an exceptional and versatile platform for probing critical quantum phenomena such as the dynamic response of charge density waves (CDW) and topological phases in 1D chains.

The recent publication "Exceptionally Slow, Long-Range, and Non-Gaussian Critical Fluctuations

Dominate the Charge Density Wave Transition" [*Phys. Rev. Lett.* **132**, 266504 (2024)] addresses fundamental aspects of fluctuation dynamics near CDW phase transitions. Through precise low-frequency noise measurements, the team revealed that the CDW transition in a model low-dimensional system is governed by slow, spatially extended, and highly non-Gaussian critical fluctuations. This study provides rare experimental access to fluctuations dynamics near the criticality and offers crucial insight into the design of fluctuation-sensitive quantum sensors and memory architectures.

We have also explored the magneto-optical characteristics of few-layer ferromagnetic van der Waals nanoflakes. In our recent publications

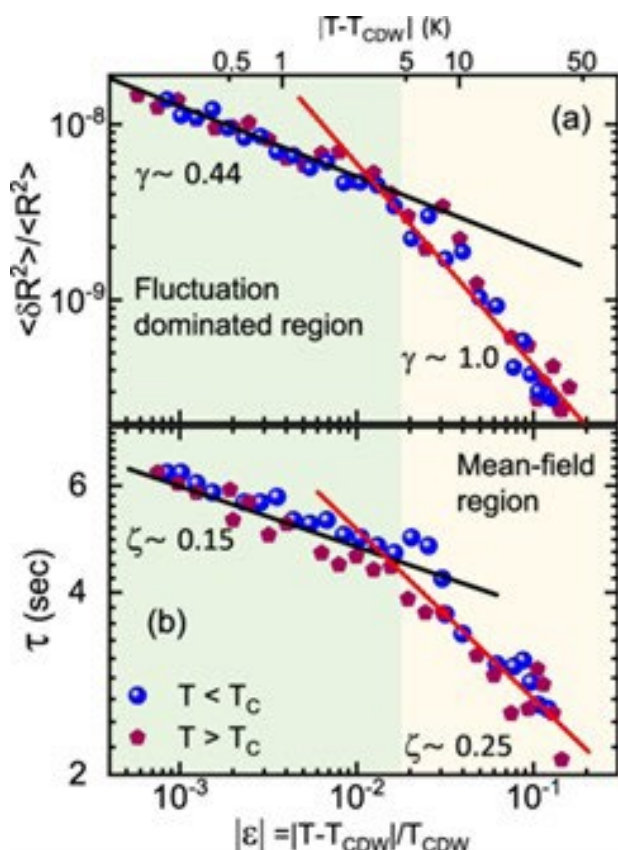


Figure 1: Demonstration of diverging critical fluctuations and critical slowing down associated with second-order CDW phase transitions in a quasi-1D compound, (TaSe₃)₂I system. Measurements were performed using a customized, home-built setu.

entitled “Nonlinear Optical Properties of 2D vdW Ferromagnetic Nanoflakes for Magneto-Optical Logic Applications” [Adv. Optical Materials 13, 2402318 (2025)], we have demonstrated that these materials exhibit pronounced nonlinear optical responses under moderate magnetic fields, including tunable birefringence and field-induced optical bistability. Such behavior opens up the possibility for implementing magnetically gated optical switches and logic devices with ultralow power consumption. This work advances the field of opto-spintronic device engineering by highlighting the multifunctionality of 2D magnets in integrated photonic circuits.

Publications in Journals :

1. *Raman signatures of inversion symmetry breaking structural transition in quasi-1D compound \$(TaSe_4)_3I\$* - Arnab Bera, Partha Sarathi Rana, Suman Kalyan Pradhan, Mainak

Palit, Surabhi Saha, Sk Kalimuddin, Satyabrata Bera, Tuhin Debnath, Soham Das, Deep Singha Roy, Subhadeep Datta, Mintu Mondal, and Mintu Mondal, *Journal of Physics: Condensed Matter*, **37 (12), 125403 (2025)**.

2. *Electronic pyroelectricity in a supramolecular assembly of an acceptor-donor-acceptor-type ambipolar π -system* - Pritam Sadhukhan, Sk Kalimuddin, Aritri Pal, Tuhin Debnath, Swadesh Paul, Shubhankar Barman, Suhrit Ghosh*, Mintu Mondal*, and Anuja Datta, *Chemical Communications*, **61 (28), 5289-5292 (2025)**. [IF:]
3. *Nonlinear Optical Properties of 2D vdW Ferromagnetic Nanoflakes for Magneto-Optical Logic Applications* - Satyabrata Bera, Sk Kalimuddin, Arnab Bera, Deep Singha Roy, Tuhin Debnath, Soham Das and Mintu Mondal, *Advanced Optical Materials*, **13, 2402318 (2025)**.
4. *Exceptionally Slow, Long-Range, and Non-Gaussian Critical Fluctuations Dominate the Charge Density Wave Transition* - Sk Kalimuddin, Sudipta Chatterjee, Arnab Bera, Hasan Afzal, Satyabrata Bera, Deep Singha Roy, Soham Das, Tuhin Debnath, Bhavtosh Bansal*, and Mintu Mondal, *Physical Review Letters*, **132, 266504 (2024)**. [IF:]
5. *Room Temperature Evolution of Laser-Induced Ultrafast Spin and Phonon Dynamics in 2D van der Waals Magnets FexGeTe₂ (x= 3, 4, 5)* - Arundhati Adhikari, Bipul Kumar Mahato, Sourav Sahoo, Suchetana Mukhopadhyay, Mainak Palit, Satyabrata Bera, Subhadeep Dutta, Mintu Mondal and Anjan Barman, *Advanced Functional Materials*, **2418006 (2024)**. [IF:]
6. *Amplifying reactivity of bio-inspired [FeFe]-hydrogenase mimics by organic nanotubes* - Md Estak Ahmed, Puspendu Das, Sk Mustak Ahamed, Samir Chattopadhyay, Abhijit Nayek, Mintu Mondal, Sudip Malik, and Abhishek Dey, *Chemistry-A European Journal*, **e202403011 (2024)**. [IF:]
7. *Chiral anomaly and weak antilocalization effects in the Weyl semimetal EuAuSb* - Shubhankar Roy, Bishal Das, Arup Ghosh, Arnab Bera, Chanchal K. Barman, Mintu Mondal, Aftab Alam, and Prabhat Mandal *Physical Review B* **110 (8), 085145 (2024)**. [IF:]

Ph.D. Degree Awarded :

(1) Satyabrata Bera (IACS Deemed to be University)

Lectures Delivered :

Invited talk at (1) IIT Guwahati, (2) IIT Kharagpur, (3) TIFR Mumbai, (4) University of Strasbourg, France and (5) SNBNCBS, Kolkata.

Sponsored Project :

- » Correlated response of Nonlinear materials – SERB Core research grant
- » Quasi1D materials Harvesting applications – CSIR Core research grant
- » Fabrication of thin film Bottom Gate structure TARE



Satyanarayan Mukhopadhyay

Associate Professor

(1) Cosmology of Particle Dark Matter, (2) Dark Matter Searches using Cosmological, Astrophysical and Laboratory-based Probes, (3) Elementary Particle Physics

Associates : (1) Sampriti Roy, JRF, (2) Sourav Gope, SRF, (3) Deep Ghosh and (4) Avirup Ghosh, RA-I.

There is a significant uncertainty in the prediction of atmospheric muon neutrino and anti-neutrino flux ratio using different flux models, especially at higher energies. We studied the prospects of experimentally measuring this flux ratio as a function of energy with the ATLAS detector at the LHC. To this end, we compute the contained-vertex and external upward going charged current event rates induced by atmospheric muon (anti-) neutrinos through deep inelastic scattering at the 4 kiloton hadron calorimeter component of ATLAS. We illustrate the event selection criteria necessary to eliminate the cosmic ray muon background for the above event classes. Our estimates show that the energy dependence of the ratio of negative and positively charged muons induced by atmospheric muon neutrino and anti-neutrino fluxes can be measured by ATLAS upto a muon energy of 100 GeV, with 1000-live days of neutrino physics exposure over a period of several years, considering only the period with the LHC beams not in circulation, but the detector and magnetic fields of ATLAS in operation. This proposal is now being actively

pursued by the experimentalists in the ATLAS and CMS collaborations.

In the study of cosmological aspects of particle dark matter (DM), we have pointed out that in the most commonly considered mechanism of the production of DM and the standard model (SM) particles during the reheating epoch after inflation, there is an inevitable scattering process between DM and SM particles mediated by the inflatons. These scatterings significantly modify the phase-space distribution function of DM, and may even lead to the thermalization of this sector with the SM bath, which in turn has significant consequences in the production and detection of the DM particles.

Publications in Journals :

1. Cosmological implications of inflaton-mediated dark and visible matter scatterings after reheating - D. Ghosh, S. Gope and S. Mukhopadhyay, *Physical Review D*, **109**, 083541 (2024).[IF:5.0]

- Measuring the atmospheric muon neutrino and anti-neutrino flux ratio with the ATLAS detector at LHC - D. Ghosh, S. Mukhopadhyay, and B. Mukhopadhyaya, e-Print: 2409.20231 [hep-ph], to appear in Physical Review D. [IF: 4.6]

Ph.D. Degree Awarded :

(1) Sourav Gope (IACS Deemed to be University)

Lectures Delivered :

Invited talk at (1) IMSc, Chennai, (2) IISc, Bengaluru, (3) University of Tokyo, Japan, (4) IIT Guwahati, (5) NISER, Jatani, (6) SINP Kolkata and (7) Ramakrishna Mission Vivekananda Educational and Research Institute, Belur.



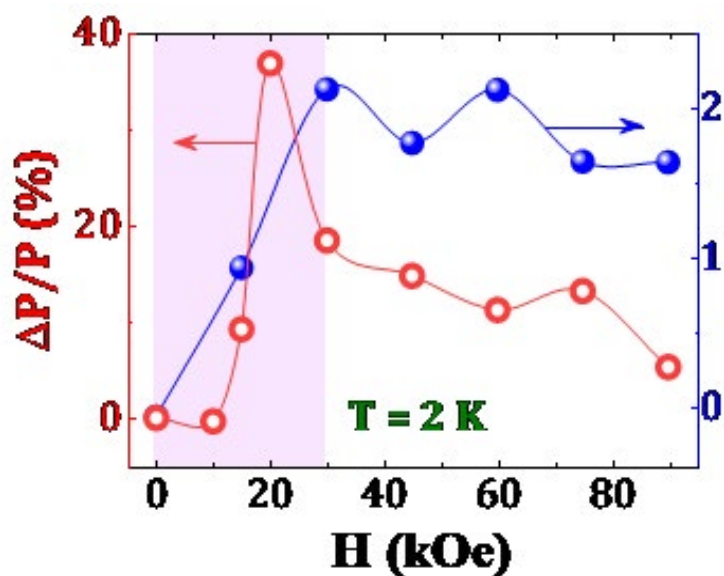
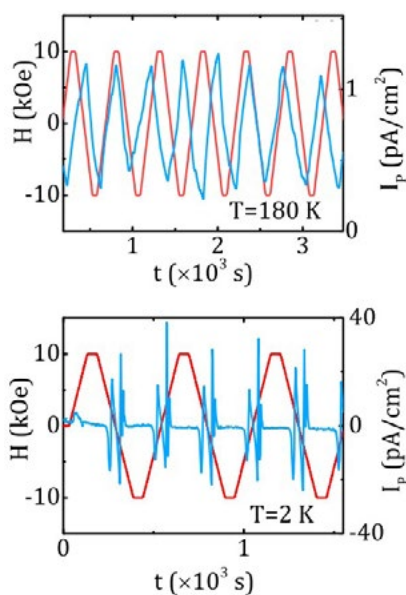
Saurav Giri

Senior Professor

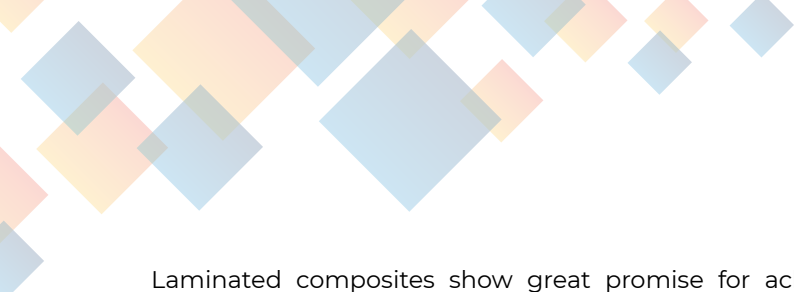
Topological quantum materials, magnetoelectric coupling, multiferroics, and thermoelectric properties

Associates : (1) Atanu Roychoudhury, SRF (Institute), (2) Shameek Mukherjee, SRF (Int.-PhD), (3) Arpan Hati, SRF (UGC-NET), (4) Debapriya Chatterjee JRF (CSIR-NET) and (5) Sudip Saw (Institute).

Cros-talk between magneto-electric coupling and magnetostriction



First panel: Dynamics of different magneto-electric coupling at 2 and 180 K, where I_p is the pyroelectric current; Second panel: Magnetostriction ($\Delta c/c$) correlates static response of magneto-electric coupling ($\Delta P/P$). [PHYSICAL REVIEW B 111, L140412 (2025)].



Laminated composites show great promise for achieving substantial magnetoelectric (ME) coupling. Through the manipulation of magnetostriction and piezoelectric engineering. However, the ME coupling mechanism in composites is less understood due to complex extrinsic effects at the interfaces, unlike the well-understood ME mechanism in chemically single-phase compounds. Our study reveals unexplored ferroelectric (FE) orders along c-axis and magnetostriction-driven ME couplings, indicating type-II multiferroic order in TbFeO₃. These findings directly demonstrate magnetostriction-driven ME coupling, and they suggest it as one of the potential mechanisms underlying ME coupling in multiferroics.

Publications in Journals :

1. Crosstalk between magnetostriction and magnetoelectric coupling in type-II multiferroic TbFeO₃ - A. Indra, S. Mukherjee, K. Dey, O. Fabelo, L. Canadillas- Delgado, T. Chatterji, J. Stremper, S. Majumdar, and S. Giri, *Physical Review B*, **111**, L140412 (2025).[IF:3.2]
2. Field-induced transformation of complex spin ordering and magnetodielectric and magnetoelastic coupling in MnGeTeO₆ - Y. H. Chang, Arkadeb Pal, P. T. W. Yen, C. W. Wang, S. Giri, G. R. Blake, Javier Gainza, M.-J. Hsieh, J.-Y. Lin, C. Y. Huang, Y. J. Chen, T. W. Kuo, Ajay Tiwari, D. Chandrasekhar Kakarla, and H. D. Yang, *Physical Review B*, **110**, 064405 (2024).[IF: 3.2]

Ph.D. Degree Awarded :

(1) Shameek Mukherjee (IACS Deemed to be University) and (2) Pradipta Kumar Ghose (IACS Deemed to be University).

Lectures Delivered :

Invited talk at (1) NISER Bhubaneswar.

Sponsored Project

- » Magnetoelectric coupling ferroelectrics
- » Developing materials coupling
- » Growth of single crystal Thermoelectric properties



Sourov Roy

Senior Professor

Particle, astro-particle and cosmo particle physics including physics of axions and axion-like particles, neutrinos, dark matter physics and cosmic inflation.

Associates : (1) Ananya Tapadar (SRF), (2) Tanmoy Kumar (SRF), (3) Pratick Sarkar (SRF), (4) Shivarama Krishna Singirala (RA-I), (5) Soumya Sadhukhan (TARE Fellow), (6) Shihabul Haque (BS-MS Project student), (7) Suvendu Giri (Integrated M.Sc-PhD project student), (8) Subhadarsi Sahoo (Integrated M.Sc-PhD project student), (9) Anuran Sarkar (BS-MS project student).

Collaborator : (1) Prof. Biswarup Mukhopadhyaya, IISER-Kolkata, (2) Dr. Arpan Kar, LPTHE, CNRS & Sorbonne University, Paris and (3) Prof. Subhendra Mohanty, IIT Kanpur and (4) Prof. Santosh Vadawale, PRL, Ahmedabad.

Particle, Astro-particle Physics and Cosmo-particle Physics

Cosmic inflation and $(g-2)_\mu$ in minimal gauged $L_\mu-L_\tau$ model

The minimal $U(1)_{L_\mu-L_\tau}$ gauge symmetry extended Standard Model (SM) is a well motivated framework that resolves the discrepancy between the theoretical prediction and experimental observation of muon anomalous

magnetic moment. We envisage the possibility of identifying the beyond Standard Model Higgs of $U(1)_{L_\mu-L_\tau}$ sector, non-minimally coupled to gravity, as the inflaton in the early universe, while being consistent with the $(g-2)_\mu$ data. Although the structure seems to be trivial, we observe that taking into consideration a complete cosmological history along with existing constraints on model parameters leave us a small window of allowed reheating temperature. This further results into restriction of (n_s-r) plane which is far severe than the one in a generic non-minimal quartic inflationary set up.

(with **A.Paul** and **A.K. Saha** and published in JCAP(IF:5.3))

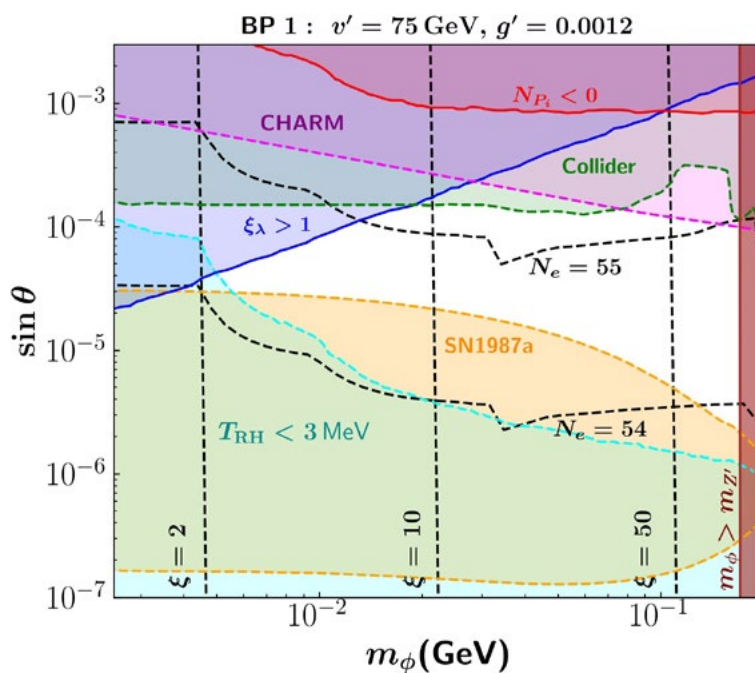


Figure caption: The correlation between inflation sector parameters and the scalar sector parameters are shown

» **Translating current ALP photon coupling strength bounds to the Randall- Sundrum model**

In this work, we look at the current bounds on the coupling strength of axion-like particles (ALPs) with two photons in the context of the Randall-Sundrum (RS) model. We relate the coupling strength to the compactification radius that governs the size of the extra dimension in the RS warped geometry model and show how the current bounds on the ALP can be used to derive appropriate constraints on the size of the extra fifth dimension in the RS model.

(with **S. Haque and S.SenGupta** arXiv:2411.08396)

» **Constraining eV-scale axion like particle dark matter : insights from the M87 Galaxy**

Axion-like particles (ALPs) can account for the observed dark matter (DM) of the Universe and if their masses are at the eV scale, they can decay into infrared, optical and ultraviolet photons

with a decay lifetime larger than the age of the Universe. We analyze multi-wavelength data obtained from the central region of Messier 87 (M87) galaxy by several telescopes, such as, Swift, Astrosat, Kanata, Spitzer and International Ultraviolet Explorer in the infrared to ultraviolet frequencies, to constrain the narrow emission lines indicative of the eV scale ALP DM decay.

(with **A. Kar and P. Sarkar** arXiv:2501.01860)

Publications in Journals :

1. Cosmic inflation and $(g-2)_\mu$ in minimal gauged $L_\mu-L_\tau$ model, A.Paul, S.Roy and A.K. Saha, *JCAP*, **10**, 077(2024).[IF:5.3]

Ph.D. Degree Awarded :

- (1) Ananya Tapadar (IACS Deemed to be University)

Lectures Delivered :

Invited talk at (1) SINP Kolkata, (2) WDMAP at IOP, Bhubaneswar, (3) University of Dhaka, Bangladesh and (4) IISc, Bengaluru.



Subhadeep Datta

Associate Professor

Experimental Condensed Matter Physics: Molecular electronics, Nanospintronics, Nanomagnetism, Hybrid 2D materials (Graphene, 2D TMDCs, etc.)

Associates : (1) S. Maity, SRF, (2) B. Das, SRF, (3) T. Kundu, SRF (4) R. Pramanik, SRF, (5) P. Maji, SRF, (6) S. Das, SRF, (7) P. Hazra, SRF, (8) B. Karmakar, JRF, (9) S. Mandal, JRF, (10) H. Khatun, JRF, (11) A. Saha, JRF, (12) Dr. Mainak Palit, RA-I, (13) Dr. Chirantan Singha, RA-I and (14) Dr. Shrabani Guhathakurata, RA-I.

Our research group is dedicated to advancing the science of two-dimensional (2D) magnetism and the technology of related micro-/nano-electronic devices by investigating fundamental spin-dependent interactions, developing circuit prototypes, and creating voltage-control methods essential for scalable sensor processing. A key focus is leveraging the unique phonon modes of the 2D lattice to understand magnon-phonon

hybridization. Achieving magnetic atomic layers in solid-state systems provides a new route to scalable quantum devices. This approach draws on expertise in electronic circuits and is well-positioned to utilize innovative nanomaterials, such as large-area monolayer magnets, magnetic heterostructures, magnetic nanowires, and quasi-1D nanoribbons.

In two-dimensional van der Waals (vdW) layered materials, application of pressure often induces a

giant lattice collapse, which can subsequently drive an associated Mott transition. Here, we investigate Room-temperature layer-dependent insulator-metal transition (IMT) and probable spin-crossover in vdW magnet, FePS₃, under high-pressure using micro-Raman scattering. Experimentally obtained spectra, in agreement with the computed Raman modes, indicate evidence of IMT of FePS₃ started with a thickness-dependent critical pressure (P_c) which reduces to 1.5 GPa in trilayer flakes compared with 10.8 GPa for the bulk counterpart. Using a phenomenological model, we argue that strong structural anisotropy in few-layer flakes enhances the in-plane strain under applied pressure and is, therefore, ultimately responsible for reducing the critical pressure for the IMT with decreasing layer numbers. Reduction of the critical pressure for phase transition in vdW magnets to 1–2 GPa marks the possibility of using intercalated few-layers in the field-effect transistor device architecture, and thereby, avoiding the conventional use of the diamond anvil cell. (Published in Physical Review B, 2024)

Induced magnetic order in a topological insulator (TI) can be realized either by depositing magnetic adatoms on the surface of a TI or engineering the interface with epitaxial thin film or stacked assembly of 2D van der Waals (vdW) materials. Herein, the observation of spin-phonon coupling in the otherwise non-magnetic TI Bi₂Te₃ is reported, due to the proximity of FePS₃ (an antiferromagnet (AFM), T_N ≈ 120 K), in a vdW heterostructure framework. Temperature-dependent Raman spectroscopic studies reveal deviation from the usual phonon anharmonicity originated from spin-lattice coupling at the Bi₂Te₃/FePS₃ interface at/below 60 K in the peak position (self-energy) and linewidth (lifetime) of the characteristic phonon modes of Bi₂Te₃ (106 and 138 cm⁻¹) in the stacked heterostructure. The Ginzburg-

Landau (GL) formalism, where the respective phonon frequencies of Bi₂Te₃ couple to phonons of similar frequencies of FePS₃ in the AFM phase, is adopted to understand the origin of the hybrid magneto-elastic modes. At the same time, the reduction of characteristic T_N of FePS₃ from 120 K in isolated flakes to 65 K in the heterostructure, possibly due to the interfacial strain, which leads to smaller Fe-S-Fe bond angles as corroborated by computational studies using density functional theory (DFT). Besides, inserting hexagonal boron nitride within Bi₂Te₃/FePS₃ stacking regains the anharmonicity in Bi₂Te₃. Controlling interfacial spin-phonon coupling in stacked heterostructure can have potential application in surface code spin logic DEVICES. (Published in Advanced Functional Materials, 2024)

Ferroelectric negative capacitance field-effect transistors, or FE-NCFETs, are promising device architectures for achieving improved performance in terms of hysteresis, on-off ratio, and power consumption. The study investigates the influence of negative capacitance (NC) on the transfer characteristics of van der Waals field-effect transistors below and above a critical voltage (V_{th}) on the heterophase of the CuInP₂S₆ (CIPS) gate ferroelectric. Notably, a less pronounced NC resulting from the spatial distribution of the ferroelectric and paraelectric phases plays a crucial role in stabilizing n-channel conductance by dual gate modulation. This results in the emergence of a nonvolatile logic state between the two binary states typical of conventional tunnel field-effect transistors (TFETs). Concerned study proposed NCTFETs based on ferroionic crystals as promising devices for generating a stable logic state below the coercive voltage. In addition, tunneling and voltage pinning effects play a key role for enhancement of the transistor's on-off ratio. (Published in ACS Applied Nano Materials, 2024)

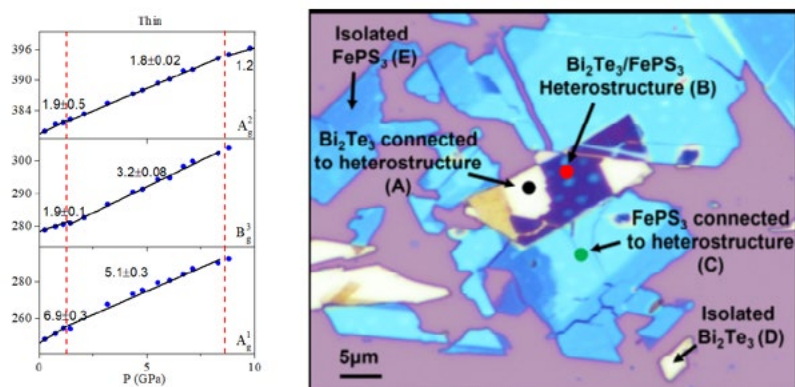


Figure 1: (a) Pressure dependent phonon behavior of bulk, few layer and atomic layer FePS₃. (b) Magnetic topological van der Waals heterostructure formed by micromanipulation method.

Publications in Journals :

1. Negative Capacitance for Stabilizing the Logic State in a Tunnel Field-Effect Transistor - Koushik Dey, Bikash Das, Pabitra Kumar Hazra, Tanima Kundu, Sanjib Naskar, Soumik Das, Sujan Maity, Poulomi Maji, Bipul Karmakar, Rahul Paramanik, Subhadeep Datta*, *ACS Applied Nano Materials*, **7** (23), 26405-26413 (2024).[IF: 5.5]
2. Dimension-dependent critical scaling analysis and emergent competing interaction scales in a two-dimensional van der Waals magnet $\text{Cr}_2\text{Ge}_2\text{Te}_6$ -PC Mahato, Suprotim Saha, Bikash Das, Subhadeep Datta, Rajib Mondal, Sourav Mal, Ashish Garg, Prasenjit Sen, SS Banerjee, *Physical Review B*, 109 (16), 165405, (2024). [IF: 3.2]
3. Pressure-induced insulator-to-metal transition in few-layer FePS₃ at 1.5 GPa, Bidyut Mallick, Mainak Palit, Rajkumar Jana, Soumik Das, Anudeepa Ghosh, Janaky Sunil, Sujan Maity, Bikash Das, Tanima Kundu, Chandrabhas Narayana, Ayan Datta, Subhadeep Datta*, *Phys. Rev. B*, **109** (23), 235417 (2024).[IF:3.2]
4. Manipulating Spin-Lattice Coupling in Layered Magnetic Topological Insulator Heterostructure via Interface Engineering, Sujan Maity, Dibyendu Dey, Anudeepa Ghosh, Suvadip Masanta, Binoy Krishna De, Hemant Singh Kunwar, Bikash Das, Tanima Kundu, Mainak Palit, Satyabrata Bera, Kapildeb Dolui, Kenji Watanabe, Takashi Taniguchi, Liping Yu, A Taraphder, Subhadeep Datta*, *Advanced Functional Materials*, 2402544 (2024).[IF:19]
5. Room Temperature Evolution of Laser-Induced Ultrafast Spin and Phonon Dynamics in 2D van der Waals Magnets $\text{Fe}_x\text{Ge}_{1-x}\text{Te}_2$ ($x = 3, 4, 5$), Arundhati Adhikari, Bipul Kumar Mahato, Sourav Sahoo, Suchetana Mukhopadhyay, Mainak Palit, Satyabrata Bera, Subhadeep Datta, Mintu Mondal, Anjan Barman, *Advanced Functional Materials*, 2418006, (2024).[IF:19]
6. Residue-free layered material interfaces for device processing, Subrata Paul, Das Bikash,

Arunava Kar, Shuvankar Das, Smruti Ranjan Mohanty, Kenji Watanabe, Takashi Taniguchi, Subhadeep Datta, Krishnakumar S.R. Menon, *Applied Surface Science*, **685**, 161961, (2025).[IF:6.9]

7. Raman signatures of inversion symmetry breaking structural transition in quasi-1D compound, $(\text{TaSe}_4)_3\text{I}$, Arnab Bera, Partha Sarathi Rana, Suman Kalyan Pradhan, Mainak Palit, Surabhi Saha, Sk Kalimuddin, Satyabrata Bera, Tuhin Debnath, Soham Das, Deep Singha Roy, Subhadeep Datta, Mintu Mondal, *Journal of Physics: Condensed Matter*, **37** (12), 125403, (2025).[IF:2.6]
8. Magnetodielectric properties in two dimensional magnetic insulators, Koushik Dey, Hasina Khatun, Anudeepa Ghosh, Soumik Das, Bikash Das, Subhadeep Datta*, *Journal of Physics: Condensed Matter*, **37** (16), 163003, (2025).[IF:2.6]

Award/Recognition :

- » Young Scientist Award, National Univ. of Singapore and Sunkonnect Pte Ltd. Singapore.
- » Young Scientist Award, 67th DAE Solid State Physics Symposium, BARC Mumbai.

Ph.D. Degree Awarded :

- (1) Anudeepa Ghosh (IACS Deemed to be University)

Sponsored Project :

- » Microneedle basedGlucose Monitoring (DBT)
- » Two-dimensional Magnets Magnetic Order
- » Wearable bio-electronic of Glucose (DST)

Lectures Delivered :

Invited talk at (1) CEFIPRA, Strausbourg, (2) CEITEC Brno, Czech Republic, (3) MTMM/SiMS-2024, IISc, Bangalore, (4) NISER, (5) AC2MP, IIT Patna, (6) APCTP-KIAS-IACS, Seoul, (7) AFS@IITKGP and (8) CENSE, IISc, Bengalore.



Subham Majumdar

Senior Professor & Chair, SCS

Magnetism, Strongly correlated electron system

Associates : (1) Md. Numan, RA-I, (2) Prasanta Chowdhury, SRF (INSPIRE), (3) Tamali Roy, SRF (UGC) and (4) Basab Mukherjee, JRF (Institute).

Collaborators: (1) S. Giri (IACS), (2) I. Dasgupta (IACS), (3) S. Ray (IACS), (4) D. T. Adroja (Oxford)

The group studies the interaction between spin, charge, and lattice symmetry in strongly correlated electron systems. Tools like magnetization, electronic transport, heat capacity, neutron scattering, and x-ray absorption spectroscopy are used to explore these materials' unique properties. Key observations from the past year are summarized below.

- » The elusive effect of electron-electron interaction in the anomalous Hall effect is addressed through a detailed transport study on a chiral beta-Mn type cubic compound $\text{Co}_7\text{Zn}_7\text{Mn}_6$ lacking global mirror symmetry. The alloy orders magnetically below 204 K and exhibits a spin glass state at low temperatures. The longitudinal resistivity shows a pronounced upturn below 75 K, associated with carrier localization due to quantum interference. The temperature dependence and field insensitivity indicate electron-electron interaction as the primary cause. The studied sample exhibits a significant anomalous Hall effect, with localization present in the ordinary Hall coefficient but absent in the anomalous Hall resistivity or conductivity. This may be due to high carrier density, warranting further theoretical investigations, especially in systems with broken mirror symmetry.
- » We analyzed the magnetic and electronic transport properties of the layered chalcogenide $\text{Cr}_{1+\delta}\text{Te}_2$ in its single-crystalline form. It exhibits a ferromagnetic transition at 191 K with significant

thermal hysteresis. Isothermal magnetization, magnetocaloric effect, and magnetoresistance show strong magnetocrystalline anisotropy, with the c axis as the easy axis. The compound shows a pronounced anomalous Hall effect (AHE), but its nature and origin remain unclear. Our experimental findings suggest the skew scattering mechanism is the primary cause. Theoretical study reveals gapped nodal points with nonzero Berry curvature, expected to contribute to intrinsic AHE. Density functional theory calculations show Berry curvature at different nodal points with both positive and negative signs, canceling each other out and significantly reducing the intrinsic AHE.

Publications in Journals :

1. Effect of carrier localization on anomalous Hall effect in the structurally chiral β -Mn type $\text{Co}_7\text{Zn}_7\text{Mn}_6$ alloy- Prasanta Chowdhury, Mohamad Numan, Shuvankar Gupta, Souvik Chatterjee, Saurav Giri, Subham Majumdar, *Phys. Rev. B*, **109**, 134428 (2024).[IF:3.2]
2. Evolution of structural, magnetic and transport properties of 3d-5d based double perovskites $\text{Nd}_{2-x}\text{Sr}_x\text{CoIrO}_6$ - Raktim Datta, Suman Mondal, Suchanda Mondal, Suman Kalyan Pradhan, Subham Majumdar and Subodh Kumar De, *J. Phys.: Condens. Matter*, **37**, 065801 (2025).[IF:2.3]
3. Suppression of intrinsic Hall effect through competing Berry curvature in $\text{Cr}_{1+\delta}\text{Te}_2$ - Prasanta Chowdhury, Jyotirmay Sau, Mohamad Numan, Jhuma Sannigrahi, Matthias Gutmann, Saurav

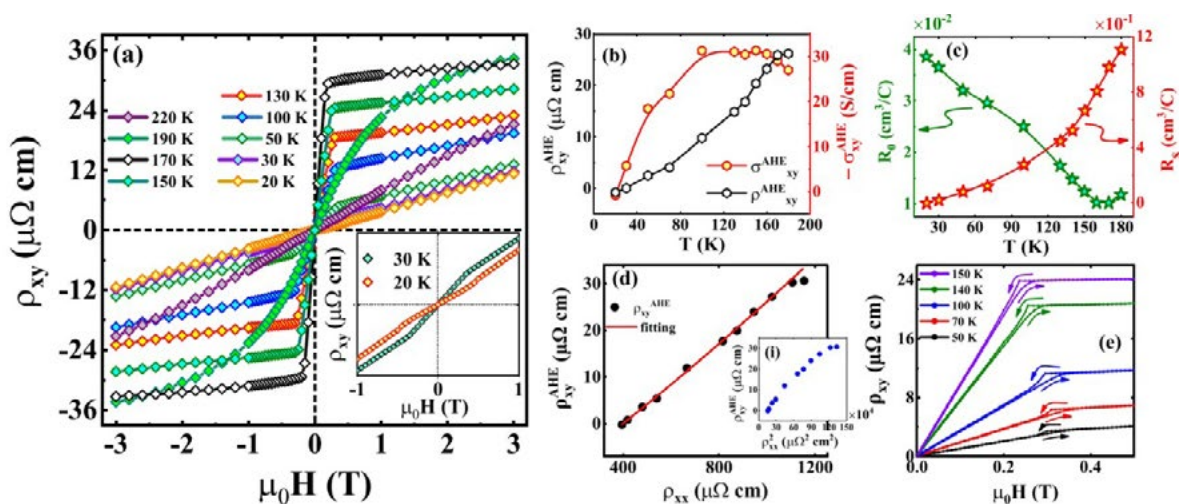
Giri, Manoranjan Kumar, Subham Majumdar, *Phys. Rev. Mater.*, **9**, 024407 (2025).[IF:3.1]

Subham Majumdar, *J. Mag. Mag. Mater.*, **614**, 172674 (2025).[IF:2.5]

4. Interplay between lattice and magnetism in distorted diamond spin chain compound $\text{Cu}_3\text{Nb}_2\text{O}_8$ - Mohamad Numan, Gangadhar Das, Manjil Das, Saurav Giri, Giuliana Aquilanti,

Ph.D. Degree Awarded :

(I) Mohamad Numan (IACS Deemed to be University).



Hall resistivity of $\text{Cr}_{1+\delta}\text{Te}_2$ measured at different temperatures.



Sumanta Chakraborty

Assistant Professor and Academic Coordinator-BS-MS

Black Hole Physics, Gravitational Waves, Quantum Physics in Curved Spacetime, Cosmology, Theories beyond general relativity, Quantum aspects of gravity.

Associates : (1) K. Das, JRF (CSIR), (2) R. Paul, JRF (UGC), (3) V. Mondal, SRF (Inspire) and (4) S. Biswas, SRF. And (5) N. Debnath, JRF.

My focus has been on both theoretical as well as observational aspects of gravitational wave astrophysics along with mathematical relativity. In particular, I have worked on the dynamical tidal deformations of black holes and have found them to be non-zero, for the first time in the literature, in striking contrast with the static Love numbers of black holes. Besides, I have also been involved in the study of dynamical Love numbers for exotic compact objects and found that only a very specific branch of them will have non-zero tidal deformation. I have also studied the effect of extra dimensions on the inspiral of compact binaries through tidal heating, and also on the microlensing of gravitational waves. It turns out that, while tidal heating can be used to put interesting constraints on the physics of extra dimensions, through next generations of gravitational wave detectors, gravitational lensing is not a useful probe for the same. We have also studied environmental effects, in particular, the effect of accretion on the stability of a black hole spacetime and the effect of dark matter and its detectability through dynamical friction. In particular, we have shown that the existence of ultralight bosons in the environment of a black hole will help in assessing the classical versus quantum nature of the same. We have also provided a supertranslation invariant Lorentz charge at both spatial and temporal boundaries, and have shown their equivalence through the null boundary of an asymptotically flat spacetime. Finally, we have also studied the implications of quantum cosmology in evading the singularity inside the Schwarzschild black hole.

Award/Recognition :

- » Outstanding Reviewer Award, Institute of Physics, UK, London.

Publications in Journals :

1. Distinguishing cosmological models through quantum signatures of primordial perturbations – Rathul Nath Raveendran and Sumanta Chakraborty, *General Relativity and Gravitation*, **56**, 55 (2024).[IF:2.1]
2. Probing black hole charge from binary black hole inspiral – N.V. Krishnendu and Sumanta Chakraborty, *Physical Review D*, **109**, 124047 (2024).[IF:4.6]
3. Accreting Schwarzschild-like compact object: Plasma-photon Interaction and Stability – Avijit Chowdhury, Shauvik Biswas and Sumanta Chakraborty, *Physical Review D*, **110**, 064072 (2024).[IF:4.6]
4. Probing the quantum nature of black holes with ultralight boson environment – Soumodeep Mitra, Sumanta Chakraborty, Rodrigo Vicente and Justin C. Feng, *Physical Review D*, **110**, 084012 (2024).[IF:4.6]
5. Dynamical tidal Love numbers of Kerr-like compact objects – Sumanta Chakraborty, Elisa Maggio, Michela Silvestrini and Paolo Pani, *Physical Review D* **110**, 084042 (2024).[IF:4.6]
6. Gravitational Physics in the context of Indian Astronomy: A vision document – P. Ajith, K.G. Arun, Sukanta Bose, Sumanta Chakraborty, et. al., *Journal of Astrophysics and Astronomy*, **46**, 6 (2025).[IF:1.6]

7. Connecting quasi-normal modes with causality in Lovelock theories of gravity – Avijit Chowdhury, Akash K. Mishra and Sumanta Chakraborty, *Physics Letters B*, **861**, 139219 (2025). [IF:4.3]
8. Scalar-tensor theories of gravity from a thermodynamic viewpoint – Krishnakanta Bhattacharya and Sumanta Chakraborty, *Journal of High Energy Physics*, **2501**, 037 (2025). [IF: 5]
9. On supertranslation invariant Lorentz charges – Sumanta Chakraborty, Sk. Jahanur Hoque and Amitabh Virmani, *General Relativity and Gravitation*, **57**, 44 (2025). [IF:2.1]
10. Rotating black holes experience dynamical tides – Rajendra Prasad Bhatt, Sumanta Chakraborty and Sukanta Bose, *Physical Review D*, **111**, L041504 (2025). [IF:4.6]
11. Probing the charge of compact objects with gravitational microlensing of gravitational waves – Uddepta Deka, Sumanta Chakraborty, Shasvath J. Kapadia, Md. Arif Shaikh and P. Ajith, *Physical Review D*, **111**, 064028 (2025). [IF:4.6]

- » Singularity avoidance from path integral – Ribhu Paul and Sumanta Chakraborty, *Journal of cosmology and astroparticle physics*, **2503**, 032 (2025). [IF:5.3]

Sponsored Project :

- » Probing quantum effects Universe Cosmology
- » Testing the nature Wave observations

Lectures Delivered :

Invited talk at (1) NIT Rourkela, (2) Indian PTA Collaboration, (3) Utrecht University, Netherlands, (4) ICTS-TIFR, Bangalore, (5) RRI, Bangalore, (6) SGT University, Gurugram, (7) Kodaikanal Solar Observatory, Tamil Nadu, (8) CUSAT, Cochin, (9) Sapienza University, Roma, Italy, (10), IIT Bombay, (11) Abruzzo, Italy, (12) Grossmann Meeting, Pescara, Italy, (13) SRM University, Vijaywada, (14) Jadavpur University, Kolkata, (15) IIT Madras, Chennai, (16) BRICS-AGAC Symposium.



Utpal Chattopadhyay

Senior Professor

Beyond the Standard Model Particle Physics

Associates : (1) Md. Isha Ali, SRF, CSIR

Collaborators: (1) Debottam Das (IOPB), (2) A. K. Saha (IOPB), (3) R. Puri (IOPB), (4) N. Rajeev (PRL), (5) S. Poddar (Diamond Harbour Women's University), (7) D.K. Ghosh (IACS) and (7) J. Roy (formerly at IACS).

SMEFT analysis of charged lepton flavor violating B-meson decays : Charged lepton flavor violation (cLFV) processes, potentially important for various

Beyond the Standard Model (BSM) physics scenarios are analyzed in the Standard Model effective field theory (SMEFT) framework. We consider the most relevant two-quark-two-lepton operators for various leptonic and semi leptonic LFV B-decay (LFVBD) processes. We analyze the interplay among the Wilson coefficients responsible for these LFVBDs and other cLFV processes, like

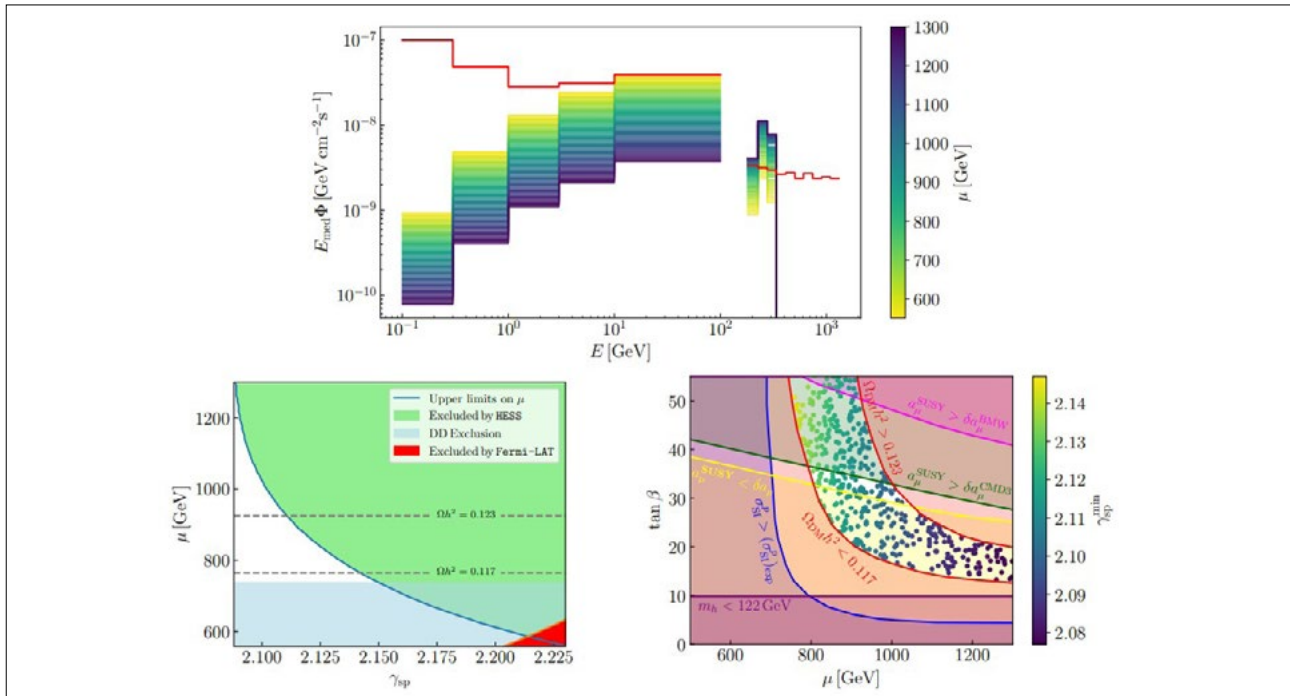
Muon-electron conversion rates (CR Mu to e), li to lj+ photon, li to lj,lk,lm, Z to li,lj , to find the maximal possible LFV effects in B-meson decays.

(With Md. I. Ali, J. Roy, N. Rajeev, Published in Phys. Rev. D.)

Implications of Sgr A* on the gamma-rays searches of Bino dark matter with Muon g-2 : We analyze the impact of dark matter density spike around the Milky Way's supermassive black hole (SMBH), Sgr A*, in probing the Bino-dominated neutralino dark matter (DM) within the Minimal Supersymmetric Standard Model (MSSM), which typically produces

relatively faint signals in the conventional DM halos. In particular, we explore the indirect search prospects of sub-TeV Bino-Higgsino and Bino-Wino-Higgsino DM in the MSSM, consistent with the supersymmetric predictions required to explain the anomalous magnetic moment of the muon. Accommodating the inclusive effects of density spike, we present the requisite boost factor to facilitate gamma-ray searches of Bino-dominated DM in the MSSM, especially focusing on the Fermi-LAT and HESS observations.

(With, A.K. Saha, D. Das, R. Puri and S. Poddar, Published in Phys. Rev. D.)



Caption: Constraining the boost parameter in MSSM using observations from FERMI-Lat, HESS, PLANCK, DM SI and SD detection limits, and Muon g-2 experiment.

Constraints on lepton flavor universal and non-universal New Physics in $b \rightarrow s l l$ -decays: a global SMEFT survey : The Flavor Changing Neutral Current (FCNC) semileptonic decays of B-mesons provide an excellent platform for indirectly probing New Physics (NP) beyond the Standard Model (SM). Although precise tests of lepton flavor universality (LFU), such as the ratios R_K and R_{K^*} , are consistent with the SM predictions, other observables in $b \rightarrow s l l$ transitions show significant deviations. Using various limits from LHCb, Belle-II etc. for

various relevant measurements, we perform a global analysis of dimension-6 Standard Model Effective Field Theory (SMEFT) operators, considering the possibility of new physics contributions not only in $b \rightarrow s \mu \mu$ transitions but also in $b \rightarrow s e e$ transitions.

(With, I. Ali, N. Rajeev, D.K. Ghosh, in communication with Phys. Rev. D.)

Lectures Delivered :

Invited talk at (I) NVDM-2024 Cairo, Egypt.

Emeritus Professors & Senior Scientists

Photonic Crystal Fiber

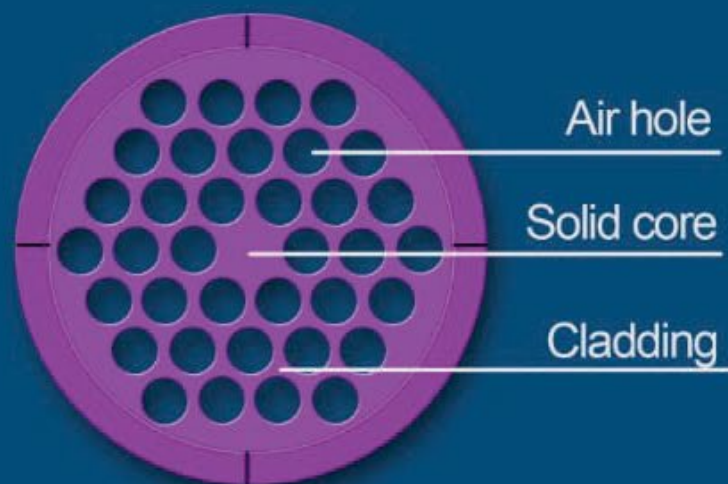


Diagram of Solid core PCF

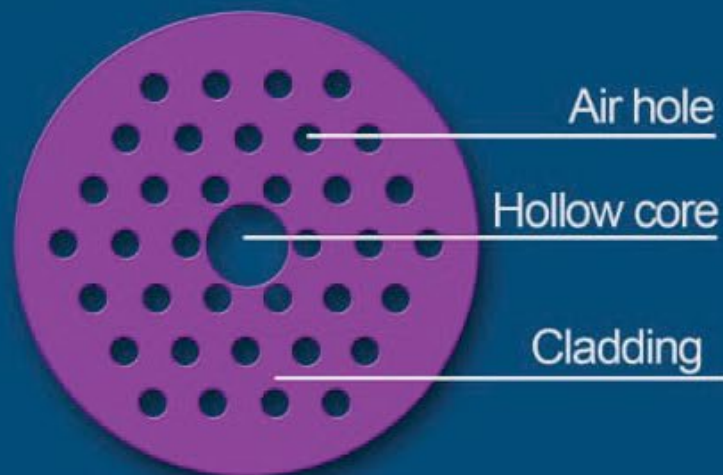


Diagram of Hollow core PCF



Brindaban Chandra Ranu, FASc, FNA

INSA Honorary Scientist

Green synthesis

A feature article highlights the potential of ball milling in the synthesis of pharmaceutically important classes of molecules without using any solvent (solvent-free conditions). The solventless reaction is of much interest as it contributes significantly to cleanliness of environment. This is an invited article for a special issue of Chemical Communications. Another review reports the various procedures for the synthesis of oxygen- and sulfur-containing heterocycles of biological importance under visible light induced reactions. The green aspects and mechanism of each procedure have been discussed. This review highlights the recent developments in visible light induced methods for the synthesis of some selected biologically active *N*- and *S*-containing heterocycles such as benzothiazoles, indoles and triazoles and their functionalization. The advantages, green aspects and limitations of these methods have also been discussed. A book chapter in a book, 'Carbohydrates in Chemistry and Biology' published by De Gruyter, Germany reports the synthesis of various carbohydrates in different green solvents such as water, alcohols.

Awards/Honours/Recognitions :

- » Professor Asima Chatterjee Endowment lecture award , 2025 by Professor Asima Chatterjee Endowment Trust, Calcutta University

List of Publications :

1. Sustainable and Solvent-free Synthesis of Molecules of Pharmaceutical Importance by Ball Milling - P. Pattanayak, S. Saha, T. Chatterjee, B. C. Ranu, *Chem. Commun*, **61**, 247 – 265 (2025). [IF:4.3]
2. Recent Developments on the Synthesis of Oxygen- and Sulfur- Containing Heterocycles and Their Derivatives under Visible Light Induced Reactions – B, C. Ranu, T. Ghosh, S. Santra, G.V. Zyryanov, *Curr. Top. Med. Chem.*, **25**, 124. (2025). [IF:3.57]
3. Current progress in visible light induced synthesis and functionalization of *N*- and *S*-heterocycles: a sustainable perspective – D. Saha, B C Ranu, *Curr. Green Chem.*, **25**, 2025 (2024). [IF:1.1]
4. Pillararenes as catalyst carriers: a brief update - S.Santra, D.S.Kopchuk, I.S.Kovalev, L.K.Sadieva, I.L.Nikonov, Ya.K.Shtaitz, G.V.Zyryanov, A.Majee, A.Hajra, V.N. Charushin, B.C. Ranu, *Russ. Chem. Rev.*, 93 (12), RCR5139, DOI: <https://doi.org/10.59761/RCR5139> (2024). [IF:7.0]
5. One-pot Synthesis and Photophysical Studies of α -Cycloamino-Substituted 5-Aryl-2,2'-Bipyridines –A. F. Khasanov, M. R. Guda, M. I. Valieva, D. S. Kopchuk, A. Rammohan, O. S. Taniya, A. S. Novikov, G. V. Zyryanov, B. C. Ranu, *J. Fluorescence*, **34**, 579–586 (2024). [IF:2.6]
6. Sigmatropic Rearrangements in the synthesis of Heterocyclic Compounds and their Functionalization- B. C Ranu, T. Ghosh, S. Santra, G.V. Zyryanov, *App. Chem. Eng.*, **7**, 1869. (2024). [IF:0.19]

Publications in Books/Book Chapter/ Monographs:

1. Green solvents in carbohydrates synthesis – S. Ahammed, P. Dey, B. C. Ranu, in Carbohydrates in Chemistry and Biology, Eds. V. K. Tiwari and B. Banerjee, De Gruyter, Germany, Vol. 9, Ch.12, **2025**, pp 139-165.

Sponsored Project :

- » INSA Honorary Scientist.

Lectures Delivered :

Invited talk at (1) Kazan University, Russia (virtual platform), (2) BIT Mesra, (3) Ural Federal University, Yekaterinburg, (4) ICRA GCD-2024 at Akal University, Bhatinda, Punjab (virtual platform), (5) Assam University, Silcharon (virtual platform), (6) Ural Federal University, Yekaterinburg, Russia (virtual platform), (7) Calcutta University, Kolkata and (8) International Conference on Emerging Concepts in Organic Synthesis at Tripura.

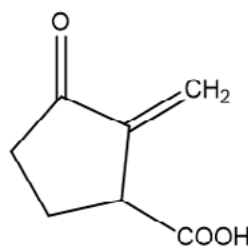


Subrata Ghosh, FASc, FNA

INSA Senior Scientist

Synthesis of bioactive complex natural products.

Sarkomycin, a cyclopentanoid natural product, was isolated from the strain of the soil microorganism *S. erythrochromogenes*, *Shygelle species* and *S. neyagawaensis*. It exhibits antibacterial and antiphage properties as well as antitumor activity. Because of its wide ranging biological activities it attracted the attention of synthetic organic chemists leading to a large number of synthesis. In connection to our continued interest in cyclopentanoid natural products, we have developed a simple protocol for synthesis of sarkomycin in enantiomerically pure form. The key step in this approach is ring closing metathesis of a dienol derived from D-mannitol to produce a cyclopentenol derivative having all the required functional groups present in sarkomycin. It is to be noted that sarkomycin itself is relatively unstable because of the presence of the carboxylic acid group. Thus the cyclopentenol derivative was transformed to the more stable methyl ester of sarkomycin through a number of steps in over all good yield.



Sarkomycin

Publications in Journals :

- » Synthetic Strategies for Cyclobutane Derivatives Without Employing [2+2] Cycloaddition and Their Application in Organic Synthesis, Ram N Yadav, Md. Firoj Hossain, and Subrata Ghosh, *Chemistry Select*, (in press).

Sponsored Project :

- » Synthesis of Natural Products containing α -Methylene- γ -butyrolactone unit.

Lectures Delivered:

(1) Participated in a Symposium in "Advances in Organic Chemistry" held at Kenilworth Resort, Goa

during January 27-29, 2025; (2) Chaired a Scientific Session in an International Conference on "IGP Sustainable Chemistry III 2025" held at IIT Indore during March 18-20, 2025.



Aswini Ghosh

Raja Ramanna Fellow

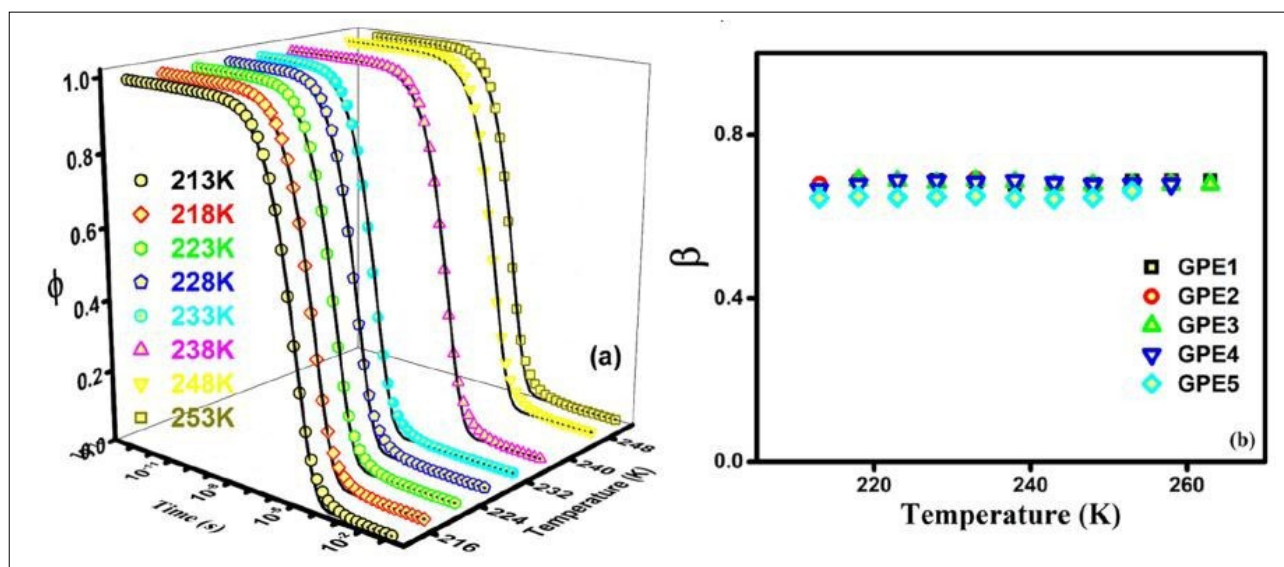
Structure, charge carrier dynamics, relaxation and scaling in glasses; perovskites; polymer electrolytes; energy conversion and storage devices.

Associates : (1) Anirban Chakrabarti (SERB-NPDF), (2) Souvik Bhattacharya (SERB-NPDF)

(a) Dynamics and Relaxation of Charge Carriers in Gel Polymer Electrolytes and Perovskites:

The fundamental understanding of the relationship between ion transport and segmental dynamics of polymer chains in several gel polymer electrolytes was studied. The broadband conductivity spectra of several redox active gel polymer electrolytes were analyzed in the framework of Universal Power

law model coupled with Poisson–Nernst–Planck model and the charge transport mechanism in these electrolytes was unveiled. Ruthenium and gadolinium-doped molybdenum disulfides were used to fabricate energy storage devices, which provided higher energy density and specific capacity compared to other conventional supercapacitors.



Journal of Applied Physics, 135, 205102 (2024)



A series of lead-free all-inorganic double perovskites with general formula Cs_2MBiX_6 ($\text{M} = \text{Li, Na, K, Ag}$; $\text{X} = \text{Cl, Br}$) were synthesized via a colloidal wet-chemical route. Rietveld refinement confirmed phase purity and crystallinity of these perovskites, revealing micro-strain, while temperature-dependent XRD confirmed their phase stability over a wide temperature window. Analysis of temperature dependent dielectric properties revealed polaron transport model for charge carrier dynamics and relaxation in these perovskites. DFT calculations corroborated structural stability, band dispersion, optical and transport properties. Importantly, piezoelectricity revealed by Piezoelectric Force Microscopy (PFM), despite their centrosymmetric crystal structures, was attributed to local dynamic distortions.

(b) Correlation of Ion Transport with Structure in Glass: New Na^+ conducting glassy electrolytes with the high room-temperature ionic conductivity required for solid-state sodium-ion (Na^+) batteries were developed using mixed network formers SiO_2 and P_2O_5 . The impact of the mixed network formers on Na^+ ion dynamics in these glasses was obtained by studying the microscopic characteristic lengths such as mean square displacement and critical hopping distance from the analysis of the AC conductivity. A correlation of Na^+ diffusion coefficients with structural changes investigated by NMR was also established. Ion dynamics in several transparent glass-ceramics containing NaNbO_3 as the major crystalline phase was also studied.

Publications in Journals :

1. Charge Carrier Dynamics and Relaxation in Highly Conducting Gel Polymer Electrolytes Added with Adiponitrile and Dual Redox, S.K. Patla, and A. Ghosh, Journal of Applied Physics, **135**, 205102 (2024).[IF:3.2]
2. Hydrothermally synthesized gadolinium doped molybdenum disulfide for electrochemical supercapacitor applications, S. Das, A. Banerjee, P. Pal, S. Rudra, U. Nandi and A. Ghosh, Journal of Energy Storage, **99**, 113268 (2024).[IF:8.9]
3. Mixed network former effect on the ion-dynamics of Sodium Alumino-Phospho-Silicate glasses, S.R. Keshri, I. Mandal, A. Gaddam, S. Ganiseti, S. Haque, C. Venkateswaran, G.E. Stan, T. Tite, A. Ghosh, N.N. Gosvami, N.M. A. Krishnan and A. R. Allu, Acta Materialia, 288, 120837 (2025). [IF:8.3]
4. Unlocking the potential of Ruthenium-Incorporated Molybdenum Disulfide for advanced supercapacitors in energy storage devices, S. Das, A. Banerjee, P. Pal, U. Nandi, A. Ghosh, Journal of Energy Storage, 119, 113268 (2025).[IF:8.9]

Sponsored Project :

» INSA Honorary Scientist

Lectures Delivered:

Invited talk at (I) Scottish Church College, Kolkata.



Deb Shankar Ray, FASc, FNA

Emeritus Professor

Nonlinear Dynamics and Statistical Mechanics

Nonlinear stochastic differential equations describe a wide range of phenomena in physical, chemical and biological sciences. While its linear version is exactly solvable, the nonlinearity poses serious difficulty where its interplay with stochasticity becomes important for understanding some of the generic dynamical features. Based on the separation of the deterministic and stochastic time scales and renormalization group technique we have proposed a general method for solution of the noisy nonlinear equations. We have shown how nonlinearity and noise brings in corrections to the frequency of the dynamical systems as reflected in the renormalization group flow equations for amplitude and phase. We have applied the theory to noisy van der Pol and Duffing oscillators and verified by direct numerical simulations.

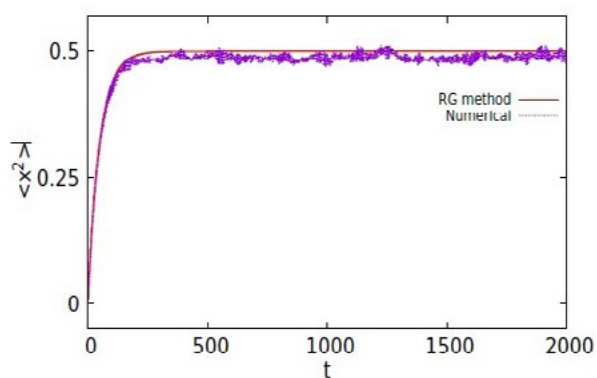


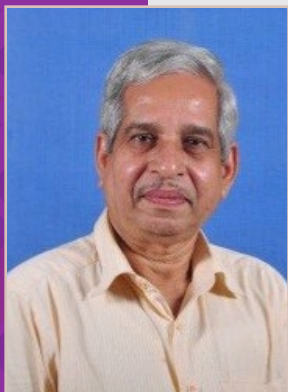
FIG. 1. The mean-square displacement $\langle x^2 \rangle$ is plotted against time t for the stochastic Duffing oscillator for the following parameter set: $\beta = 1.0$, $\omega_0 = 1.0$, $\gamma = 0.02$, $c = 0.02$, and $D = 0.01$ (analytical renormalization group method = solid red line and numerical = purple dotted line). For the numerical simulation, the averaging is done over 10^5 trajectories (units arbitrary).

Publications in Journals:

1. Nonlinear stochastic differential equations: A renormalization group approach to direct calculation of moments, P Sarkar and D S Ray, *Phys. Rev. E* **110**, 064217 (2024) [IF : 2.529]

Lectures Delivered:

Invited talk at (1) Lecture at Heritage Institute of Technology, Kolkata on hundred years of Bose Statistics, July 2024, Lecture on P C Ray at Rammohan Library, Kolkata, 2 August 2024.



Arun K Nandi, FASc

Emeritus Scientist, CSIR

Polymer Synthesis, Polymers in energy

A 'grafting onto' strategy is used to synthesize polythiophene (PT) graft block copolymers with significantly enhanced conductivity and photocurrent property.

PANI-*b*-PT-DNND SA, and PANI-*ran*-PT-DNND SA and their composite with Ag nanocluster were synthesised by emulsion polymerization technique showing enhanced conductivity and photocurrent property.

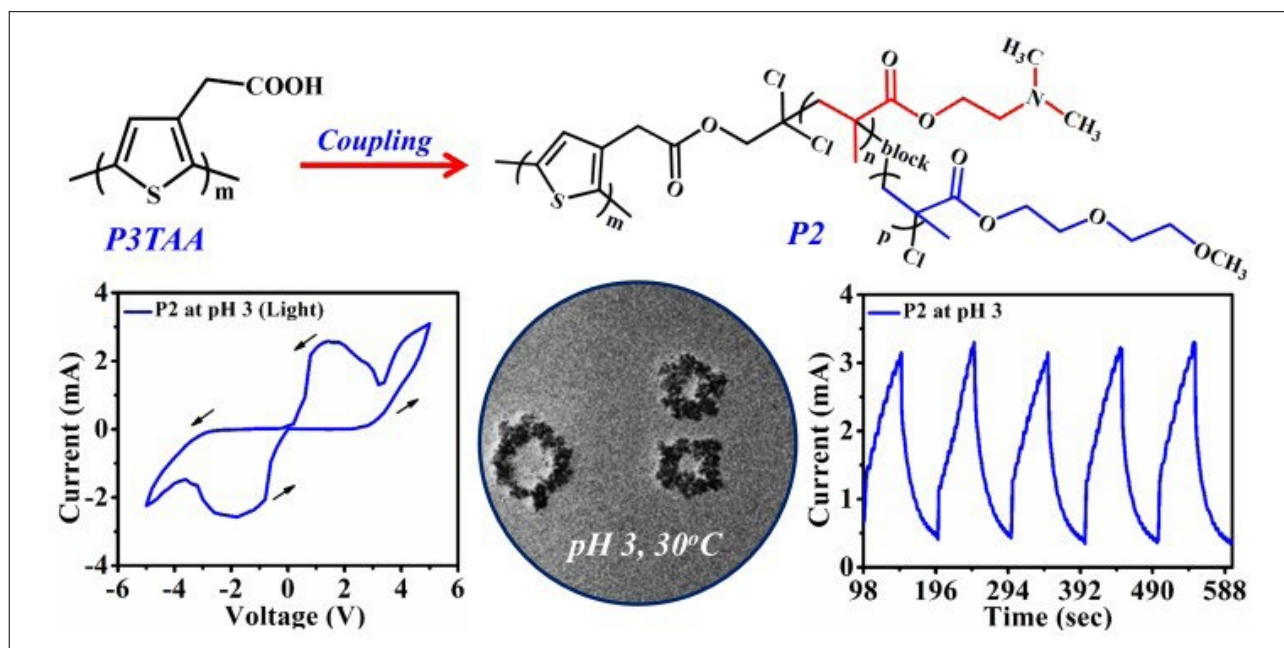
Photo-assisted supercapacitor, fabricated using a substituted polythiophene as energy harvesting unit and spinel NiCo_2O_4 as energy storage unit

Associates : (1) U. Basak, RA (CSIR, ES), (2) Sudipta Mondal (MSC Proj.)

Polymer Synthesis: A 'grafting onto' strategy is used to synthesize polythiophene(PT) graft block copolymers where poly(thiophene acetic acid) (P3TAA) was first made and then coupled with PDEGMEM₄₄-*b*-PDMAEMA₁₃-Cl, PDMAEMA₅₄-*b*-PDEGMEM₂₁-Cl and PDMAEMA-*ran*-PDEGMEM-Cl copolymers produced separately by ATRP technique. The TEM study exhibits mostly vesicular morphology in the P-series polymer and optical properties measured using UV-Vis and PL-spectroscopy show pH dependent behavior. The dc-conductivity values indicate semiconducting nature following the order $P2 > P3 > P1$, the abrupt hike of P2 (~80 times) at pH-3 from that of PT graft block copolymers previously prepared by 'grafting from' process is attributed to the removal of ~11 mol % contamination. With increasing pH, conductivity

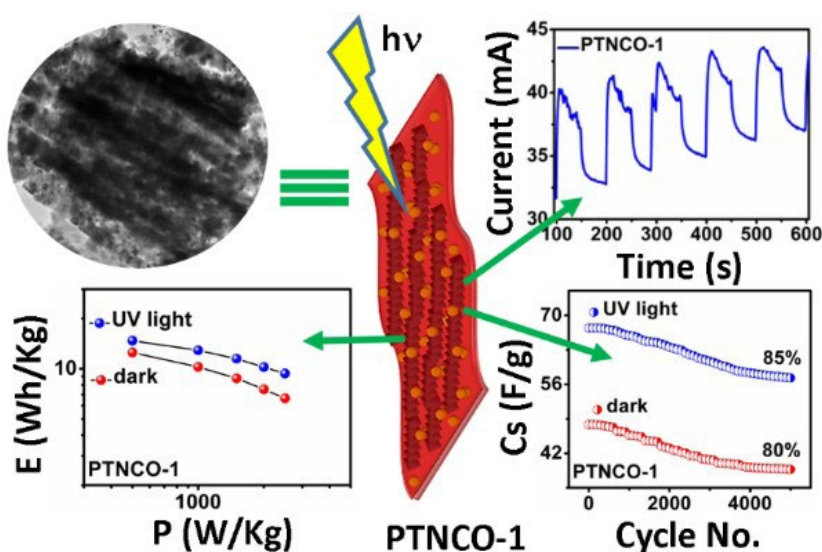
decreases in accordance with blue shifts of λ_{abs} peaks due to coiling of PT-backbone. The *I*-*V* plots exhibit bimodal memory as well as OMEIC property and higher current flow and electronic memory occur on light irradiation from that of dark.

Dinonyldisulphonic acid doped polyaniline-*block*-polythiophene (PANI-*b*-PT-DNND SA, PABT) and dinonyldisulphonic acid doped polyaniline-*ran*-polythiophene (PANI-*ran*-PT-DNND SA, PART) were synthesised by emulsion polymerization using APS initiator and DNND SA as surfactant-cum-dopant. SEC and XPS analysis indicate that PABT has composition $\text{PANI}_{34}\text{-}b\text{-PT}_{16}\text{-DNND SA}_{11}$. A polymerization mechanism is proposed for both PABT and PART systems. In PABT-Ag system the UV-Vis, fluorescence, XRD and TEM study suggest that Ag-nanoclusters (AgNCs) are formed and stabilized by sulphur atom of PT chain via soft acid-base interaction. Particle size measured from HRTEM images show nanocluster sizes (~3.5 nm) comprised of about 10 Ag atoms for both PABT-Ag and PART-Ag systems. The absorption peaks of PART showed 5-8 nm blue shift from PABT attributed to heteroatom nonbonding ($p\pi\text{-}d\pi$) interaction between closely spaced nitrogen and sulphur atoms of PART conjugated chain and fluorescence spectra also supports it. dc-conductivity and *I*-*V* data indicates semiconducting nature and AgNCs causes an enhancement of conductivity. PART exhibits ~3.5 times higher current than PABT system and on irradiation with white light, photocurrent increases 2.5-3 times in the AgNC coupled systems, also exhibiting electronic memory.



Polymers in energy : To prepare photo-assisted supercapacitor, we have chosen a substituted polythiophene (3-[1-ethyl-2-(2-bromoisobutyrate)] thiophene) (PT) as energy harvesting unit and spinel NiCo_2O_4 (NCO) as energy storage unit. The PT coated nano-octahedron assembled NCO nanorods are synthesized via 'in situ' oxidative polymerization with different ratio of PT and NCO (PT:NCO=1:1, PTNCO-1 and PT:NCO=2:1 (w/w), PTNCO-2) to get an optimum composition showing excellent electrochemical performance at both dark and illuminated conditions. Significant increases of dc-conductivity, dark current and photocurrent

($\sim 10^4$ times) from that of PT occurred in PTNCO nanocomposites. Electrochemical experiments using three electrode devices indicate that the PTNCO-1 show maximum specific capacitance (C_s) of 958 F/g at 1 A/g current density. PTNCO-1 solid state device show C_s value 90 F/g at dark condition and at illuminated condition it is 106 F/g at 1 A/g current density and at 5 A/g current density C_s values are 47.8 and 67.4 F/g, respectively. Thus, an increase of C_s from 17.8% to 41% at 1 to 5 A/g current density is noticed under UV-light ($\lambda=365$ nm) showing higher increase of C_s at higher current density.



Publications in Journals :

1. Polythiophene Derived Nickel Cobaltite Nanocomposite Showing Excellent Photo-switching and Photo-supercapacitor Properties - U. Basak, P. Ghosh, D. P. Chatterjee, G. Mahapatra, A. Banerjee and A. K. Nandi, *J. Mater Chem. A*, **13**, 7813 – 7833 (2025).[IF:10.7]
2. Development of Organic Mixed Ion-Electron Conductive and Photo responsive Property in a Peptide Linked Boronic Acid Conjugated Naphthalimide Derivative - P. Ghosh, K. Gayen, N. Hazra, B. Hansda, G. Mahapatra, S. Das, S. Das, A. K. Nandi and A. Banerjee, *ACS Applied Electronic Materials*, **6**, 9154-9164 (2024).[IF 4.4]
3. Enhanced Optoelectronic Properties of Polythiophene-g-Poly(dimethyl amino ethyl methacrylate)-b-Poly(diethylene glycol methyl ether methacrylate) Copolymers using 'Grafting onto' Synthetic Strategy - U. Basak, D.

P. Chatterjee and A. K. Nandi, *ACS Appl. Mater. Interfaces*, **16**, 48854–48869 (2024).[IF:8.5]

4. Emulsion Polymerized Sulfonic Acid Doped Polyaniline-co-Polythiophene Showing Photo-Switching Property by *in situ* Growth of Silver Nanocluster - S. Mondal, U. Basak and A. K. Nandi, *ACS Applied Polymer Materials*, **6**, 10121-10135 (2024).[IF. 4.7]

Awards/Recognitions:

- » Prof. P.L. Nayak Memorial Award (CIPET Sponsored), Orissa Chemical Society in AMC-2024.

Lectures Delivered:

Invited talk at (1) Odisha University, Bhubaneswar, (2) NCPAFM-2024, IASST, Guwahati and (3) POLYSOLVAT-15, IACS, Kolkata.



Parthasarathi Majumdar

Visiting Professor

Gravitational Theory, Gauge Field Theory

» Can BBH Merger GW Data Constrain Corrections to Bekenstein-Hawking Entropy ?

We examine possible additive corrections to the Bekenstein-Hawking (BH) entropy of black holes due to very general classical and quantal modifications of general relativity. In general, black hole entropy is subject to the Generalized Second Law of Thermodynamics. For the case of binary black hole coalescence, the difference in corrections to the inspiral and remnant black hole entropies is shown, within this law, to be

bounded by the difference in the corresponding BH entropies. This latter difference has been measured by several groups attempting to validate Hawking's Area Theorem on black hole horizons, by analyzing gravitational wave data from possible binary black hole mergers. The former difference - that between corrections to remnant and inspiral black hole entropies beyond the BH entropy, is thus constrained by a bound measured from observational data. We examine the implications of this constraint

for general binary black hole coalescence. If calculated entropy corrections follow the essential pattern of BH entropies dictated by the Hawking Area Theorem, consistency with the observational bound is shown to be guaranteed. If they do not, these corrections are then nontrivially constrained by the observational bound. (Published in: Phys.Rev.D 111 (2025) 6, 064040 • e-Print: 2408.13820 [gr-qc])

- » **Particle Creation in a Linear Gravitational Wave Background :** Inspired by Leonard Parker's pioneering 1968 work demonstrating matter quanta production in a dynamical spacetime background, we consider production of scalar quanta in a gravitational wave background. Choosing the spacetime to be a flat spacetime perturbed linearly by a spherical plane gravitational wave, we show that scalar particles may indeed be produced in a perturbative manner. Our formulation is valid for any linear gravitational wave background profile, and should generalize straightforwardly to production of massless elementary particles of diverse species (photons, electrons, ...). In this aspect, irrespective of the astrophysical nature of the binary merger sourcing the gravitational

wave signal, one expects the dynamical nature of the spacetime to produce all species of light particles. Thus, any binary coalescence is in effect a source of multimessenger astrophysics. (Collaborator : Tanmoy Chakraborty, BSMS-SPS-IACS; Published in: Phys.Rev.D 110 (2024) 2, L021701 • e-Print: 2404.01840 [gr-qc])

Publications in Journals :

1. Particle creation in a linear gravitational wave background - T. Chakraborty and Parthasarathi Majumdar, Phys.Rev.D 110 (2024) 2, L021701 (Published 19 July 2024).[IF:4.6]
2. Can binary-black-hole-merger gravitational-wave data constrain corrections to Bekenstein-Hawking entropy? – Parthasarathi Majumdar, Phys.Rev.D 111 (2025) 6, 064040 (Published 12 March 2025).[IF:4.6]

Lectures Delivered:

Invited talk at (1) Flatiron Institute, New York, USA, (2) Cornell University, Ithaca, NY, USA, (3) Two lectures at IEM Kolkata, (4) Bangkok 2025, (5) SPS, IACS, Kolkata and (6) TCG-CREST, Bidhan Nagar, Kolkata.



Sunanda Banerjee

INSA Senior Scientist

Experimental High Energy Physics

- » Sunanda Banerjee has been a member of the Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC) for over thirty-two years. He took four responsibilities in the CMS experiment: (1) calibration of the hadron

calorimeter; (2) design of the upgraded CMS detector for future high luminosity run of the CMS experiment; (3) geometrical description of the entire CMS detector which is one of the most important ingredients of CMS simulation

and reconstruction software; (4) improvement and testing of the CMS simulation software.

- » CMS took proton-proton collision data during March-September 2024 and lead-lead collision during October-November, 2024. CMS introduced an additional detector, Zero-Degree-Calorimeter (ZDC) for the heavy ion run. This detector, also present during the previous decade, was significantly modified in this run with additional detector components. The simulation and reconstruction software needed a significant modification to handle both the earlier and the new data. Sunanda was the only expert in this area who could handle the required modifications. He was also responsible for determining the calibration coefficients of the barrel and endcap hadron calorimeter for seven periods of 2024. For this, he interacted with members of the Physics Object Group who were responsible for jet energy measurement.
- » The forward calorimeter of CMS underwent severe damage due to high radiation during the past several years of collisions. The radiation level is expected to be further worse during the high luminosity runs during and after 2029. So CMS has been planning to replace several parts of the detector to handle the new running condition. One such replacement is a new calorimeter which will replace the current endcap electromagnetic and hadron calorimeter. The proposed detector is novel in the field of high-energy physics. It is a sampling calorimeter with silicon and scintillator detectors having several million readout channels. This will be a tracking calorimeter and needs a detailed study using the framework of Geant4 simulation. Sunanda is one of the principal designers of this component and is defining the description of the detector within the CMS simulation environment.
- » The detector layout of the CMS experiment is not static and it has changed almost every year. Sunanda is taking care of the CMS geometry description and he has defined the layout for the period of 2024 and is now looking into the changes needed for the 2025 run period. The main changes are in the Zero-Degree-Calorimeter and in the forward muon system. CMS is also adopting a new software package, DD4hep, from CERN. This has been tested for the current and future runs but needs changes

in the CMS software system for legacy runs which happened during the period between 2009 and 2018.

- » CMS is using the toolkit Geant4 for detector simulation. Sunanda is a member of the Geant4 team as well as the leading expert of the full simulation of the CMS detector. Geant4 makes continuous improvements to the software kit and provides reference releases every month. Sunanda monitors the goodness of the shower generation part by comparing Geant4 predictions with data from fixed target experiments as well as from CMS. At the same time, he detects compatibility of the new software with the CMS simulation program. This provides important feedback to the Geant4 team. Sunanda has been doing this regularly during the last year and this made CMS confident to move to the most up-to-date version of Geant4.
- » Sunanda gave several colloquia based on how colliders started in particle physics and how Indian groups got involved in these activities. He also gave a special seminar at IACS about special experiments proposed at the Large Hadron Collider to search for Physics Beyond the Standard Model. He gave an invited talk on "Experiments and Physics objects" at the PHANC 2025 conference in Puri in February 2025. He is a member of the analysis review committee refereeing papers on Standard Model physics. He was invited to a conference in Dhaka that celebrated 100 years of the phenomenal paper by Prof Satyendra Nath Bose. This paper gave birth to Bose-Einstein statistics. Sunanda summarized the discovery of Higgs Boson at that conference.

Publications in Journals :

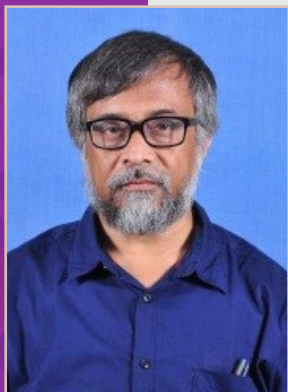
1. Search for inelastic dark matter in events with two displaced muons and missing transverse momentum in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan et al. - S. Banerjee+ 2000 other authors; *Physical Review Letters*, **132** 041802. (2024)
2. Observation of new structure in the J/ψ J/ψ mass spectrum in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration -- A. M. Sirunyan et al. - S. Banerjee+ 2000 other authors; *Physical Review Letters* **132** 111901.(2024)

3. Multiplicity and transverse momentum dependence of charge-balance functions in pPb and PbPb collisions at LHC energies; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee+ 2000 other authors; *Journal of High Energy Physics*, **2408** 148. (2024)
4. Study of charm hadronization with prompt Λ^+c baryons in proton-proton and lead-lead collisions at $\sqrt{s_{NN}} = 5.02$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee+ 2000 other authors; *Journal of High Energy Physics*, **2401** 128. (2024)
5. Measurement of the production cross section for a W boson in association with a charm quark in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration -- A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *European Physical Journal*, **C84** 27. (2024)
6. Search for Scalar Leptoquarks Produced via τ -Lepton-Quark Scattering in pp Collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee+ 2000 other authors; *Physical Review Letters*, **132** 061801. (2024)
7. Search for a third-generation leptoquark coupled to a lepton and a b quark through single, pair, and nonresonant production in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Journal of High Energy Physics*, **2405** 311. (2024)
8. Evidence for the Higgs boson decay to a Z boson and a photon at the LHC / ATLAS Collaboration; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Physical Review Letters*, **132** 021803. (2024)
9. Development of the CMS detector for the CERN LHC Run 3; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Journal of Instrumentation*, **19** P05064. (2024)
10. Luminosity determination using Z boson production at the CMS experiment; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee+ 2000 other authors; *European Physical Journal*, **C84** 26. (2024)
11. Measurement of the τ lepton polarization in Z boson decays in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Journal of High Energy Physics*, **2401** 101. (2024)
12. Inclusive and differential cross-section measurements of tt-bb- production in the lepton+jets channel at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee + 2000 other authors; *Journal of High Energy Physics*, **2405** 042. (2024)
13. Search for supersymmetry in final states with disappearing tracks in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee+ 2000 other authors; *Physical Review D*, **109** 072007. (2024)
14. Search for a new resonance decaying into two spin-0 bosons in a final state with two photons and two bottom quarks in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee+ 2000 other authors; *Journal of High Energy Physics*, **2405** 316. (2024)
15. Search for stealth supersymmetry in final states with two photons, jets, and low missing transverse momentum in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Physical Review D*, **109** 112009. (2024)
16. Study of azimuthal anisotropy of $\Pi(1S)$ mesons in pPb collisions at $\sqrt{s_{NN}} = 8.16$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Physics Letters B*, **850** 138518. (2024)
17. Muon identification using multivariate techniques in the CMS experiment in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration -- A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Journal of Instrumentation*, **19** P02031. (2024)
18. Observation of WW γ production and search for H γ production in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration -- A. M. Sirunyan *et al.* -- S. Banerjee + 2000 other authors; *Physical Review Letters*, **132** 121901. (2024)
19. Search for central exclusive production of top quark pairs in proton-proton collisions at $\sqrt{s} = 13$ TeV with tagged protons; CMS Collaboration -- A. M. Sirunyan *et al.* -- S. Banerjee+ 2000 other authors; *Journal of High Energy Physics*, **2406** 187. (2024)
20. Search for dark matter particles in W $^+$ W $^-$ events with transverse momentum imbalance

- in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration -- A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Journal of High Energy Physics* **2403** 134.(2024)
21. Search for Narrow Trijet Resonances in Proton-Proton Collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee + 2000 other authors; *Physical Review Letters*, { \bf 133} 011801.(2024)
 22. Search for W' bosons decaying to a top and a bottom quark in leptonic final states in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee + 2000 other authors; *Journal of High Energy Physics*, **2405** 046.(2024)
 23. Search for an exotic decay of the Higgs boson into a Z boson and a pseudoscalar particle in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration -- A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Physics Letters*, **B852** 138582.(2024)
 24. Search for high-mass exclusive diphoton production with tagged protons in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee+ 2000 other authors; *Physical Review D*, **110** 012010.(2024)
 25. Search for new Higgs bosons via same-sign top quark pair production in association with a jet in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration -- A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Physics Letters*, **B850** 138478.(2024)
 26. Higher-order moments of the elliptic flow distribution in PbPb collisions at $\sqrt{s_{NN}} = 5.02$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee+ 2000 other authors; *Journal of High Energy Physics*, **2402** 106.(2024)
 27. Search for the lepton flavour violating $\tau \rightarrow 3\mu$ decay in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration -- A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Physics Letters B*, **853** 138633.(2024)
 28. Search for Charged-Lepton Flavor Violation in the Production and Decay of Top Quarks using Trilepton Final States in Proton-Proton Collision at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Physical Review D*, **111** 012009.(2025)
 29. Measurement of simplified template cross-sections of the Higgs boson produced in association with W or Z bosons in the $H \rightarrow b\bar{b}$ decay channel in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Physical Review D*, **109** 092011.(2024)
 30. Search for flavour-changing neutral current interactions of the top quark in final states with a photon and additional jets in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Physical Review D*, **109** 072004.(2024)
 31. Search for long-lived heavy neutral leptons with lepton flavour conserving or violating decays to a jet and a charged lepton; CMS Collaboration - A. M. Sirunyan *et al.* -- S. Banerjee + 2000 other authors; *Journal of High Energy Physics*, **2403** 105.(2024)
 32. Evidence for tWZ production in proton-proton collisions at $\sqrt{s} = 13$ TeV in multilepton final states; CMS Collaboration - A. M. Sirunyan *et al.* - S. Banerjee+ 2000 other authors; *Physics Letters B*, **855** 138815.(2024)
 33. Measurement of the primary Lund jet plane density in proton-proton collisions at $\sqrt{s} = 13$ TeV; CMS Collaboration -- A. M. Sirunyan *et al.* -- S. Banerjee+ 2000 other authors; *Journal of High Energy Physics*, **2405** 116.(2024)

Sponsored Project:

- » INSA Senior Scientist Scheme



Soumitra SenGupta, FNASc

Amal Kumar Raychaudhuri Chair Professor

Extra dimensional Theories, Braneworld, Supergravity, String Theory, Gravity, Cosmology, Blackholes

Associate and Collaborators : (1) T. Paul, (2) S. Odintsov, (3) S.Nojiri, (4) A. Bhaumik, (5) B. Mandal, (6) S. Gulzar Elahi, (7) S. S. Mandal, (8) S. Choudhury, (9) S. Roy, (10) S. Haque, (11) S.Chakraborty, (12) S. Bhattacharyya, (13) S. Alam, (14) S. Sen and (15) H. Kumar

We show that the second law of thermodynamics gets naturally satisfied during the entire cosmic evolution of the universe starting from inflation to the late dark energy era, without imposing any exotic condition. This makes the inter-connection between cosmology and thermodynamics more concrete. Consequently, it also depicts that why the matter fields are not in thermal equilibrium with the apparent horizon during most of the cosmic era of the universe, except for the fluids with $\omega = -1/3$ leading to the transitions of the universe from an accelerating to a decelerating era and vice-versa.

In order to unravel the present situation of the PBH overproduction problem, our study emphasizes the critical role played by the equation of state (EoS) parameter w within the framework of effective field theory (EFT) of non-singular bounce.

We derived a consistent exposition of the regularization, renormalization, and resummation procedures in the setup of having a contraction and then nonsingular bounce followed by inflation with a sharp transition from slow-roll (SR) to ultra-slow roll (USR) phase for generating primordial black holes (PBHs). We consider following an effective field theory (EFT) approach and study the quantum loop corrections to the power spectrum from each phase.

We analyze the effective four-dimensional dynamics of the extra-dimensional moduli fields in curved braneworlds having nested warping, with particular emphasis on the doubly warped model which is interesting in the light of current collider constraints on the mass of the Kaluza-Klein graviton. The presence of a non-zero brane cosmological constant (Ω) naturally induces an effective moduli

potential in the four-dimensional action, which shows distinct features in dS ($\Omega > 0$) and AdS ($\Omega < 0$) branches. For the observationally interesting case of dS 4-branes, a metastable minimum in the potential arises along the first modulus, with no minima along the higher moduli. The underlying nested geometry also leads to interesting separable forms of the non-canonical kinetic terms in the Einstein frame, where the brane curvature directly impacts the kinetic properties of only the first modulus. The non-canonicity of the scenario has been illustrated via an explicit computation of the field space curvature.

We examine the second law of thermodynamics in the context of horizon cosmology, in particular, whether the change of total entropy (i.e. the sum of the entropy for the apparent horizon and the entropy for the matter fields) proves to be positive with the cosmic expansion of the universe. The matter fields inside the horizon obey the thermodynamics of an open system as the matter fields has a flux through the apparent horizon, which is either outward or inward depending on the background cosmological dynamics. Regarding the entropy of the apparent horizon, we consider different forms of the horizon entropy like the Tsallis entropy, the Rényi entropy, the Kaniadakis entropy, or even the 4-parameter generalized entropy; and determine the appropriate conditions on the respective entropic parameters coming from the second law of horizon thermodynamics. The constraints on the entropic parameters are found in such a way that it validates the second law of thermodynamics during a wide range of cosmic era of the universe, particularly from inflation to radiation dominated epoch followed by a reheating stage. Importantly,

the present work provides a model independent way to constrain the entropic parameters directly from the second law of thermodynamics for the apparent horizon.

The duality between a higher curvature $f(R)$ gravity model and a scalar-tensor theory helps to bring out the role of the additional degree of freedom originating from the higher derivative terms in the gravity action. Such a degree of freedom which appears as a scalar field has been shown to have multiple implications in Cosmological/ Astrophysical scenario. The present work proposes a novel generalization to this correspondence between $f(R)$ gravity and a dual scalar-tensor theory when the affine connection is considered to have an antisymmetric part. It turns out that the $f(R)$ action in presence of spacetime torsion can be recast to a non – minimally coupled scalar-tensor theory with a 2-rank massless antisymmetric tensor field in the Einstein frame, where the scalar field gets coupled with the antisymmetric field through derivative coupling(s).

Publications in Journals :

1. Natural validation of the second law of thermodynamics in cosmology - S.D. Odintsov,

T. Paul, S. SenGupta, *Phys.Rev.D*, **111** 4, 0435442 (2025).[IF:]

2. Obviating PBH overproduction for SIGWs generated by pulsar timing arrays in loop corrected EFT of bounce - S. . Choudhury, S. Ganguly, S. Panda S SenGupta, P. Tiwari , *JCAP*, **09**, 013 (2024).[IF:]
3. Moduli dynamics in effective nested warped geometry in four dimensions and some cosmological implications - A. Bhaumik, S. SenGupta, *JHEP*, **09** 003 (2024).[IF:]
4. Regularized-renormalized-resummed loop corrected power spectrum of non-singular bounce with Primordial Black Hole formation - S. Choudhury , A. Karde ,S. Panda, S. SenGupta, *Eur.Phys.J.C*, **84** 11, 11495 (2024).[IF:]
5. Second law of horizon thermodynamics during cosmic evolution - S. D. Odintsov, T. Paul, S. SenGupta, *Phys.Rev.D*, **109** 10, 1035156 (2024).[IF:]
6. Gravity with spacetime torsion - H. Kumar, T. Paul , S. SenGupta *EPL*, **147** 2, 29001 (2024).[IF:]

Ph.D. Degree Awarded :

- (1) Bhaswati Mandal (IACS Deemed to be University)



Amlan Jyoti Pal, FASc, FNAE, FNA, FNASc

J C Bose National Fellow

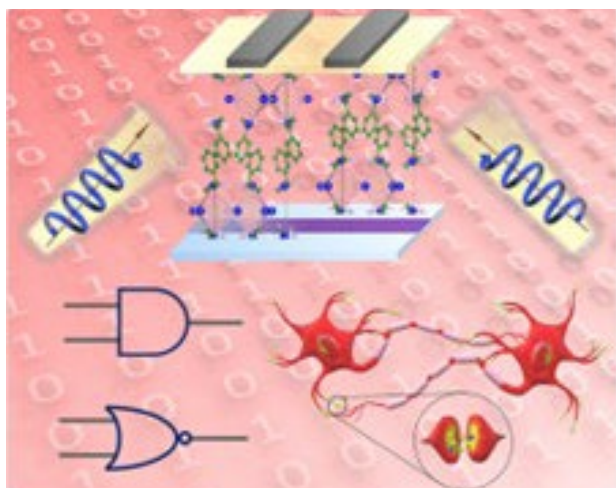
Organic electronics, Device Physics, Scanning Tunneling Spectroscopy of 2D transition metal dichalogenides and topological insulators, spintronics, Fabrication and characterization of light emitting diodes (LEDs) and ReRAM devices, solar cells based on hybrid halide perovskites.

Associate and Collaborators : (1) Raja Chakraborty, SRF (Integrated Ph.D.); (2) Subham Paramanik, SRF (CSIRNET); (3) Soirik Dan, SRF (UGC NET); (4) Arpan Bera, SRF (DST-INSPIRE); (5) Sourav Mukherjee, SRF (DST-INSPIRE).

Introducing Chiro-optical Activities in Photonic Synapses for Neuromorphic Computing and In-Memory Logic Operations :

In artificial synaptic devices aimed at mimicking neuromorphic computing systems, electrical or optical pulses, or both, are generally used

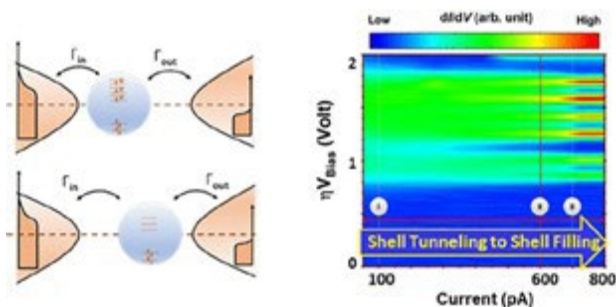
as stimuli. In this work, we introduce chiral materials for tailoring the characteristics of photonic synaptic devices to achieve handedness-dependent neuromorphic computing and in-memory logic gates. In devices based on a pair of chiral perovskites, the use of circularly polarized light (CPL) as the optical stimulus mimicked a series of



electrical and opto-synaptic functionalities in order to emulate the multifunctional complex behavior of the human brain. Upon illumination in this two-terminal device, anisotropy in current has been observed due to the out-of-plane carrier transport, originating from spin-selective carrier transport. More importantly, the logic gate achieved in devices based on optoelectronic memristors turned out to be chirality-dependent; while an R-device functioned as an AND gate, the device based on the same perovskite of the opposite chirality (S-device) acted as a NOR gate toward in-memory logic operations. These findings in chiral perovskite-based artificial synapses can identify further strategies for future neuromorphic computing, vision simulation, and artificial intelligence.

S. Dan, S. Paramanik, and A. J. Pal, *ACS Nano* 18 (22), 14457–14468 (2024).

Electronic States of Single Perovskite Quantum Dots in Weak and Strong Interaction Regimes: Implications in Electrically Pumped Quantum Emitters :

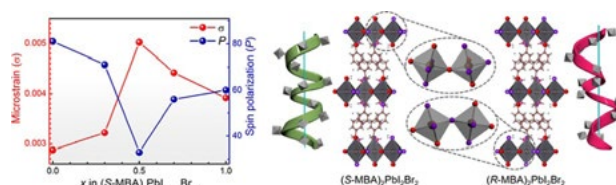


The effect of Coulomb interactions on the electronic states of a single perovskite quantum dot (PQD), CsPbBr₃, through scanning tunneling microscopy/spectroscopy (STM/S) has been investigated here.

Under a weak interaction regime, where the time-averaged occupation of electrons in a PQD remains zero, the peaks observed in the differential tunneling conductance (dI/dV) spectrum correspond to the single-particle density of states (DOS) without any electron–electron correlation. However, with a shorter tunnel distance between the STM tip and PQD, additional electrons are trapped in the QD, leading to a strong interaction regime with well-defined electronic fine structures due to the lifting of spin degeneracy in the conduction bands. Interestingly, we observe that the strong Coulomb interaction can modify the spin–orbit coupling (SOC) strength in the PQDs. We have concluded that the energy levels under a strong electron–electron interaction regime are of utmost importance since they will be applicable to electrically pumped PQD-based single photon quantum emitters.

A. Bera, A. Maiti, A. J. Pal, *Nano Letters* 24 (37), 11544–11550 (2024).

Why Mixed Halides in 2D Chiral Perovskites Weaken Chirality-Induced Spin Selectivity :



2D Ruddlesden–Popper (RP) perovskites, upon inclusion of a chiral amine, exhibit chirality-induced spin selectivity (CISS). Although alloying at the halogen site in MBA-based RPs (MBA: methylbenzylammonium) is one of the suitable routes to tune the CISS effect, the mixed-halide RP perovskites exhibited complete suppression of chirality when probed through circular dichroism (CD). Here, we present the CISS effect in a series of mixed-halide RP perovskites. We show that photoinduced halide segregation is the origin for the apparent chirality suppression. The spin-dependent charge transport was evidenced through magnetic-conducting atomic force microscopy (mc-AFM) studies and magnetoresistance (MR) measurements. The mc-AFM results show that in $(R/S\text{-MBA})_2\text{PbI}_{4(1-x)}\text{Br}_{2x}$, the CISS effect decreases with bromide inclusion, nonmonotonically; the microstrain developed in the lattice and the spin-polarized charge transport are found to be correlated. Such a behavior has been explained



through an inhomogeneity in the strength of the hydrogen bond between the organic moieties and halogens in the inorganic framework of the compounds. Our results further inferred that the hydrogen-bond-induced coupling transfers the chirality from the amine to the inorganic sublattice. The work explains the weakened CISS effect in mixed-halide chiral RP perovskites and provides a strategy to tune the spin-polarized charge transport as well.

S. Dan, S. Paramanik, and A. J. Pal, *ACS Nano* **18** (52), 35644-35653(2024).

Publications in Journals :

1. Why Mixed Halides in 2D Chiral Perovskites Weaken Chirality-Induced Spin Selectivity - S. Dan, S. Paramanik, and A. J. Pal, *ACS Nano* **18**, 35644-35653 (2024). [IF:16.0]
2. Electronic States of Single Perovskite Quantum Dots in Weak and Strong Interaction Regimes: Implications in Electrically Pumped Quantum Emitters - A. Bera, A. Maiti, and A. J. Pal, *Nano Letters* **24**, 11544-11550 (2024).[IF:9.1]
3. Correlating Lattice-Distortion-Induced Ferroelectricity with Solar-Cell Performance in All-Inorganic Mixed-Halide Perovskites - S.

Mukherjee, S. Dan, and A. J. Pal *Physical Review Applied* **22**, 034063 (2024).[IF:4.4]

4. Introducing Chiro-optical Activities in Photonic Synapses for Neuromorphic Computing and In-Memory Logic Operations - S. Dan, S. Paramanik, and A. J. Pal, *ACS Nano* **18**, 14457-14468(2024).[IF:16.0]
5. Does an Intrinsic Strain Contribute to the Effect of Quantum Confinement Phenomenon? An Alloyed Transition Metal Dichalcogenide Series, $\text{Mo}(\text{S}_{1-x}\text{Se}_x)_2$ as A Case Study - A Bera, B Kundu, and A. J. Pal, *Nanoscale* **16**, 9966-9974(2024). [IF:5.1]

Ph.D. Degree Awarded :

(1) Soirik Dan (IACS Deemed to be University)

Sponsored Project:

- » JC Bose National Fellowship – Second Term
- » Asian Office of Aerospace Research and Development (AOARD)
- » India-South Africa International Cooperation – DST
- » DST-JSPS International Bilateral Cooperation

ACADEMIC PROGRAMME OF THE IACS DEEMED TO BE UNIVERSITY





Academic Programme of the IACS Deemed to be University

The MHRD, Government of India vide the Gazette Notification No.F.9-7/2017-U.3 (A) dated May 26, 2018 declared IACS as an Institution Deemed to be University under de novo category. IACS has been functioning as a Deemed to be University conferring its BS-MS, MS and Ph.D. degrees to the students registered with IACS, Deemed to be University.

With the approval of the Governing Council, IACS as a Deemed to be University has started its Integrated Bachelor's-Master's Program in Science from the Academic Year 2018-19, which is a research-oriented de-novo BS-MS Program that has successfully run through its 7th year of existence and has attracted some of the best young students aspiring for building research career in Science from all over the country. IACS is offering MS/ Integrated MS-PhD and Regular PhD programs in Science in the emerging areas in the disciplines of Biological Sciences, Chemical Sciences, Applied and Interdisciplinary Sciences, Materials Sciences, Mathematical and Computational Sciences and Physical Sciences; the courses being designed by the Boards of Studies comprising renowned experts and academicians in the fields are truly de-novo in structure and spirit. The Academic Programs are being run under the Academic Administration of the Academic Office under the Dean (Academic) and the Dean (Students' Affairs), and also the Academic Coordinators (PhD, BS-MS and Results). IACS has given its best efforts to ensure that highest quality is maintained in terms of students, teaching and other resources and infrastructure for all the programs, while not compromising with the research quality and productivity of the faculty members as sustained over the years.

The syllabus and the curriculum of each one of the courses is unique in the sense that the students from one discipline can opt for elective courses from other disciplines which without doubt will help in widening their scientific outlook, commensurate with the renowned institutes all over the world. The courses are versatile and wide, allowing flexibility both equal stress on the fundamental

science education. There are courses on Scientific Ethics, Communicating Skills and History of Indian Science, which even being an integral part of any Science education system in India often does not get adequate coverage in a formal way. As per MOE directives, IACS has adopted NEP and has aligned its courses in conformity with the NEP guidelines.

The administrative structure of the deemed university is:

Chairperson

Director

Academic Council

Board of Studies

Core Committee

Faculty Board

The MOA of the IACS Deemed to be University has been duly approved by the Hon'ble Minister of Science and Technology and has been registered with the Registrar of Societies. Conferred with the new status of de novo Science Research University in 2018 by the Government of India, IACS envisages many new programs. The MOA gets duly amended from time to time as per UGC guideline after getting approval of the administrative ministry. The founding of IACS-Deemed to be University represents a renaissance in its initiatives and ruminates to host an International Center for Fundamental Research and Teaching offering de-novo courses which will be a multi-disciplinary initiative to promote cutting edge research in various fundamental and applied sciences.

The 5th Annual Convocation of IACS will be held on August 04, 2025, which will presided over by Dr. Renu Swarup, Former DBT Secretary, Chairperson, Governing Council and graced by the august presence of Professor J.B. Joshi, Padma Bhushan, Emeritus Professor, Homi Bhabha National Institute, Mumbai as the Chief Guest.

During the year, all the UGC mandated requirements have been complied with.

Summary of the degree recipients:

School	PhD	MS	BS-MS
School of Applied and Interdisciplinary Sciences (SAIS)	13	13	-
School of Biological Sciences (SBS)	8	-	4
School of Chemical Sciences (SCS)	24	19	6
School of Materials Sciences (SMS)	12	11	-
School of Mathematical and Computational Sciences (SMCS)	1	8	6
School of Physical Sciences (SPS)	20	11	12
Total number of degree recipients	78	62	28

Medal winners:

Name	School	Achievement	Medal
Kisalay Nandi	SCS	Highest CGPA among MS degree recipients of all Schools	Gold
Sulagna Chanda	SAIS	Highest CGPA among MS degree recipients of SAIS	Silver
Shamitava Roy	SMS	Highest CGPA among MS degree recipients of SMS	Silver
Saumyadip Kar	SMCS	Highest CGPA among MS degree recipients of SMCS	Silver
Sanhita Guha	SPS	Highest CGPA among MS degree recipients of SPS	Silver
Shihabul Haque	Major in Physics	Highest CGPA among all BS-MS degree recipients	Gold
Medha Sen	Major in Computer Science	2 nd Highest CGPA among all BS-MS degree recipients	Silver
Shreetama Bhattacharya	Major in Chemistry	3 rd Highest CGPA among all BS-MS degree recipients	Silver

Details of the PhD degree recipients:

SI No	Candidate	Supervisor	Title
1	Sourav Gope	Satyanarayan Mukhopadhyay	Cosmology of An Internally Thermalized Dark Matter
2	Himangshu Sharma	Rajib Goswami	Total Synthesis of Thailandamide Lactone and the Journey towards the Total Synthesis of Thailandamide A, Nemamide A and Neaumycin B
3	Sukhendu Maity	Praveen Kumar	Hybrid 2D Materials based Self-powered and Broadband Photodetectors
4	Krishnendu Roy	Praveen Kumar	Hybrid Two-Dimensional Materials for Electrochemical Hydrogen Evolution Under External Stimulus

Sl No	Candidate	Supervisor	Title
5	Avijit Patra	Narayan Pradhan	Facet Modulation for Designing Polyhedral Lead halide Perovskite Nanocrystals and Their Epitaxial Heterostructures
6	Sourya Shankar Auddy	Rajib Kumar Goswami	Total Synthesis of Bacilotetrin C and BipolamideA Acetate and Studies towards Amphidinins A & G: Evaluation of Anticancer Activities of Bacilotetrin C Analogues Generated via Systematic Structure-Activity Relationship Study.
7	Ujjwal Maji	Joyram Guin	Enantioselective Construction of C-N & C-C Bonds Using Non-covalent NHC-Catalysis
8	Subhasis Mandal	Prosenjit Sen	Design and Synthesis of N-Containing Heterocyclic Derivatives: Investigating their Biological Applications
9	Somsubhra Ghosh	Krishnendu Sengupta	Hilbert Space Fragmentation: en route to ETH Violation and Reality
10	Subhankar Sutradhar	T K Paine	Effect of Two or More Metal Centers on Catalytic Water Oxidation and Dioxygen Reduction by Nonheme Iron and Copper Complexes
11	Indrajit Sau	Arnab Sen	Correlated quantum systems with disorder and local constraints
12	Jayanta Dolai	N R Jana	Designing Ultrasound Responsive Nanomaterials for Advanced Biomedical Applications
13	Atish Nag	Suhrit Ghosh	Hydrogen Bonding Regulated Self-Assembly of (Macro) molecules and Functional Materials
14	Sukanya Bera	Suhrit Ghosh	Amphiphilic Polydisulfide and Drug Delivery
15	Moinul Haque Sahana	Rajib Goswami	Total Synthesis of Bioactive Natural Products Strasseriolide A & Sorangiolide A and a Journey towards the Total Synthesis of Zampanolide B.
16	Sayan Atta	Amit Majumdar	Transition Metal Complexes of Polychalcogenides and Nitrite: Oxidation of Polychalcogenides and Reduction of Nitrite
17	Ananya Tapadar	Sourov Roy	Some studies on non-thermal production of dark matter
18	Shameek Mukherjee	Saurav Giri	Geometric Magnetic Frustration and Magnetoelectric Coupling without Long-Range Magnetic Ordering
19	Dipanjan Ray	Deepak Kumar Sinha	Mechanics of the Cytoplasm: The role of Cytoskeletal Filaments and Cytolinker Plectin
20	Aritra Pal	Koushik Ray	Conformal Integrals in Various Dimensions and Conformal Field Theories
21	Atanu Ghosh	Surajit Sinha	Synthesis of Regular and Modified Morpholino Oligonucleotides in Automated DNA Synthesizer for Therapeutic Evaluation
22	Sukalyan Shyam	Debajyoti Das and A Bhaumik	Growth and Characterization of Nanocrystalline Si, Ge, and TiO ₂ Thin Films for Photosensitive Applications
23	Brij Mohon Paramanik	Debajyoti Das and A Bhaumik	Low-temperature Synthesis of Carbon and Zinc Oxide Nanostructured Thin Films for Energy Applications

Sl No	Candidate	Supervisor	Title
24	Bhargab Prasad Mondal	Anuja Datta and Suhrit Ghosh	Exploring Paper-Based Thermoelectric Generators as Efficient Waste Heat Harvesters
25	Soumya Jyoti Basak	Jyotirmayee Dash	Synthetic Strategies for the Construction of Biologically Active Heterocycles: Quinazolinone Alkaloids and Their Analogues
26	Mohamad Numan	Subham Majumdar	Exploring Quantum Magnetism and Multiferroicity through Structural and Spectroscopic Studies of 3d Transition Metal Oxides
27	Subhendu Biswas	Anindita Das	Design and Synthesis of Degradable Functional Polyesters and their Implications in the Biological Domain
28	Rajesh Khamrui	Suhrit Ghosh	Supramolecular Biomaterials by H-bonding Regulated Aqueous Self-assembly of Naphthalene-Diimide Derived Amphiphiles
29	Purnadas Ghosh	Arindam Banerjee	Carbon Dots Decorated Metal Nanocomposites and Peptide Appended Various Rylene Dyes for Antibacterial Activities, Environmental Remediation and Optoelectronic Studies
30	Pulakesh Pramanik	S Bhattacharya and S S Jana	New Small Molecular Entities as Therapeutic Agents Via Selective Targeting and Stabilization of the Secondary Structure of Nucleic Acids
31	Anushree Dey	Bimalendu Deb	Some Model Studies on Quantum Coorelations in strong Coupling Cavity QED Regime
32	Ankan Kumar Sarkar	N R Jana	Designed Nanodrugs for Subcellular Targeting and Prevention of Neurodegenerative Disease
33	Arpan Choudhury	Debashree Ghosh	Structure & Photoactivity of Melanin: A Combined Computational Chemistry, Machine Learning & Quantum Computing Study
34	Payel Sahu	Debajyoti Das and A Bhaumik	Design and Development of ZnO Nanorod-Based Heterostructures: Application in Catalysis and Photovoltaics
35	Sarita Kolay	Amitava Patra	Synthesis of Metal Nanoclusters: Self-assembly and Excited-state Dynamics
36	Rumela Adhikary	Avisek Das	Structure and Mechanism of Self-assembly of Ultrashort Peptides: Insights from Atomistic Computer Simulations
37	Bhaskar Deb Mondal	Joyram Guin	Enantioselective Construction of 3,3-Disubstituted Benzofuran-2(3H)-ones via Noncovalent N-Heterocyclic Carbene Catalysis
38	Madhubrata Ghora	Shinto Varghese and Raju Mondal	Exploring Intermolecular Interactions for Tuning Molecular Organization and Functions in π -Conjugated Materials
39	Subhojit Paul	Prosenjit Sen	Studying the Role of Blood Coagulation Factors in Chemotherapeutic Resistance and Cancer Immune Evasion
40	Sumitava Kundu	Avisek Das	Orientational disorder in crystalline assemblies of hard particles
41	Anupam Ghosh	Ayan Datta	Molecular Dynamics Simulations for Biomolecule-Nanomaterial Interactions

SI No	Candidate	Supervisor	Title
42	Pradeepta Kumar Ghosh	Saurav Giri	Magnetotransport & Magneto- Seebeck Studies of Topological Materials
43	Sujan Maity	Subhadeep Datta	Magnetic Proximity Effect in Two-dimensional van der Waals Heterostructures
44	Sourav Mondal	Rupa Mukhopadhyay	Structural alterations in DNA molecules exposed to exogenous agents: An investigation at the single molecule level
45	Manik Jana	Harapriya Rath	Controlled Syntheses of Core modified N-confused N(C)-fused Porphyrinogen, Porphodimethenes, Porphotrimethenes and Porphyrinoids with Adaptive Features
46	Ditipriya Mallick	Siddhartha S Jana	Non-Muscle Myosin II Paralogs in Mechanotransduction Pathway and their Splicing at LOOP2 Region
47	Swadesh Paul	Anuja Datta and Suhrit Ghosh	Understanding Mechanical Energy Harvesting Potential in Piezoelectric Lead-Free Ceramics Nanocomposites and Self-Assembled Soft Molecular Systems for Micropower Applications
48	Rounak Nath	Ankan Paul	Elucidating the Role of Protein Environment in the Catalytic Activity of Salicylate 1,2-Dioxygenase: Insights from Hybrid Quantum Mechanical/Molecular Mechanical Studies
49	Abu Raihan Sarkar	N R Jana	Development of Reactive Oxygen Species Generating Nanomaterials for Cell Therapy
50	Jayanta Dey	Joyram Guin	Oxime-Ether Group Transfer via Light Induced HAT Catalysis
51	Nabin Parui	Jyotirmayee Dash	Synthesis of Indole- and Indanone Fused Ring Systems from Diketone Building Blocks via RCM
52	Arnab Das	Surajit Sinha	Synthesis and Biological Assessment of Nucleobase Modified Phosphorodiamidate Morpholino Oligonucleotides
53	Kamal Hossain	Amit Majumdar	Activation of Chalcogens and Reduction of Nitrite by Binuclear Transition Metal Complexes
54	Suman Patra	Abhishek Dey	Mechanistic Investigation of CO ₂ reduction by Iron Porphyrin: Role of Second Sphere
55	Priyanka Dinda	Tarun Kumar Mandal	Polar Amino Acid-Derived Polymers: Stimuli-Responsiveness and Applications
56	Bikash Das	Subhadeep Datta	Electronic Transport Properties of Quasi-One-Dimensional Van der Waals Materials
57	Sharmista De	Ankan Paul	DFT Studies on Fe-oxyhydroxide Nanoclusters : Growth Mechanism, Arsenic Binding and Catalysis
58	Sudip Bhattacharjee	Asim Bhaumik	CO ₂ as C1 feedstock for the synthesis of valuable chemicals using porous nanomaterials as heterogeneous catalyst
59	Nasiruddin Mondal	Devajyoti Mukherjee	Investigating magneto-optic Kerr effect and topological Hall effect in epitaxial ferromagnetic thin film heterostructures
60	Sk Jeusun	Dilip Ghosh	Study of Dark Sector Signature Through Cosmological Observations

Sl No	Candidate	Supervisor	Title
61	Ayan Datta	Sudip Malik	Design and Synthesis of Tetraphenylbuta-1,3-diene Based Monomers and Polymers: Leveraging AIE Characteristic to Improve Functional Properties
62	Vikramaditya Mondal	Sumanta Chakraborty	Quantum Features of the Universe: Aspects of Quantizing Bouncing and Inflationary Cosmological Models
63	Arnab Ghosh	Prosenjit Sen	Deciphering the significance of GPCR-mediated signaling and non-coding RNAs in cancer immune evasion.
64	Arnab Bera	Mintu Mondal	Role of Symmetry in Quantum Phases and Phase Transitions in Transition Metal-Based vdW Materials
65	Madhusudan Ghosh	Partha Basuchowdhury	From Textual Data to Structured Knowledge : A Computational Study on Neural Information Extraction
66	Sourav Dutta	Joyram Guin	N-Heterocyclic Carbene-Catalyzed Asymmetric Desymmetrization and Kinetic Resolution of Alcohols via Transfer Acylation
67	Soirik Dan	Amlan J Pal	Electronic and Spin Transport in Compound Semiconductors: Advancement toward Band-Engineering and Chiro-Optical Activities
68	Tanushri Banerjee	Suhrit Ghosh	New Organic Photosensitizers and their Stimuli-Responsive Polymeric Conjugates for Activable Photodynamic Therapy
69	Aritri Pal	Suhrit Ghosh	Supramolecular Polymers of Polarizable π -Systems and Functional Materials
70	Subal Mondal	Pradyut Ghosh	Development of Stereo- and Regio-Selective C-C/C-O Bond Formation Reactions Using Palladium-Catalyzed Denitrative and Photo-Decarboxylative Pathways
71	Sk. Kalimuddin	Mintu Mondal	Charge density wave and critical phenomena in quasi-1D compounds
72	Sourav Mondal	Durga Basak	Defect and substrate induced modulation in photoluminescence and photoconductivity of undoped and doped ZnO thin films and monolayer to few-layer MoS ₂
73	Diptam Nasipuri	Narayan Pradhan	Colloidal Engineering of Perovskite and Metal Halide Nanocrystals: Doping, Dimensional Tuning and Self-Assembly
74	Priyanka Roy	Deepak Kr Sinha	Studying the impact of membrane tension, extracellular microenvironment, and cytoskeleton disassembly on TNFR1 signaling
75	Sourav Pramanik	Pradyut Ghosh	Selective Recognition and Extraction of Iodine and Perrhenate Anion from Water via Chalcogen Bonding Interaction
76	Arpan Bera	A J Pal & S Giri	Effect of External Perturbations on the Electronic States of Some Halide Perovskites and Transition Metal Dichalcogenides
77	Santanu Pal	Durga Basak	Defect Induced Modulation in Electrical and Magneto-electric Transport Mechanisms in Transparent Conducting Oxide Films
78	Mahuya Kar	Tarun Kr Mandal	Water-Soluble Amphiphilic Fluorophore-Based Polymers: Synthesis, Stimuli-Responsiveness and Biological Applications

Details of the MS degree recipients:

SAIS		
SL NO	NAME	DEGREE TITLE
1	Devesh Shukla	Chemical Sciences (Polymer Science and Soft Matter)
2	Puja Banerjee	Chemical Sciences (Polymer Science and Soft Matter)
3	Soumi Chanda	Chemical Sciences (Polymer Science and Soft Matter)
4	Tarun Kumar	Chemical Sciences (Polymer Science and Soft Matter)
5	Rima Das	Chemical Sciences (Polymer Science and Soft Matter)
6	Krittika Biswas	Physical Sciences (Soft Matter)
7	Gr. Abhishek Rao	Physical Sciences (Soft Matter)
8	Avigyan Bose	Biological Sciences (Molecular Biosystems and Biomedicine)
9	Syed Sarwar Zaman	Biological Sciences (Molecular Biosystems and Biomedicine)
10	Sulagna Chanda	Biological Sciences (Molecular Biosystems and Biomedicine)
11	Aritra Bhowmick	Biological Sciences (Molecular Biosystems and Biomedicine)
12	Sagnik Majumdar	Biological Sciences (Molecular Biosystems and Biomedicine)
13	Kushal Bhattacharya	Biological Sciences (Molecular Biosystems and Biomedicine)

SCS		
SL NO	NAME	DEGREE TITLE
14	Kaustuv Bag	Major in Chemistry
15	Subhadip Bhoj	Major in Chemistry
16	Manoranjan Manna	Major in Chemistry
17	Sangita Bayal	Major in Chemistry
18	Aryaveer Singh	Major in Chemistry
19	Aditi Goswami	Major in Chemistry
20	Swapnajit Bhar	Major in Chemistry
21	Dharmendra Jaiswal	Major in Chemistry
22	Kisalay Nandi	Major in Chemistry
23	Satakshi Dey	Major in Chemistry
24	Gopeswar Das	Major in Chemistry
25	Bibhuti Bhusan Debnath	Major in Chemistry
26	Arka Das	Major in Chemistry
27	Anis Khan	Major in Chemistry
28	Subrata Mahato	Major in Chemistry
29	Md Tuhin Shaikh	Major in Chemistry
30	Sujoy Shit	Major in Chemistry
31	Mintu Patra	Major in Chemistry
32	Lipika Baral	Major in Chemistry

SMCS		
SL NO	NAME	DEGREE TITLE
33	Aranya Bhowmick	Mathematics and Computing (Specialization in Computer Science)
34	Sutirtha Bhattacharyya	Mathematics and Computing (Specialization in Computer Science)
35	Saumyadip Kar	Mathematics and Computing (Specialization in Computer Science)
36	Lavisha Sharma	Mathematics and Computing (Specialization in Computer Science)
37	Thaneshwar Prasad Choudhary	Mathematics and Computing (Specialization in Mathematics)
38	Rakesh Mandal	Mathematics and Computing (Specialization in Mathematics)
39	Suvam Goswami	Mathematics and Computing (Specialization in Mathematics)
40	Soumyajit Raha	Mathematics and Computing (Specialization in Mathematics)

SMS		
SL NO	NAME	DEGREE TITLE
41	Syamantak Ray Sarkar	Chemical Sciences (Materials)
42	Ilora Maiti	Chemical Sciences (Materials)
43	Sayan Maji	Chemical Sciences (Materials)
44	Nachiketa Mahato	Chemical Sciences (Materials)
45	Hriday Das	Chemical Sciences (Materials)
46	Subhadip Mondal	Chemical Sciences (Materials)
47	Arghyadip Panda	Chemical Sciences (Materials)
48	Chandan Panda	Chemical Sciences (Materials)
49	Aditya Patra	Physical Sciences (Materials)
50	Dipayan Sarkar	Physical Sciences (Materials)
51	Shamitava Roy	Physical Sciences (Materials)

SPS		
SL NO	NAME	DEGREE TITLE
52	Rijoo Ghoshal	Major in Physics
53	Arijit Mondal	Major in Physics
54	Rick Sundar Garai	Major in Physics
55	Subhadarsi Sahoo	Major in Physics
56	Sanhitaa Cuha	Major in Physics
57	Samarjeet Banerjee	Major in Physics
58	Rohit Das	Major in Physics
59	Bubai Layek	Major in Physics
60	Sayan Maji	Major in Physics
61	Biswas Anubhab Mehedi	Major in Physics
62	Jaydip Barua	Major in Physics

Details of the BS-MS degree recipients:

BIOLOGY		
SL NO	NAME	DEGREE TITLE
1	Arkajyoti Banerjee	Integrated Bachelor's-Master's in Science (Major in Biology)
2	Sehasree Mohanta	Integrated Bachelor's-Master's in Science (Major in Biology)
3	Bristi Paul	Integrated Bachelor's-Master's in Science (Major in Biology)
4	Soumili Biswas	Integrated Bachelor's-Master's in Science (Major in Biology)

CHEMISTRY		
SL NO	NAME	DEGREE TITLE
5	Shreetama Bhattacharya	Integrated Bachelor's-Master's in Science (Major in Chemistry)
6	Pritam Baidya	Integrated Bachelor's-Master's in Science (Major in Chemistry)
7	Suchismita Karmakar	Integrated Bachelor's-Master's in Science (Major in Chemistry)
8	Akash Dip Paik	Integrated Bachelor's-Master's in Science (Major in Chemistry)
9	Aditya Bhattacharyya	Integrated Bachelor's-Master's in Science (Major in Chemistry)
10	Anirban Pal	Integrated Bachelor's-Master's in Science (Major in Chemistry)

MATHEMATICS		
SL NO	NAME	DEGREE TITLE
11	Maitreyo Bhattacharjee	Integrated Bachelor's-Master's in Science in Mathematics and Computing (Specialization in Mathematics)
12	Anuraj Chatterjee	Integrated Bachelor's-Master's in Science in Mathematics and Computing (Specialization in Mathematics)

COMPUTER		
SL NO	NAME	DEGREE TITLE
13	SK Asif Iqbal	Integrated Bachelor's-Master's in Science in Mathematics and Computing (Specialization in Computer Science)
14	Bitan Sarkar	Integrated Bachelor's-Master's in Science in Mathematics and Computing (Specialization in Computer Science)
15	Girish	Integrated Bachelor's-Master's in Science in Mathematics and Computing (Specialization in Computer Science)
16	Medha Sen	Integrated Bachelor's-Master's in Science in Mathematics and Computing (Specialization in Computer Science)



PHYSICS		
SL NO	NAME	DEGREE TITLE
17	Subham Chakraborty	Integrated Bachelor's-Master's in Science (Major in Physics)
18	Nilanjan Sasmal	Integrated Bachelor's-Master's in Science (Major in Physics)
19	Shihabul Haque	Integrated Bachelor's-Master's in Science (Major in Physics)
20	Sukanya Panja	Integrated Bachelor's-Master's in Science (Major in Physics)
21	Sayantan Nandi	Integrated Bachelor's-Master's in Science (Major in Physics)
22	Kanad Bhaumik	Integrated Bachelor's-Master's in Science (Major in Physics)
23	Arnav Chauhan	Integrated Bachelor's-Master's in Science (Major in Physics)
24	Shruti Kundu	Integrated Bachelor's-Master's in Science (Major in Physics)
25	Sourin Dey	Integrated Bachelor's-Master's in Science (Major in Physics)
26	Mandas Biswas	Integrated Bachelor's-Master's in Science (Major in Physics)
27	Surajit Ghosh	Integrated Bachelor's-Master's in Science (Major in Physics)
28	Pratyay Chowdhury	Integrated Bachelor's-Master's in Science (Major in Physics)



TRC

TECHNICAL RESEARCH CENTRE FOR MOLECULES & MATERIALS



Technical Research Centre for Molecules and Materials

Indian Association for the Cultivation of Science (IACS), is the oldest scientific Institution in Asia funded by the Department of Science & Technology, Government of India and the Government of West Bengal. IACS continues to adorn the mantle of academic and intellectual excellence in India and abroad and now stands at the crossroad of a critical era. Apart from fundamental researches in the various frontier areas of physics and chemistry, IACS has ventured in a significant way, for the past few years, into the emerging multidisciplinary areas such as non-conventional energy sources, advanced and novel nano-materials, chemical biology and interdisciplinary sciences. In this preamble, TRC in IACS is covering a variety of areas

such as design and synthesis of new nanomaterials, quantum materials, functional polymers and other organic/organometallic molecules and systems, materials with spintronics applications, strongly correlated electron systems, biomaterials and biology-inspired materials. Under this initiative, IACS has put together and installed several advanced instruments and developed facilities that would promote multidisciplinary research in materials, both in terms of syntheses of molecules and materials and investigation of their properties and functionalities, with the translational goal of developing applications and technologies based on such molecules and materials and making such research useful for industries and society.

The project has resulted in 35 publications, 7 filed patents, 1 granted patent and 4 commercialized technologies.

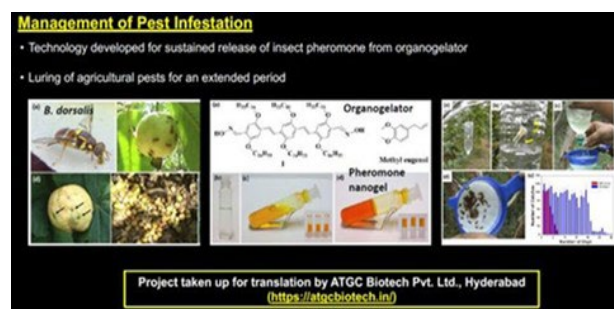


Figure: Two of the technologies that have been commercialized

Some notable success stories during the last year are highlighted below:

1. C1-C2 Useful Chemicals from CO₂ conversion to methane (green fuel).
2. Development of Nucleoside derived metallo-hydrogel with inherent antimicrobial property to combat drug resistant infectious diseases.
3. Development of single use paper-based sensors for the detection of volatile organic compounds.
4. Development of primary tumor cells for drug screening.
5. Development of Segmented polyurethanes that exhibit highly potent antibacterial (broad spectrum/ selective, depending on pendant group) activity.
6. Development of process chemistry for making morpholino oligonucleotides by an automated DNA synthesizer.
7. Two-dimensional (2D) Quantum Materials and Heterostructures.
8. CdSe/CdS CS NPLs-based photodetector device.
9. Nano-structures for water remediation.
10. Nano-structures for water remediation.
11. Flexible Micro Energy Harvesters for Waste Heat and Vibration Recovery

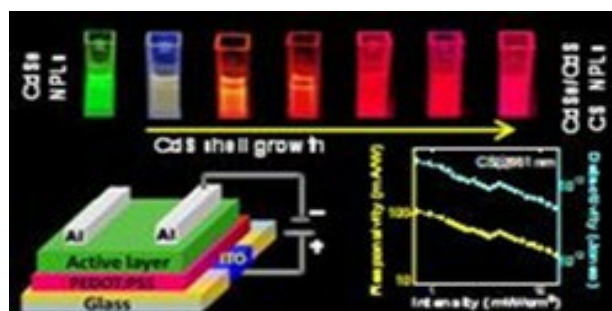
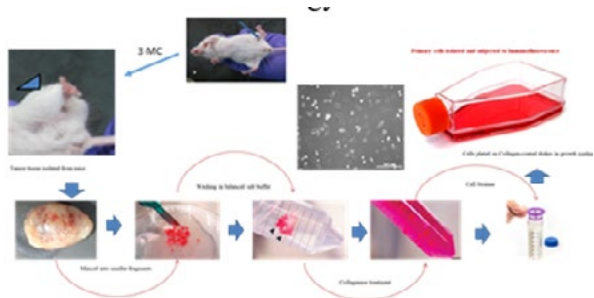
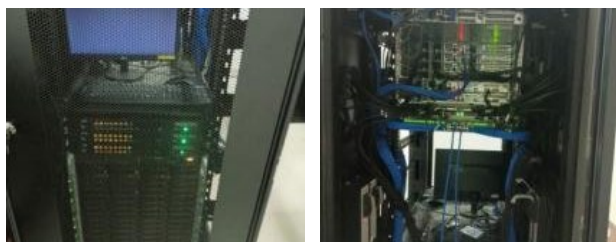


Figure: Two representative success stories in (left) biological applications and (right) nanodevices work directions under TRC

Under TRC, IACS encourages its researchers to translate in-house inventions through start-ups. From the success stories as notified above, two start-up companies named (1) **INCHEMJAIVIKA Pvt. Ltd.** with an objective to develop cost-effective drugs for anticancer and antimicrobial therapeutics and (2) **GENELIXIR PVT. LTD.** have been established for the large scale production of morpholinos.

New computational 8.9 TFLOPS facility



Altogether 14 PhDs students have been produced and 55 technical persons have been trained under different work packages under TRC project.

A total revenue of around 20 lakhs have been generated through different facilities established under TRC, a few of which are listed below :

Renovated Animal House



Anuja Dutta

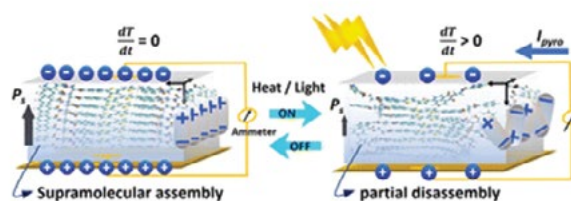
Scientist-III, TRC

Emerging functional properties and waste energy harvesting in novel inorganic, organic and hybrid perovskite materials

» Hydrogen-bonded supramolecular assembly of an acceptor–donor–acceptor (ADA)-type ambipolar π -system containing naphthalene-diimide (π -acceptor) and thiophene (π -donor) conjugated chromophores is examined for promising pyroelectric (PY) and photo-PY properties. A maximum PY coefficient of ~ 206

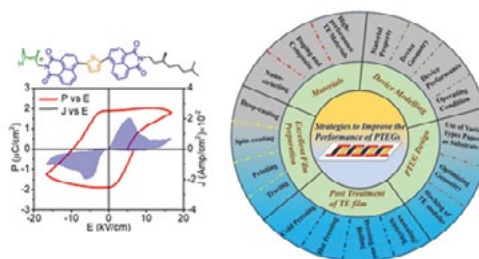
$\mu\text{C m}^{-2} \text{ K}^{-1}$ (at T_c) and multifold enhancement after light irradiation is reported. High energy density, power density and scaled efficiency indicate the efficacy of such a nontrivial system for flexible sensors. (in collaboration with Prof. Suhrit Ghosh, SAIS and Dr. Mintu Mondal, SPS)

- » Thermoelectric (TE) generators (TEG) add a robust solution toward efficiently harvesting low gradient waste heat energy into extractable micropower, offering scalable and viable choices to generate electricity ranging from excess heat generated in solar panels, automobile exhaust and factory heat outlets to day-to-day human activities, domestic electrical equipment and electronics. Paper-based TEGs (PTEGs) have become an area of immense research activity in the last few years, mainly because of the environmentally friendly, flexible, economic, and easy industry translatable nature of paper/cellulose. Even though PTEG's output performance still lags behind the performance of other flexible TEGs, rapid research directions toward materializing PTEG design, and including more varieties of TE materials and methods are having a large impact upon further PTEG performance optimization. A review article was published



that gives a concise overview of recent results, discussing the progress, advantages and potential barriers in PTEG research with a view to predicting future strategies and goals to increase their functionality in the thermal energy harvesting market.

- » Introduced a helical polyacetylene (P1) system with an appended acceptor (A)–donor (D)–acceptor (A) conjugated chromophore as a promising ferroelectric candidate. The helical conformation of P1 leads to a highly stable chiral assembly of the appended ADA chromophores. This results in prominent ferroelectricity as evident from the superior hysteresis loop at room temperature, exhibiting a saturation polarization (P_S) value $\sim 2 \mu\text{C cm}^{-2}$ and remanent polarization (P_r) value $\sim 1.8 \mu\text{C cm}^{-2}$ at a low coercive field (E_c) of 5.2 kV cm^{-1} , rarely reported before for purely organic systems. (in collaboration with Prof. Suhrit Ghosh, SAIS)



Publications in Journals

- Exploring Piezoelectric and Piezophototronic Properties of Nanostructured LN-ZnSnS₃ for Photo Responsive Vibrational Energy Harvesting - S. Das, S. Paul, A. Datta, *Nanoscale*, (17) 7218-7228 (2025).[IF:5.8]
- Low-Power Harvesting from Piezoelectric Chiral Supramolecular Polymer of a Donor-Acceptor-Donor Conjugated π -System - S. Paul, A. Paul, S. Ghosh,* A. Datta, *Chem. Eur. J.*, e202500540 (2025).[IF:5.02]
- Electronic pyroelectricity in a supramolecular assembly of an acceptor–donor–acceptor-type ambipolar π -system - P. Sadhukhan, Sk. Kalimuddin, A. Pal, T. Debnath, S. Paul, S. Barman, S. Ghosh, M. Mondal, A. Datta, *Chem. Comm.*, **61**, 5289-5292 (2025).[IF:6.065]
- Ferroelectric Helical Polymer - S. Bandopadhyay, S. Barman, S. Paul, A. Datta, S. Ghosh *Chem. Comm.*, **61**, 937-940 (2025).[IF:6.065]
- Switchable Bulk Photovoltaic Effect in Intrinsically Ferroelectric 3D All-Inorganic

CsPbBr₃ Perovskite Nanocrystals - A. Ghosh, S. Paul, M. Das, P. K. Sarkar, P. Bhardwaj, G. Sheet, S. Das, S. Kalimuddin, A. Datta, S. Acharya, *ACS Nano*, **18**, 23310–23319 (2024).[IF:17.1]

- Paper-Based Thermoelectric Generators for Viable Waste Heat Harvesting - S. Das, B. Mondal, A. Datta, *J. Phys. D: Appl. Phys.*, **58**, 043002 (INVITED TOPICAL REVIEW) (2024).[IF:3.1]
- Zn-Based Oxide Perovskite Nanocomposites for Energy and Sensing Applications” S. Paul, S. Barman, A. Datta, *J. Mat. Sc.*, **59**, 17968 (INVITED MINIREVIEW) (2024).[IF:4.00]

Lectures Delivered :

Invited talks at (1) Calcutta University, Kolkata, (2) IIT-Madras (3) EMRS Fall Meeting, Warsaw, Poland (4) EMRS Spring Meeting, Strasbourg, France.

Sponsored Project

- » Sustainable and safe nanomaterials Harnessing
- » Supramolecular Polymers Organic Ferroelectrics

Lecture/ Seminars & Colloquia



Colloquium Lecture/Seminars Organized at IACS

Name and organization of the Speaker	Title of the lecture
Prof. Pierre H. Dixneuf from the Institute of Chemical Sciences of Rennes, UMR CNRS 6226, University of Rennes, France	Catalytic Functionalisations of Phosphine C-H bonds and New Reactions of Interrupted Reduction Intermediates"
Dr. Chandra Kanta De, Group Leader, Department of Homogeneous Catalysis. Max-Planck Institut fuer Kohlenforschung, Kaiser-Wilhelm-Platz 1, 45470 Mülheim an der Ruhr, Germany	Asymmetric Counter anion Directed Photoredox Catalysis
Sergey A. Varganov, Department of Chemistry, University of Nevada, Reno	Nonadiabatic molecular dynamics with the crystal field Hamiltonian to study spin dynamics in lanthanide complexes
Indrajit Bhattacharya (TCS Research)	Knowledge Base Question Answering in the Age of LLMs
Partha Bhowmick (IIT KGP)	Curvature Estimation Made Simple—From Real to Digital
Prasenjit Mitra (Research Consultant, QCRI)	About Large Language Models (LLMs)
Amitava Das (Associate Professor, University of South Carolina)	CIVILIZING AI: Examining Emerging Capabilities and Mitigating Potential Risk of Foundation Models
Debasmita Lohar (Postdoctoral Fellow, KIT Germany)	Are Finite-Precision Programs Efficient and Correct Enough for Your Applications?
Dr. Debraj Chakraborty, Masaryk Univ., Czech Republic	Learning Explainable and Better Representations of POMDP Strategies
Prof. Sandip Trivedi, IISc, Bangalore	Universal themes in physics from black to a grain of grapheme
Prof. A. Ananthanarayan, IISc, Bangalore	Joy of Discovery in the Modern Era : Some Reflections and Directions

Meeting/Conference held in the Schools

Name of the Conference/Symposia-Convener	Duration	Funding Authority
One-day Symposium on Mathematics and Computer Science (SMCS) – Partha Basu Chowdhuri	1 Day	School Chair fund provided by IACS, INR and industrial sponsorship INR 5K each from TNS Consulting and Cidermatics.
InAdvanCS : Annual SCS Conference	January, 2025	IACS & Sponsors
Workshop on Recent Trends in Algorithms (RTA) 2024, jointly with IIT Kharagpur	July 1-3, 2024	ACM India, IIT Kharagpur
Annual Meeting, SBS-2025	1 Day	IACS
Arnab Das, Bimalendu Deb, Nabamita Deb, Subhadeep De, Kazi Rajibul Islam (University of Waterloo, Canada)	2 Days	IACS
Condensed Matter Day 2025, Prof. D. Basak	4 th March, 2025	IACS
Prof. Sourov Roy	January 30-31, 2025	IACS
School on Gravitational Wave Physics, Dr. Sumanta Chakraborty	February 17-21, 2025	IACS

Inter-Institute Collaboration

Solar Energy Research is being conducted with MNRE. A continuous Ambient Air Quality Monitoring Station (ACAAQMS) is in operation in collaboration with the West Bengal Pollution Control Board at IACS.

IACS remains as Nodal institute for India in Asia Pacific Center for Theoretical Physics (APCTP) based in Seoul, South Korea. There is a Co-Publishing Agreement between Springer Pvt. Ltd. and IACS to run the Indian Journal of Physics. Tripartite water research agreement has been in operation between IACS, University of Roma Tre and University of Cagliari, Italy. There are Japan-India Collaborative Research Projects in Molecular Sciences with the Institute for Molecular Science (IMS), Japan; National Institute of Natural Sciences (NINS), Japan; SERIUS (Solar Energy Research Institute for India and the United States); TWAS-IACS Postdoctoral Fellowship Programme which are currently underway.

In order to foster strategic partnership with industries to conduct advanced applied research of translational scope, the following activities have been initiated. Collaboration with GK Machineries and Robotics Pvt. Ltd. for the development of drone assisted pheromone dispersal through nanosensors for the early detection of pest infestation in cotton farming land. A start-up grant was sanctioned from Biotechnology Industry Research Assistance Council (BIRAC), DBT, for the development of point-of-care device for the selective detection of human serum albumin, creatine kinase and kidney injury molecule-I for the accurate determination of acute kidney injury. BIRAC, DBT has funded the formation of a start-up company, GR Agritek Labs through Biotechnology Ignition Grant-13 where the scientists from IACS are part of the team members in this project. A private industry sponsored research program has been initiated with ATGC Biotech Pvt.

Ltd. for the development of semiochemical loaded organogelators for the management of certain agricultural pests. Collaborative Research Project is going on with Unilever Research Centre, Bangalore; Research agreement between IACS-TATA Steel Ltd has been signed. Collaborative Research Project with Unilever Industries Pvt. Ltd., Mumbai, between IACS and Dystrophy Annihilation Research Trust, Bangalore between IACS and CSIR-IICB Kolkata are in operation. A joint inter-institutional Integrated M.Sc.Ph.D. programme in Chemical and Cell Biological Sciences between IACS and IIT-Kharagpur is ongoing, in which several students from various parts of country are inducted.

In addition to the on-going industrial collaborations

- » Statement of intent to establish Consortium agreement for collaborative project has been planned by IACS with Howard University, USA.
- » The Nucleic Acid Therapy Accelerator, Medical Research Council, UKRI initiated for a combined project on Primary Ciliary Dyskinesia and mucobstructive lung disease where morpholino antisense oligonucleotide therapy will be developed to treat this disease.
- » An initiative made under Indo-Swedish DBT-Vinnova Scheme for developing Artificial Intelligence aided non-contact framework for detection of acute respiratory distress syndrome using microwave sensors.
- » New Research Agreements between IACS and TATA Steel Ltd. have been signed.
- » Development of a biosensor-based testing device for clinical application has been performed in joint research with M/s. Edhaa Innovations Pvt. Ltd., Bombay.



Patents list for 2024-25

Patents filed:

1. Indian Filings during FY 2024-25 - NIL.
2. US Convention Patent Application No. 19/079,082 dated 13-March-2025 based on Indian Patent Application No. 202431019488 dated 16.03.2024, Title: Phosphoroamidite morpholino monomers towards synthesis/convergent synthesis of PMO, TMO, their chimera oligos in 5'-3' direction - Prof. Surajit Sinha

Patent granted:

- 1) Indian Granted Patent No. 547155; Grant Date: 06.08.24; Patent Application No. 202331002606 dated 12.01.2023; Title: PCR-independent detection of DNA sequences using fluorescent label-free, INA-probe-based single molecule force spectroscopy approach; Prof. R Mukhopadhyay et al.

ANNUAL ACTIVITY REPORT OF IACS (2024-25)

Indian Association for the Cultivation of Science (IACS), founded in the year 1876 by Dr. Mahendralal Sircar, an acclaimed medical practitioner of his time, is the oldest scientific institution in Asia funded by the Department of Science & Technology, Government of India and the Government of West Bengal. Sir C V Raman made his historic discovery of the 'Raman Effect' at IACS. IACS continues to adorn the mantle of academic and intellectual excellence in India and abroad and now stands at the crossroad of a critical era. Apart from fundamental researches in the various frontier areas of physics and chemistry, IACS has ventured in a significant way, for the past few years, into the emerging multidisciplinary areas such as non-conventional energy sources, advanced and novel nano-materials, chemical biology and interdisciplinary sciences. At present, IACS has more than 400 research students/associates working under the guidance of about 67 faculty members working in physics, chemistry and biology. The Institute has dynamic programmes for the pursuit of research leading to the doctoral degree and for post-doctoral work and has Visiting Scientists Scheme. There is an excellent library, good computing facilities and the campus is equipped with all modern facilities and amenities.

Apart from all these, IACS is also involved in multiple talk/popular lectures on different scientific topics, cultural events such as Cultvision, various competitions, different health and safety programs, Colloquiums, and many more national and international level programmes throughout the year. Below is the list of programs month-wise held during the Year 2024-25.

APRIL-2024

1. Science Association Club of IACS organized "Blood Donation Camp" on 19.04.2024, at IACS.
2. Heartiest Congratulation to Professor Debashree Ghosh for becoming a Fellow of the Royal Society of Chemistry.

3. Heartiest congratulation to Professor Ayan Datta for becoming a Fellow of the West Bengal Academy of Science and Technology (WAST) for 2024.

MAY-2024

1. Health Checkup Camp was held on 03rd May, 2024 organized by KPC Medical College & Hospital for all CMS beneficiaries of IACS (Employees, Pensioners and their dependent members and Scholars).
2. Inauguration of Swachhata Pakhwada-2024 and Oath Taking Ceremony was held on May 01, 2024. Check photos on the link <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=503>
3. As a part of the ongoing Swachhata Pakhwada Program at IACS, General cleanliness activities were conducted in common areas of IACS on 02.05.2024. Check the photos on <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=500>
4. As a part of the ongoing Swachhata Pakhwada Program at IACS, Digitization of physical records in searchable format as a part of Swachhata Pakhwada 2024 on 03.05.2024. For snaps, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=506>
5. As a part of the ongoing Swachhata Pakhwada Program at IACS, Removal of garbage and cleaning of pavement area outside 2B premise of IACS was conducted on 06.05.2024. For photos, click <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=507>



6. As a part of the ongoing Swachhata Pakhwada Program at IACS, a Swachhata Thematic Painting Competition was organized for display at the Ground Floor of the Main Building on 07.05.2024.



7. As a part of the ongoing Swachhata Pakhwada Program at IACS, Clearance and cleaning of all the corridors of Main Building and Centenary Building was undertaken by the respective Schools/Instrument In-charge/Department on 08.05.2024.



8. As a part of the ongoing Swachhata Pakhwada Program at IACS, Renovation of the outside walls/doors of the Main Building of IACS was conducted on 09.05.2024. For photos, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=513>
9. Celebration of World Technology Day was organized by a Talk on "Use of New Technology and Research for better Cleanliness" by Dr. Subhadeep Datta, Associate Professor,

School of Physical Sciences on May 10, 2024. Check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=515>

10. As a part of the ongoing Swachhata Pakhwada Program at IACS, Distribution of cleanliness plant saplings among agency workers of the Institute as a token of appreciation on 13.05.2024. Click <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=517> for photos.



11. As a part of the ongoing Swachhata Pakhwada Program at IACS, Cleaning of Roof top of the Centenary Building, IACS was conducted on 14.05.2024. For photos, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=52>



12. As a part of the ongoing Swachhata Pakhwada Program at IACS, Plaque/Certificate Distribution Ceremony of the event Swachhata Thematic painting at IACS followed by Vote of Thanks by the Registrar, IACS on 15.05.2024. For photos check, <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=524>
13. In compliance with the instruction from the Government of India, IACS organized a one-hour popular lecture on the topic: 'Yoga for improving mental health and quality of life' by the Speaker: Ms. Navnita Bose; Psychological Counsellor, IACS for celebration of "International Day of Yoga - IDY 2024" on 15.05.2024. For photos, check the link <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=526>
14. Heartiest Congratulation to Best Chemistry Scientists and Best Materials Science Scientists in India who are working at IACS and also to some superannuated IACS scientists for their achievements. Check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=518> for the detailed news.
15. Dr. Anindita Das has been selected for the ACES-CRSI Early Career Award 2024. This award was jointly given by the Chemical Research Society of India (CRSI) and the Asian Chemical Editorial Society (ACES) to active researchers at the early stage of their independent careers. IACS Congratulates her for the excellent achievement.

JUNE-2024

1. World Environment Day 2024 was observed at IACS by taking the pledge “OUR LAND, OUR FUTURE” for a better tomorrow and by doing a brief plantation event on 5th June, 2024. Click <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=530> for photos.



JULY-2024

1. A Workshop on “Recent Trends in Algorithms (RTA) 2024” was hosted by IACS in Kolkata from July 1-3, 2024 jointly with IIT Kharagpur. Check details on <https://cse.iitkgp.ac.in/~palash/Workshops/2024RTA.html>
2. An Outreach Programme was held where there was an Academic Visit by St. Paul's Cathedral Mission College on 2nd July, 2024. For details, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=544>





3. "Rabindra - Nazrul Jayanti" was organized by the Science Association Club on 05th July, 2024. For details, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=546>

4. IACS celebrated Ambedkar Jayanti on 19.07.2024 where popular talks were given by Honorable Justice Ashok Ganguly, Retired Judge of Supreme Court, Chief Guest & Key note speaker on the topic "Ambedkar's view of a just society" and also by Sri Suman Chatterpadhyay, Renowned journalist, Guest of Honor. For details, check <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=550>



5. Annual Convocation of the Deemed to be University was held on July 31, 2024 to confer degrees to all the eligible students who have successfully completed their BS-MS and Master's program in the year 2024, and the PhD students registered with IACS and who have defended/would be defending their PhD viva-voce examination successfully during the period July 12, 2023 to July 27, 2024. For details on this programme, check <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=532>





AUGUST-2024

1. Shri Supriya Chakraborty in the CSS Department participated in the "A Sevenday National Workshop cum hand-on training Programme on Transmission Electron Microscopy" which was held on and from 6th August, 2024 to 12th August, 2024 at USIC, The University of Burdwan. His Lecture and Session have been rated 'Very Good' (Highest among the category) by the participating delegates in the Conference.
2. Invited lecture at the School of Biological Sciences was organized on 12th August, 2024 on the title "Emerging Biology and Novel Targeting Strategies for Lung Cancer". For details, check the file https://iacs.res.in/modules/event/images/cdiv1_09-08-244326.pdf

To mark the journey of India's Independence, 'Har Ghar Tiranga' campaign under the aegis of 'Azadi Ka Amrit Mahotsav' was celebrated this year also from 9th August to 15th August, 2024 where all the citizens were being encouraged to hoist the national flag in their premises and upload selfies. Under the directives of the Ministry of Culture and Department of Science & Technology, Government of India, all the staff and scholars of IACS were encouraged to hoist the national flag in their premises and upload their selfies on www.harghartiranga.com. IACS has updated its website banner with the 'Har Ghar Tiranga' creative. Check <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=559> for details.

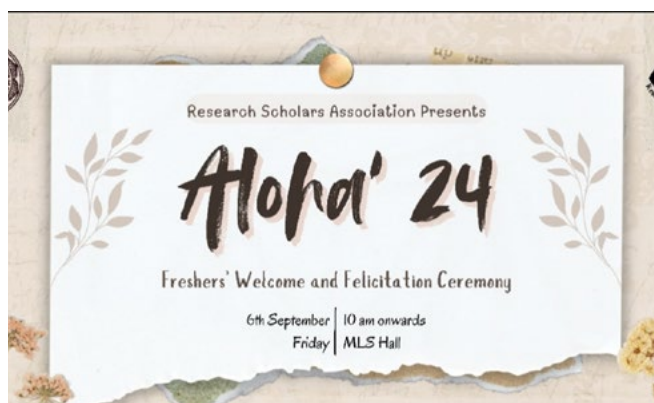
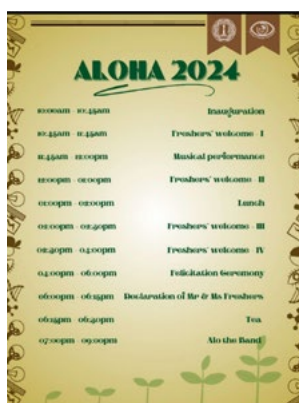


- Heartiest Congratulations to Ms. Priyanka Roy for attending the Gordon Research Conference (GRC) on Protein Processing, Trafficking, and Secretion at Colby-Sawyer College in New London, New Hampshire, United States, from July 14 to 19, 2024. She presented her research titled "Intra-cluster Receptor Density (IRD) of Tumor Necrosis Factor Receptor 1 (TNFR1) Clusters Affects the Downstream NF- κ B Signal Activation" and earned the prestigious GRC Best Poster Award as well as the Carl Storm International Diversity Award.
- On the occasion of India's 78th Independence Day marking 77 glorious years of freedom and a poignant reminder of the sacrifices made by those who fought for their motherland, the Hon'ble Director, IACS hosted the National Flag on 15th August, 2024 at 9:00 A.M. in the institute premises along with few Cultural Programmes. For details, check <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=559>
- India became the fourth country to land on the moon and the first to reach its southern polar region on August 23, 2023. To honour this landmark achievement, Hon'ble Prime Minister Shri Narendra Modi announced August 23 as "National Space Day". To commemorate this event, IACS celebrated National Space Day (23.08.2024) on 21st August, 2024. Dr. Debiprosad Duari delivered a Special Lecture on the Title :Chandrayaan 3 : Touching the Moon. For photos, check <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=557>

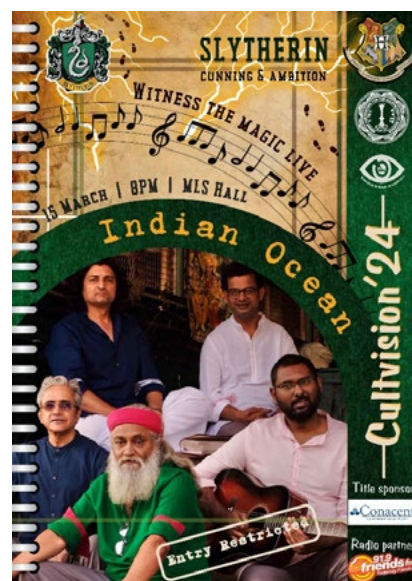
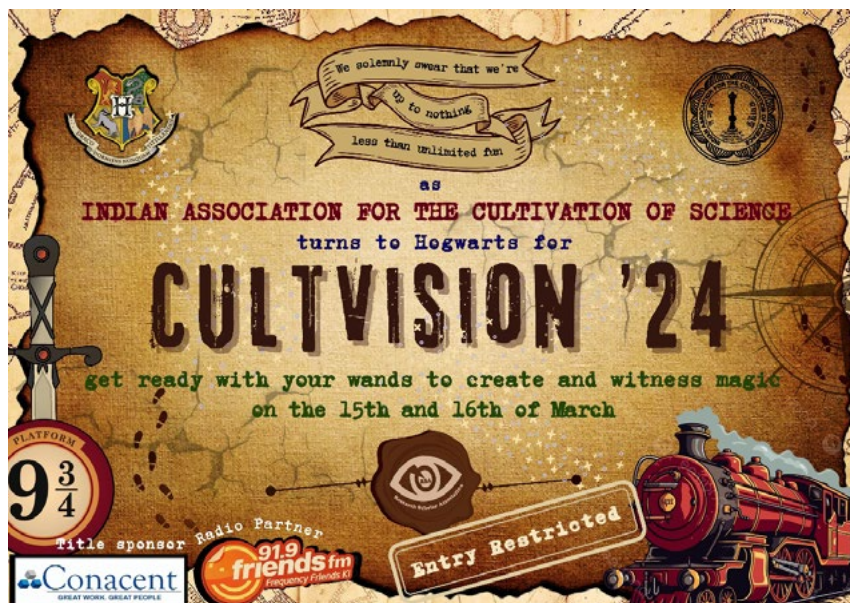
- Professor Tapan Kanti Paine, Senior Professor in the School of Chemical Sciences was offered a position to act as Editor of the Journal "Inorganic Chemistry Communications" Published by Elsevier B.V.

SEPTEMBER-2024

- Since 2nd October is observed as Swachh Bharat Diwas as a tribute to the Father of the Nation, on his Jayanti. As a prelude, a fortnight of 'Swachhata Hi Sewa' (SHS) -2024 was observed from 14th September 2024 to 1st October 2024 to strengthen voluntarism and collective action for swachhata. This year's theme for SHS-2024 was 'Swabhav Swachhata – Sansakaar Swachhata' (स्वभावस्वच्छता, संस्कारस्वच्छता). Further, to honour and commemorate the 10th anniversary of the launch of Swachh Bharat Mission, a 'Swachhata Pledge taking Ceremony', Visit of DST Officials was organized on Tuesday, 17th September 2024 at IACS. Moreover 'Ek Ped Maa Ke Naam' plantation drive on 27.09.2024 at IACS as a part of the Swachhata Hi Seva 2024. Distribution of safety gears and cleanliness tools to sanitization workers of IACS was also conducted as a part of this SHS event. For details, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=567>
- Aloha, the Freshers' Welcome and Felicitation Ceremony 2024 was celebrated at IACS on September 6th, 2024 to mark this day as promises to be a special occasion filled with meaningful interactions, melodious music, and abundant enjoyment. For details on this programme, check <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=565>



- Cultvision 2024 was celebrated on September 15th, and 16th, 2024. For details, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=661>



- Observation of Hindi Pakhwada 2024 at IACS was organized from September 17 to September 27, 2024. For details, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=575>
- IACS Colloquium from School of Physical Sciences by Professor B. Ananthanarayan, IISc Bangalore was held on September 19, 2024 on the title "Joy of Discovery in the Modern Era: Some Reflections and Directions". For details on this talk, check https://iacs.res.in/modules/event/images/event_09-09-249756.pdf
- Observance of Special Campaign 4.0 at IACS. Check details of this event on <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=583>
- As a part of the Special Campaign 4.0 from 2nd October to 31st October 2024, IACS organized a 'Lecture cum Awareness Session' on the topic – "Cleanliness: Culture, Consciousness and Conduct" by Prof. Tapan Kanti Paine, Senior Professor, School of Chemical Sciences held on 30th October, 2024.

8. As a part of the Special Campaign 4.0 from 2nd October to 31st October 2024, IACS organized a Yoga Training Session for all the employees of IACS and the session was conducted by Ms. Sweta Saha (Certified Yoga Instructor) held on 25th October, 2024. For details, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=608>
9. As a part of the Special Campaign 4.0 from 2nd October to 31st October 2024, A Preventive Health Checkup Camp was conducted for all the CMS beneficiaries and Sanitization Workers of IACS as a part of the Observance of Special Campaign 4.0. Check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=598>
10. Prof. Abhishek Dey from School of Chemical Sciences has become INSA (Indian National Science Academy) fellow. He is a scientist who has begun his independent career in IACS and published a single author, non-review JACS paper just after joining a year in IACS.

OCTOBER-2024

1. This is the first time American Chemical Society (ACS) has recognized a student chapter outside North America. The efforts of student members particularly Ms. Oshiya RA under Professor Ayan Datta and Ms. Ambreen Rashid under Professor Pradyut Ghosh are highly commendable.
2. Mr. Atanu Ghosh, SRF under the supervision of Professor Surajit Sinha, attended the "XXV International Round Table on Nucleosides, Nucleotides and Nucleic Acids" at Katsuhika Campus, Tokyo University of Science, Japan, from 03.09.2024 to 06.09.2024 and has been conferred with the Best Poster Award.
3. Media Story from IACS on "Discovery of New Cancer Treatment Target ". check <https://dst.gov.in/new-cancer-therapy-target-could-help-patients-overcome-resistant-current-treatments> for details on this.
4. A Preventive health check-up camp was conducted by Techno India DAMA Healthcare & Medical Centre on 22.10.2024.
5. A Workshop was conducted on the Oracle-ERP module and University Management System (UMS) on 24th October, 2024 as a part of the National Learning Week (NLW)

- KarmayogiSaptah. For photos, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=606>
6. Prof. Asim Bhaumik has received the prestigious 'MRSI Materials Science Annual Prize' for the year 2024.
7. Dr. Anindita Das was selected as an Editorial Advisory Board member for the journal ACS Polymers Au.
8. Prof. Arindam Banerjee, Director, IACS has received recognition and appreciation from ACS (American Chemical Society) as 2023 ACS Publications Peer Reviewer.
9. IACS observed Rashtriya Ekta Diwas on 29th October, 2024 to honor the spirit of Unity on the occasion of the birth anniversary of Sardar Vallabhbhai Patel, Rashtriya Ekta Diwas (National Unity Day) and it was celebrated across the nation on 31st October, 2024. Check details on <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=609>
10. IACS observed the Vigilance Awareness Campaign from 16th August 2024 with the theme "Culture of Integrity for Nations' Prosperity," which concluded on 15th November, 2024 under the directives of the Central Vigilance Commission and the Administrative Ministry. As a part of the campaign, a special programme on Vigilance Awareness was held on 6th November, 2024. For photos, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=611>

For details, check the link [https://www.iacs.res.in/modules/texteditor/imagesfiles/Programme%20Schedule%20\(7\).pdf](https://www.iacs.res.in/modules/texteditor/imagesfiles/Programme%20Schedule%20(7).pdf)

NOVEMBER-2024

1. IACS Science Association Club invited original write ups and drawings from ALL SAC members (Faculty, Non-faculty Staff and Students) to be printed in the SAC Souvenir 2024.
2. In the event of National Intellectual Property Festival, all IACS staffs, students and scholars were invited to register and participate for the online lecture on Intellectual Property awareness on 5th Nov 2024 by the Speaker - Nidhi Chadha, CSIR-National Chemical Laboratory and Dr. Nitin Tewari, NCL. For details check https://iacs.res.in/modules/event/images/cdiv1_30-10-249276.png

3. IACS observed the Vigilance Awareness Campaign from 16th August 2024 with the theme "Culture of Integrity for Nations' Prosperity," which was concluded on 15th November, 2024 under the directives of the Central Vigilance Commission and the Administrative Ministry. As a part of the campaign, a special programme on Vigilance Awareness was held on 6th November, 2024 and all IACS employees and students were requested to actively participate in the programme with the motto of "Being Vigilant" and fostering a culture of integrity at workplace. For photos, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=611>

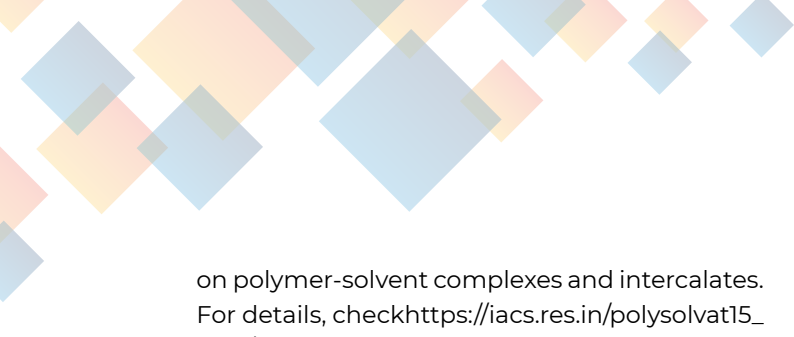
For details, check the link [https://www.iacs.res.in/modules/texteditor/imagesfiles/Programme%20Schedule%20\(7\).pdf](https://www.iacs.res.in/modules/texteditor/imagesfiles/Programme%20Schedule%20(7).pdf)

4. Shri Sanjib Naskar in the CSS Department has participated in the 3rd BalrampurChini East Zone Open Bridge Championship which is a BFI-ranked IMP Pairs championship that took place between November 8-10, 2024 at the NKDA Community Centre in New Town, Kolkata. Mr. Naskar and his partner won the 1st position in this event.
5. Mr. Souvik Banerjee of School of Materials Sciences received the Poster Presentation Winner Prize in the Fall 2024 NanoGe Conference on Materials for Sustainable and Development, Switzerland. He is the scholar of Prof. Narayan Pradhan.
6. As a part of the Curtain Raiser for the India International Science Festival (IISF) 2024, a One-day Public Outreach Program for School Students took place on 20th November 2024. For details, check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=624>
7. Mr. Sk Kalimuddin (SRF-SPS), received the best poster award at an international conference on "Bose-Einstein Condensation, Superconductivity, and Quantum Magnetism" organized by "S. N. Bose National Centre for Basic Sciences (SNBNCBS)". He is the student of Dr. Mintu Mondal (SPS, IACS). This conference was organized on the occasion of 100 years of revolutionary publication by Satyendra Nath Bose.

8. Science Association Club of IACS organized "Annual Social-2024" on 28.11.24 & 29.11.24. For details check <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=720>
9. The Bank of Baroda Officials was present at IACS on 28.11.2024 and 29.11.2024 to offer their assistance on Account operation and Account demonstration, banking and other related services in regard to the accounts opened with Bank of Baroda.
10. The NASI-Kolkata Chapter organized a Mini-Symposium in Honour of the Late Dr. Manju Sharma, Past President of NASI, on 29th November 2024. Check <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=721fordetails>.

DECEMBER-2024

1. To commemorate the valuable contribution of our brave soldiers in the service of the motherland, the Armed Forces Flag Day is celebrated every year on 7th December across the nation. This day is dedicated to remembering the valiant martyrs, disabled service personnel, ex-servicemen and their dependents and veterans with the purpose to ensure their rehabilitation and welfare. The month of December is also celebrated as pride month across India. This year the Armed Forces Flag Day Week is being observed from 1st December to 7th December, 2024 under the initiatives of the Ministry of Defense, Government of India. In this context all the staff members and scholars were encouraged to download token flags from the website www.affdf.gov.in and wear it on their respective dress with pride which shall serve as a token of gratitude to the martyrs who have laid down their lives in the service of the nation. Check [https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=722for more details](https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=722for%20more%20details).
2. 15th edition of international IUPAC conference on Polymer-Solvent Complexes and Intercalates (POLYSOLVAT 15) was held at Indian Association for the Cultivation of Science, Jadavpur, Kolkata, in December 2nd-4th, 2024 on the topic of polymer crystallo-solvates, polymer gels, supramolecular polymers and gels etc. This biennial international conference was majorly focused on structure, property and applications



on polymer-solvent complexes and intercalates. For details, check https://iacs.res.in/polysolvat15_flyer/home.html

3. Shramana Guha, a Senior Research Fellow under the supervision of Prof. Somobrata Acharya in the School of Applied & Interdisciplinary Sciences (SAIS) attended and presented her research work in the Poster Presentation Session at the International Conference on Metal Halide Perovskite 2024 (HyPe-24), organised by National Institute of Science Education and Research, Bhubaneswar from 19th-22nd December, 2024, which has won her the Best Poster Award in that conference.
4. World Mental Health Day highlighted the theme "Mental Health at Work," urging us to reflect on workplace well-being. But are our workplaces truly safe, especially for women? Hereby, A Workshop, titled "Prevention of Sexual Harassment of Women at Workplace" was held on 23rd December, 2024 to generate awareness which covered- the topics-What constitutes sexual harassment? Understanding the psychological trauma faced by victims, Strategies to prevent and cope with harassment, from a psychological perspective by the Speaker : Ms. Madhurima Dey Sarkar (Psychological Counsellor, IACS).
5. Prof. Debashree Ghosh has been awarded the prestigious Pople Medal 2025 from Asia Pacific Association for Theoretical and Computational Chemists (APATCC).
6. A chemistry conference was organized at IACS, Chem 24, from 27-29th Dec 2024. For details, check <https://iacs.res.in/Chem24/home.html>

JANUARY-2025

1. School of Biological Sciences observed its Annual Meeting on January 10, 2025. For Program Schedule, check https://iacs.res.in/modules/event/images/cdiv1_24-12-244724.pdf
2. Prof. Indra Dasgupta has been elected as a Fellow of the Indian Academy of Sciences.
3. Prof. Benu Brata Das has been elected as a Fellow of the Indian Academy of Sciences.
4. Prof. Sudip Malik has been elected as a Fellow of West Bengal Academy of Science and Technology (WAST).

5. Prof. Rajib Kumar Goswami (SCS) has been elected as a Fellow of West Bengal Academy of Science and Technology (WAST).
6. Dr. Anindita Das has been elected as an Associate of the West Bengal Academy of Science & Technology (WAST).
7. Prof. Debashree Ghosh will serve as a Topic Editor for the Journal of Chemical Theory and Computation (An ACS journal).
8. Prof. Jyotirmayee Dash has become one of the editors of Bioorganic & Medicinal Chemistry Letters – Elsevier.
9. Prof. Ayan Datta has been nominated by the Editor-in-Chief to serve as an Associate Editor for ACS Applied Energy Materials from January, 2025.
10. Prof. Amitava Patra has been invited to serve as a Senior Editor for Journal of Physical Chemistry Letters (ACS Journal).
11. India was set to observe the 76th Republic Day on 26th January, 2025 on the theme "Swarnim Bharat: Virasat aur Vikas" (Golden India: Legacy and Progress), which highlighted India's rich cultural legacy and hopes for a brighter future. On this glorious occasion, the National Flag was hoisted on the 26th of January, 2025 at 9:45 A.M. at the Institute premises. For details, check <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=663>
12. Prof. Yuval Golan, Deputy Vice President and Director of the Ilse Katz Institute for Nanoscale Science and Technology of Ben Gurion University of the Negev visited IACS during 30th January to 3rd February 2025 to deliver a lecture on the topic Nanomaterials @ Interfaces: Chemical Routes for Size, Shape and Phase Controlled Nanomaterials. For biography and Abstract, check the link https://iacs.res.in/modules/event/images/cdiv1_21-01-252056.pdf

FEBRUARY-2025

1. Science Association Club (SAC), in joint collaboration with the Medical Cell, organized a "Health Talk" on February 4, 2025 on the occasion of World Cancer Day on the topic "General Awareness on Cancer Disease" by the Speaker Dr. Sreya Mallik. Check the banner https://iacs.res.in/modules/event/images/event_03-02-251424.jpg

2. IACS Colloquium from School of Physical Sciences was organized by Professor Sandip Trivedi, Dept. of Theoretical Physics, TIFR Mumbai on the title "Title: Universal Themes in Physics: From Black Holes To A Grain of Graphene" on February 7, 2025. For Abstract and Biography, check https://iacs.res.in/modules/event/images/event_31-01-258270.pdf
3. To commemorate Diamond Jubilee of Science Association Club (SAC) , IACS, the Executive Committee organized the Annual Sports on 6th February, and 7th February, 2025 at IACS playground. Check for event details, <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=682>
4. Prof. Biman Jana of SCS has received CRSI (Chemical Research Society of India) Bronze medal.
5. To commemorate Diamond Jubilee of Science Association Club, IACS, the Executive Committee 2025 organized the 1st Cultural Evening with musical delight of Jugalbandi of Santoor (Dr.Bipul Ray) and Shehnai (Lokesh Anand) accomplished with Tabla (Indranil Mullick) on 10th February 2025. Check the banner at [https://iacs.res.in/modules/texteditor/imagesfiles/IMG-20250205-WA0011%20\(1\).jpg](https://iacs.res.in/modules/texteditor/imagesfiles/IMG-20250205-WA0011%20(1).jpg)
6. On behalf of the School of Mathematical and Computational Sciences, a presentation was invited from the representatives of a Legal-Tech company, named Lexplosion Solutions, who works in the area of automated extraction of knowledge from legal documents. They visited IACS for recruiting students with knowledge of Machine Learning and excellent programming skills. They presented briefly about their work and interacted with the interested students and also talks were given by Sovan Das (Senior Vice-President, Lexplosion Solns.), Amit Ghosh (Solution Architect) on 12th February, 2025. Check the <https://iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=673>
7. In line with the Prime Minister's vision to make Swachhata "everyone's business" and in compliance of the various directives issued by the administrative ministry from time to time, it was decided that the corridors of each floor of all the buildings should be maintained clutter free in order to promote a vibrant work

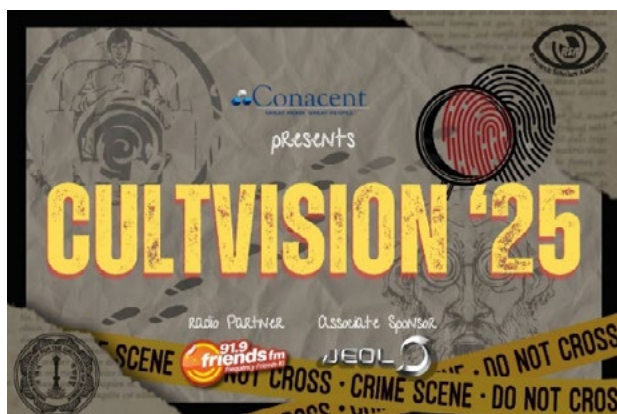
environment and to ensure safe passage in case of an emergency. This drive was carried out between 14.02.2025 and 20.02.2025 post which the list all unattended items at the corridors was prepared by the concerned individuals/ departments and brought to the notice of the Campus Upkeep Officer for further appropriate action on part of the IACS administration. Check <https://iacs.res.in/maincontroller.php?navid=24&subnavid=83&resubnavid=724> for details.

8. On behalf of the School of Mathematical and Computational Sciences, a technical program of the one-day Symposium on Mathematics & Computer Science was organized by the School of Mathematical and Computational Sciences on Feb 21, 2025. For details, check https://iacs.res.in/modules/event/images/cdiv1_21-02-255767.pdf
9. On behalf of the School of Chemical Sciences, a technical program of the annual SCS Symposium InAdvanCS 2025 was organized on 21-22 February 2025. Check details on https://iacs.res.in/modules/event/images/event_20-02-253115.pdf
10. National Science Day 2025 was celebrated at IACS on February 28, 2025 on the theme "Empowering Indian Youth for Global Leadership in Science and Innovation for a Developed India & Celebrating 100 years of Quantum Mechanics". Check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=677> for details.
11. Under the joint auspices of the National Science Day 2025 Organizing Committee and the Science Association Club, a Special Cultural Programme was organized on February 28, 2025 as a part of the National Science Day 2025 celebration. The musical evening was graced by the Maestros Indradeep Ghosh on the Violin and Indranil Mallick on the Tabla. Check <https://www.iacs.res.in/modules/texteditor/imagesfiles/Banner%20for%20the%20Cultural%20Programme.jpg> for the banner.

MARCH-2025

1. The Final Match of Volleyball Tournament 2025 organized by SAC was held on 5th March, 2025 at IACS Play Ground in between Prof. M.N.Saha(T-1) vs Prof. S.N.Bose(T-5).

2. The School of Applied and Interdisciplinary Sciences (SAIS) organized the "SAIS Symposium 2025" during March 17-18, 2025, at IACS, Kolkata. Check the Programme details on https://iacs.res.in/modules/event/images/event_10-03-254515.pdf



3. CULTVISION 2025 was celebrated at IACS on March 21st , 2025, March 22nd , 2025. Check <https://www.iacs.res.in/maincontroller.php?navid=24&subnavid=110&resubnavid=685> for details.



4. In the Diamond Jubilee year of Science Association Club, IACS, the Executive Committee 2025 commemorates the International Women's Day 2025, with a panel discussion followed by Drama by SamuhoNattyGoshthi on 26th March, 2025. Check the banner https://iacs.res.in/modules/event/images/event_20-03-259517.jpeg for details.

International Women's Day 2025

SCIENCE ASSOCIATION CLUB, IACS

Panel Discussion : নারী এবং ক্লাব সংস্কৃতি
Former and Existing Women Members, SAC

Drama : অথ হিড়িহা কথা
উপস্থাপনা : সমূহ

commemoration on
March 26, 2025
M. L. S. Hall
04-30 P.M.

**DIAMOND JUBILEE
CELEBRATION YEAR**

Cordial Invitation to All of You

Indian Journal of Physics

Indian Journal of Physics, founded in 1926 by Sir C. V. Raman, is a pioneering publication dedicated to disseminating significant, original, and contemporary scientific research. It is the official publication of the Proceedings of the Indian Association for the Cultivation of Science and is published under ISSN 0973-1458.

Since January 2009, the *Indian Journal of Physics* has been published in collaboration with Springer (www.springer.com/12648). Springer has been responsible for distributing the print version of the journal since January 2013.

In **2024** (January - December) total 1645 number of papers have been submitted by authors in online Editorial Manager System. During this period 14 issues of **Vol. 98** have been published that contain **464** numbers of research articles. No. of downloads in 2024 is **178.5k**. Acceptance rate is 28.2%. We have received **Rs. 1,06,36,214.00** (One crore six lakh thirty-six thousand two hundred fourteen only) as income on A/c. of IJP (from M/s. Springer India Pvt. Ltd. for Volume 97, No. 1 - 14, January to December 2024). Impact Factor for 2023 is **1.6**

A special issue titled “Statistical Physics and Complex Systems” has been published in Vol. 98, No. 11, October 2024.

Scope

Astrophysics, Atmospheric & Space Physics / Atomic & Molecular Physics/ Biophysics/ Condensed Matter & Material Physics / General & Interdisciplinary Physics / Nonlinear Dynamics & Complex Systems / Nuclear Physics / Optics & Spectroscopy / Particle Physics / Plasma Physics / Relativity & Cosmology / Statistical Physics

Abstract / Index Service

Other than Springer, this journal is abstracted / indexed in: Web of Science, SCOPUS, INSPEC, Chemical Abstracts Service (CAS), Google Scholar, Academic One File, Indian Science Abstracts, INIS Atomindex, INSPIRE, International Bibliography of Book Reviews (IBR), International Bibliography of Periodical Literature (IBZ), OCLC, SCImago and Summonby Serial Solutions.

Editor-in-Chief & Honorary Secretary, BOE

Professor Subham Majumdar

Staff Members of Indian Journal of Physics

Dr. Gayatri Paul, Documentation Assistant

Ms. Suhita Neogi, Technical Assistant A



Outreach Programme Carried Out in 2024-25

On the auspices of the Management Committee, IACS, an Outreach Programme for Third and Fourth Year Students (Major in Physics, Chemistry, Mathematics, Life Science and Earth & Environmental Science) of the Five-Year Integrated M. Sc. Programme at ISERC, Visva-Bharati, Santiniketan, was organized on 27th May, 2024 initially at CV Raman Hall. Eighteen Students accompanied by a faculty member, viz. Dr. Mahasweta Nandi, who happens to be alumni of IACS and also a staff member attended the visiting programme. At Registration, all the participants were handed over a Kit comprising of IACS Flyer, Stationeries, Programme Schedule, Feedback Form and a bio-degradable Bag printed with IACS Logo. Refreshment was arranged in the forenoon session considering that the students travelled a long distance for attending the visiting programme. The whole day programme at IACS comprised of Scientific Lecture and Visiting of Laboratory/ Instruments. Prof. Arindam Banerjee, Senior Professor, School of Biological Sciences and Director (Additional Charge) inaugurated the programme welcoming students and faculty member of Visva-Bharati University. Prof. Arindam Banerjee in his inaugural address gave a brief description of BS-MS Courses being conducted and the state-of-the-art research facilities being provided at IACS. Prof. Banerjee advised the attending students to practice innovative thinking and also suggested them not to use too much smart phone; use it whenever you absolutely need it. Please keep sometime for yourself for contemplation and introspection and think positive always.

Prof. Rupa Mukhopadhyay, Senior Professor, School of Biological Sciences and Dean of Student Affairs, in her short deliberation wished the visiting programme a grand success. She also suggested the attending students to practice thinking in innovative way and ask question to their faculty members if there is any doubt. She requested the attending students to submit feed back form after the day's programme.

Prof. T K Paine, Senior Professor, School of Chemical Sciences, delivered a scientific lecture of nearly one hour. Participating students engrossed in his discourse. Prof. Paine's lucid presentation with audio-visual aids motivated the students.

A Photo Session was arranged for the attending students. Dr. Mahasweta Nandi, on behalf of the Visva-Bharati University, felicitated Prof. Arindam Banerjee with an Uttariya and books on Tagore, published by the Visva-Bharati. Dr. Nandi also felicitated Prof. Rupa Mukhopadhyay and Prof. T K Paine with a book on Tagore, published by the Visva-Bharati. In the afternoon session, after lunch, the team Visva-Bharati visited Cryo-TEM, Confocal Microscope, MALDI Mass, SQUID VSM MPMS Spectrometer, AFM, Raman Spectrometer, Single Crystal X-Ray Diffractometer, XPS, Liquid Nitrogen Plant etc. etc. Finally students assembled at CV Raman Hall and submitted duly filled in feedback form, which reflected that the attending students were really inspired and highly satisfied.

Lecture & article for Science Popularization

Ayan Datta : Science in Bharat – Glorious Past and Illustrious Future, IIT KGP B. Tech Orientation Program.

Debashree Ghosh : Resource person for training program on "Chemical Science: Molecules to Materials", by Ashutosh Mukhopadhyay School of Educational Sciences, under the aegis of Malviya Mission Teacher Training Center (UGC-MMTTC), Assam University; Resource person for Journal of Chemical Sciences - Outreach Activity program, Central Tribal University of Andhra Pradesh; One-day user training workshop on Materials and Computational Chemistry Software "ANN-CI - Machine learning (artificial neural network) based software for selected configuration interaction method", C-DAC Pune

Indra Dasgupta : Delivered a popular lecture at Panskura Banamali College in the program entitled Stimulating Scientific Quality Improvement Program in Young ST Human Resources for Self-sustainable Empowerment

- » **Joyram Guin :** Delivered a lecture in the Scottish Church College, 2025.
- » **Parthasarathi Majumdar :** Visit and popular lecture Andhakuuper Bichitro Kahini to secondary school students at the Birla Industrial and Technical Museum, Kolkata, 21 January 2025.

- » **Somobrata Acharya :** Undertaken a project from SEED division to train ST graduate students in science. 200 ST science graduate students have been trained with the sophisticated scientific equipments.
- » **Tapan K. Paine :** Out-reach program for school children at F. K. Adarsha Vidyapith, Frasergunj, 24-Parganas (South), January 24, 2025.



List of Extramural Projects During 2024-25

Sl no.	Name of PI	Funding agency	Title of Project	Duration	Total sanctioned amount (INR)
1	Prof Anindita Das	SERB	Woman Excellence Research grant	1 year	1800000
2	Prof Bimalendu Deb	DST/NQM	Quantum Sensing & Metrology	05.02.25	500000
3	Prof Devajyoti Mukherjee	DST/INT/RUS	UTILIZING ANTIFERROELECTRIC EFFECTS IN MULTI-FEILD CALORIC MATERIALS FOR ECO-FRIENDLY SOLID STATE COOLING APPLICATIONS	4 years	918585
4	Prof Jyotirmayee Dash	ICMR	MOLECULAR MODULATION OF BACTERIAL VIRULENCE GENE EXPRESSION TO COMBAT ANTIMICROBIAL RESISTANCE		37496283
5	Prof Siddhartha Sankar Jana	DBT	An Approach to inhibit cancer cell migration and growth by targeting nonmuscle myosin II and Topoisomerase I	3 years	5840000
6	Prof Subhadeep Datta	DBT	MICRO-NEEDLE BASED FLEXIBLE DEVICE FOR GLUCOSE MONITORING	3 years	6255644
7	PROF SURAJIT SINHA	SERB-DST-SUPRA	exploration of guanidinium linked morpholino (gmo) units in SIDEVELOP GMO-RNA CHIMERA AS A SELF-PENETRATING GENE SILENCING AGENTS FOR IN VITRO AND IN VIVO APPLICATIONS	3 years	6390976
8	Prof Praveen Kumar	SERB	UNRAVELING SPIN-MANIPULATE CHARGE TRANSPORT IN HYBRID ASYMMETRIC/ DISORDERED 2D MATERIALS FOR DEVELOPING EFFICIENT BROADBAND AND SELF-POWERED PHOTODETECTORS	3 years	5341766
9	Prof Raju Mondal	SERB	STUDIES ON INORGANIC CLUSTER BASED METAL-ORGANIC FRAMEWORS	3 years	5955620
10	Prof Sumanta Chakraborty	SERB	TESTING THE NATURE OF COMPACT OBJECTS AND THEORIES BEYOND GENERAL RELATIVITY THROUGH GRAVITATIONAL WAVE OBSERVATIONS	3 years	4306024
11	Prof N Pradhan	DST	THE WOMEN IN SPACE AND ALLIED SCIENCES LEADERSHIP PROGRAMME		1296841
12	DR.SUDIP MALIK	SERB	Buta-1,3-Diene based...Emitting Diodes	3 years	6792249
13	DR.SUDIP MALIK	SERB	POLYMER-SOLVENT COMPLEXES AND INTERCALATES (POLYSOLVAT 15)"		180000
14	Prof Shyamal Roy	INSA	INSA/SENIOR SCIENTIST-SYAMAL ROY	3 years	2100000
15	Prof Suhrit Ghosh	IFCPAR (CEFIPRA)	(Macro) Molecular Assembly and Materials	-	1998000

Sl no.	Name	Category	Funding agency	Title of Project	Duration	Total sanctioned amount
1	Subhro Mondal (Under Prof R K Goswami)	NPDF	SERB	STEREOSELECTIVE TOTAL SYNTHESIS OF GLYCOSYLATED MACROLIDES DACTYLIDES AND CATENULISPOROLIDES AND THEIR RELEVANT ANALOGUES	2 yrs	2980800
2	Dr UDAYAN BASAK	NPDF	SERB	NPDF under mentorship of Prof Urmimala Maitra	2 yrs	2980800
3	DR.PRITAM SADHUKHAN	NPDF	SERB	NPDF under mentorship of Prof Suhrit Ghosh	2yrs	2980800
TARE						
1	Dr Soumya Sadhukhan	TARE	SERB	TARE fellow under Prof Sourav Roy	3 yrs	1005000
WOS						
1	WOS MOUMITA MUKHERJEE	WOS	DST	MACHINE LEARNING ASSISTED DFT STUDY OF CO2 REDUCTION"-	3 yrs	4263240

Sl no.	Name of the PI	Title of the project	Duration	Total sanctioned amount
1	Prof Pradyut Ghosh (TATA STEAL)	MODIFICATION OF CAGE COMPLEX RECEPTOR FOR CYANIDE REMOVAL	----	1999400
2	Prof Asim Bhaumik (TATA STEAL)	Catalyst development for conversion of CO2 to DME	----	2717000
3	Prof K B M Rao	ULTRAPURE ENVIROCARE PVT,LTD	----	54000

Implementation of the Official Language

वित्तीय वर्ष 2024-25 के दौरान आईएसीएस के निदेशक (अतिरिक्त प्रभार) के रूप में वरिष्ठ प्रो. अरिंदम बनर्जी की अध्यक्षता में भारत सरकार की राजभाषा नीति को सफलतापूर्वक लागू किया गया। संस्थान में 14.09.2024 को हिन्दी दिवस पालन की शुरुआत के साथ 27.09.2024 तक हिन्दी पखवाड़ा कार्यक्रम मनाया गया। हिन्दी पखवाड़ा के दौरान 17 सितंबर, 2024 को हिन्दी कार्यशाला का आयोजन, 18 सितंबर, 2024 को हिन्दी अखबार वाचन प्रतियोगिता का आयोजन, 20 सितंबर, 2024 को राजभाषा प्रश्नोत्तरी ज्ञान प्रतियोगिता का आयोजन, 23 सितंबर, 2024 को हिन्दी आशुभाषण प्रतियोगिता का आयोजन, 25 सितंबर, 2024 को पत्र लेखन एवं अंग्रेजी हिन्दी प्रशासनिक शब्दावली प्रतियोगिता का आयोजन, एवं 27 सितंबर, 2024 को पुरस्कार वितरण एवं समापन समारोह में विजेता प्रतिभागियों को आकर्षक पुरस्कार प्रदान कर उत्साहपूर्ण कार्यक्रम का बड़े ही रोचक ढंग से समापन किया।

The Official Language Policy of the Government of India was successfully implemented during the financial year 2024-25 under the Chairmanship of Senior Prof. Arindam Banerjee, Director (Additional Charge) of IACS. Hindi Pakhwada program was celebrated till 27.09.2023 in the institute with the beginning of Hindi Diwas on 14.09.2024. During Hindi Pakhwada, Hindi-workshop was organized

on 17th September, 2024; Hindi Newspaper reading competition was organized on 18th September, 2024; Official Language Quiz competition was conducted on 20th September, 2024; Hindi extempore competition was organized on 23rd September, 2024; Letter writing & Administrative Glossary competition was conducted on 25th September, 2024; and prize distribution and closing ceremony was organized on 27th September, 2024, the enthusiastic program concluded in a very interesting manner and attractive prizes were handed over to the winning participants.

नगर राजभाषा कार्यान्वयन समिति, कोलकाता, कार्यालय-2 द्वारा दिनांक 3 सितंबर, 2024 को आयोजित द्वितीय वार्षिक बैठक में अंशकालिक हिन्दी अधिकारी ने भाग लिया और राजभाषा के प्रभावी उपयोग के लिए बहुमूल्य सुझाव दिए।

The 2nd Annual Meeting organized by the Town Official Language Implementation Committee, Kolkata, Office-2 on 3rd September, 2024, Part-Time Hindi Officer participated and gave valuable suggestions for effective use of the official language.



Implementation of right to information act 2005

RTI report for the Financial Year 2024 -2025

No. of RTI applications received	85
No. of RTI applications "disposed of"	84
No. of First Appeals received	19
No. of First Appeals "disposed of"	19

Status of reservation for SC/ST/OBC Physically Disabled person EWS

Annual Report of Internal Complaints Committee

Members:

Prof. Srimonti Sarkar	Chairperson	Dr. Anindita Das	Member
Prof. Tanusree Kar	Advisor and Permanent Invitee	Ms. Rita Bhattacharya	Lady NGO Member
Prof. Jyotirmoyee Dash	Member	Ms. Shweta Mukherjee	Lawyer Member
Prof. Deepak Kr. Sinha	Member	Ms. Sarbani Saha	Secretary

During 2024-25

No. of Complaints Received	No. of Complaints disposed	No. of cases pending	No. of awareness programme carried out
01	01	0	03

Status of Reservation for SC/ST/OBC/Physically Disabled Persons/EWS

A brief statement in regard to the recruitment in the post of reserved categories till 31st March, 2025 is appended below:-

Category	No. of post identified	No. of vacancy available	No. of post filled up	No. of post advertised	No. of post to be advertised	Post to be filled up against future vacancy
Group A	09	08	01	07	00	-
Group B	55	32	29	13	19	-
Group C	95	51	50	01	50	-
Total	159	91	80	21	69	-

Note:-

1. After implementation of 6th CPC's recommendation, all cadres of PB-2, Grade Pay of Rs. 4600 have been merged with Group B and Cadres of PB-1, below Grade Pay of Rs. 1900 (erstwhile Group D) have been merged and designated as Multi Tasking Staff (MTS) in Group C and accordingly shown above.

Library

The IACS Library is one of the richest and oldest reference & Information Centre in the field of basic sciences in Eastern India. It came into existence in 1876. It is originally accommodated on the ground floor of Centenary Building and occupied about 15000 square feet area. The library having a huge resource of books, serials, thesis, manuscripts, photographs and 65021 bound volumes of books/journals. Library as an institutional member of ONOS and DST-CSIR Consortium New Delhi (NKRC), users have access to over 13,190 online journals and databases. The library remains open five days a week except for Saturday, Sunday and holidays. The library has also provided remote access facility of e-resources for the faculty members and special users. In 2018 the new archive museum has been included. Library has automated all its routine activities through library software called "LIBSYS 10" and also extended the scope of various services like database search and OPAC (online public access catalogue).

Library Resources & Services

- I. Large number of Rare books since 17th & 18th century.
- II. Bibliographic services.
- III. Reprography Services.
- IV. Inter Library Loan.
- V. E Document Delivery Services.
- VI. Web OPAC in network
- VII. New arrivals.
- VIII. Plagiarism checker software (iThenticate).
- IX. Tools for Grammar Checking.
- X. E-resources
- XI. Library User Training Programme.
- XII. ILL Services

Library Membership Details

Description	Number of Books	Period of Loan
Faculty	15	3 Months
Research Scholar	04	3 Months
Student	02	15 days
Staff	01	1 Month

Library Consortium/ Membership:

Library enrolled its membership for following consortium,

- I. National Knowledge Resource Consortium (NKRC)
- II. One Nation One Subscription (ONOS)

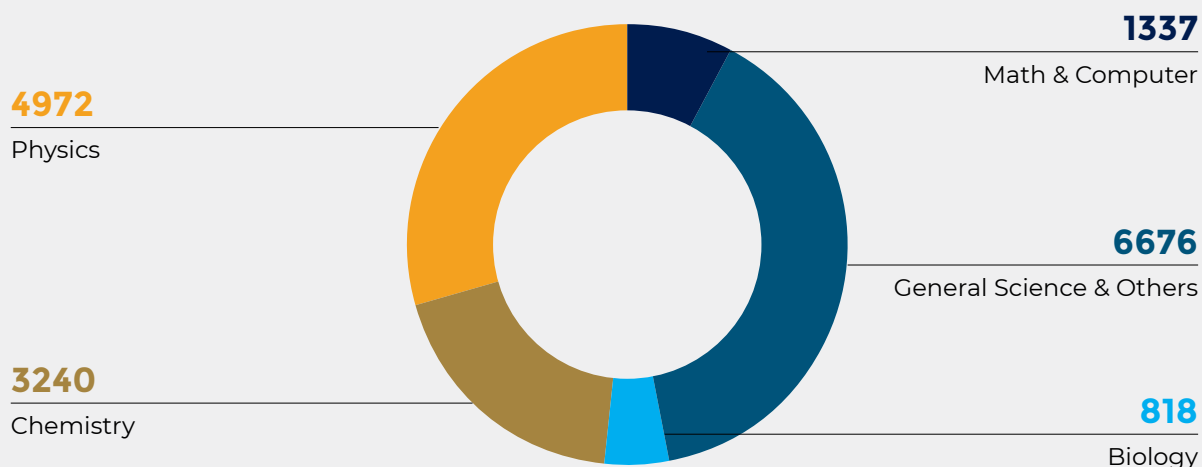
Library Statistics

65021 Bound Volumes

Print books:

14764 | **17043**
Total Titles | Total Volumes

Subject Wise Books



E-Resources/Databases accessible to IACS for the year 2024-25

SL. NO	Publisher	Consortium	Number of Journals	Hyperlink
1	AACS- Science	ONOS	1	https://www.science.org/journal/science
2	American Chemical Society(ACS)	ONOS	86	http://pubs.acs.org/
3	ACM Digital Library (ACM)	ONOS	158	http://dl.acm.org/
4	American Institute of Aeronautics and Astronautics (AIAA)	ONOS	8	http://www.aiaa.org/journals/
5	American Institute of Physics (AIP)	ONOS	28	https://pubs.aip.org/
6	American Mathematical Society (AMS)	ONOS	9	http://www.ams.org/journals
7	American Physical Society (APS)	ONOS	15	http://publish.aps.org/browse.html
8	American Society for Microbiology (ASM)	ONOS	16	https://journals.asm.org/
9	Annual Reviews	ONOS	51	http://arjournals.annualreviews.org
10	ASCE	ONOS	36	http://ascelibrary.org/
11	ASME	ONOS	38	http://asmedigitalcollection.asme.org/
12	Bentham Science	ONOS	118	http://benthamscience.com/
13	BMJ	ONOS	36	https://journals.bmj.com/home
14	Cambridge University Press (CUP)	ONOS	442	https://www.cambridge.org/core
15	Cold Spring Harbor Laboratory Press	ONOS	8	https://www.cshlpress.com/

SL. NO	Publisher	Consortium	Number of Journals	Hyperlink
16	Elsevier Science Direct	ONOS	2389	http://www.sciencedirect.com/
17	Emerald	ONOS	311	https://www.emerald.com/insight/
18	ICE Virtual Library	ONOS	34	http://www.icevirtuallibrary.com
19	IEEE	ONOS	210	http://ieeexplore.ieee.org/
20	IndianJournals.com	ONOS	253	http://indianjournals.com/
21	Institute of Physics (IOP)	ONOS	72	http://iopscience.iop.org/journals
22	Lippincott Williams & Wilkins (Wolters Kluwer)	ONOS	305	https://oce.ovid.com/
23	Oxford University Press	ONOS	375	https://academic.oup.com/journals/
24	Project Muse	ONOS	731	http://muse.jhu.edu/
25	SAGE	ONOS	1097	http://journals.sagepub.com/
26	SPIE Digital Library	ONOS	11	https://www.spiedigitallibrary.org/
27	Springer Nature	ONOS	2404	https://link.springer.com/
28	Taylor and Francis	ONOS	2548	https://www.tandfonline.com/
29	Thieme	ONOS	51	https://www.thieme-connect.com/products/all/home.html
30	Wiley	ONOS	1333	https://onlinelibrary.wiley.com/
31	Indian Open Access Society Journals	ONOS	18	https://nopr.niscpr.res.in
Bibliographic Databases/Plagiarism Tool/ Patent/ English writing Tool				
32	Scifinder	NKRC	1	my.cas.org
33	Web of Science	NKRC	1	https://www.webofscience.com/wos/woscc/basic-search
34	Derwent Innovation	NKRC	1	https://derwentinnovation.clarivate.com.cn/login/
35	Scopus	NKRC	1	https://www.scopus.com/
36	Grammarly	NKRC	1	https://www.grammarly.com
37	iThenticate: Plagiarism Detection Software	NKRC	1	https://www.ithenticate.com/
38	Thieme Database	NKRC	1	https://www.thieme-connect.com/
39	Questel QPAT	NKRC	1	https://www.questel.com/patent

Updating of Library Automation Software:

- » Library automation software “Libsys10” updated to “Web Centric Libsys10”

Department of Central Scientific Services

Professor Sugata Ray, Head

Instrument Under CSS Department

Spectroscopic Unit

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
1.	Circular Dichroism Spectrometer (JASCO Make, Model -J-1500)	Prof. Anindita Das (psuad2@iacs.res.in)	Mr. Chanchal Kumar Das cd@iacs.res.in	cd@iacs.res.in	Room no.10 Biological Chemistry Bldg.1 st . Floor 1509)
2.	EPR Spectrometer (OLD)	Prof. Tapan Kanti Paine (ictkp@iacs.res.in)	Dr. Bhola Nath Mondal	epr@iacs.res.in	Room no M-066 Main Bldg. Ground Floor (1808)
3.	EPR Spectrometer (NEW)	Prof. Somdutta Ghosh Dey. (icsgd@iacs.res.in)	Mr. Subrata Ghosh	(icsgd@iacs.res.in)	Room No. M 064.
4	FT-IR (New)	Dr. Subhadeep Datta (sspsdd@iacs.res.in)	Operated by Student	ftir@iacs.res.in	Room No. M-117 Main Bldg. 1 st Floor (1203)
5	FT-IR (Old)	Dr. Subhadeep Datta (sspsdd@iacs.res.in)	Operated by Student	ftir@iacs.res.in	Room No. M-117 Main Bldg. 1 st Floor (1203)
6	FT-NMR (300MHz, 500MHz & 400MHz)	Prof. Tapan Kanti Paine (ictkp@iacs.res.in) Prof. JoyramGuin (ocjg@iacs.res.in) Prof. Rajib Goswami (ocrkg@iacs.res.in)	Mr. Sumit Ray Mr. Sachin Das	nmrfacility@iacs.res.in	Room No. M-033 Main Bldg. 1 st Floor (1173)
7	HR-MS	Prof. Rajib Goswami (ocrkg@iacs.res.in)	Mr. Goutam Biswas	hrms@iacs.res.in	Room No. M-135 Main Bldg. Gr. Floor (1180)
8	MALDI Mass Spectrometer	Dr. Anindita Das (psuad2@iacs.res.in)	Ms. Champa Bag	maldi@iacs.res.in	Room No. 301 Centenary Bldg. 2 nd Floor. (2126)
9	Laser Raman Spectrometer	Prof. Abhishek Dey (icad@iacs.res.in)	Dr. Sasanka Maji	raman@iacs.res.in	Room No. M-120 Main Bldg. 1 st . Floor (1260)
10	TCSPC	Prof. Narayan Pradhan (camnp@iacs.res.in)	Operated by Student	tcspc@iacs.res.in	Room No. 85 Main Bldg. 1 st . Floor (1274)
11	UV-VIS- NIR Spectrophotometer (Agilent carry 5000 UV-VIS- NIR)	Dr. Subhadeep Datta (sspsdd@iacs.res.in)	Operated by Student	uvvis@iacs.res.in	Room No. M-117 Main Bldg. 1 st Floor (1274)

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
12	Steady State, Fluorescence and Phosphorescence Lifetime Measurement Spectrometer (Model: FLS1000-DD-stm)	Prof. Sudip Malik (psusm2@iacs.res.in)	Operated by student.		Room No. M-253 Main Bldg. 2 nd Floor (Beside SAIS office) (1564)
13	Fluorescence Spectrometer	Dr. Shinto Varghese (trcsv@iacs.res.in)	Operated by student.	trcsv@iacs.res.in	Room No. M-258 Main bldg. 2 nd floor (1145)
14	ICP-OES System	Prof. Sugata Ray (mssr@iacs.res.in)	Operated by student.	mssr@iacs.res.in	Room no. M-274 Mail Bldg. 2 nd floor, opposite to the S N Bose Hall (1414)
15	NMR (600 MHZ)	Prof. Surajit Sinha (ocss5@iacs.res.in)	Mr. Gour Gopal Paul	nmr600@iacs.res.in	Room No. 004 CRAFT Building Gr. Floor (2324)
16	Gas Chromatography-Mass Spectroscopy	Prof. Amit Majumdar (icam@iacs.res.in)	Mr. Sridib Bera	gcms@iacs.res.in	Room no. M-036, Main bldg. Ground floor (1165)
17	DLS (Zeta-Potential Particle Size and Molecular Weight) [Zetasizer ZEM 3600 Instrument]	Tarun Kumar Mandal (psutkm@iacs.res.in)	Ms. Champa Bag	dls@iacs.res.in	Room No. M-255 Main Bldg., 2 nd floor (1562)
18	Electrochemical Cell/ Diode Array Spectrophotometer.	Prof. Asim Bhaumik (msab@iacs.res.in)	Operated by students	msab@iacs.res.in	Room No. 79 Main Bldg. 1 st Floor (1453)

Microscopy Unit

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
1.	Fluorescence Microscope (Leica DMI8 Digital Microscope)	Prof. Benu Brata Das (pcbbsd@iacs.res.in)	Mr. Sanjay Sarkar	pcbbsd@iacs.res.in	Room 23B Biological Chemistry Bldg. 1 st floor (2108)
2	Leica Stellaris STED Super resolution microscope.	Prof. Benu Brata Das (pcbbsd@iacs.res.in)	Mr. Sanjay Sarkar	pcbbsd@iacs.res.in	Room 23B Biological Chemistry Bldg. 1 st floor (2108)
3.	LSM880/ Axio Observer7 [Confocal Microscope]	Prof. Deepak Kr. Sinha (bcdks@ics.res.in) Prof. S. Jana (bcssj@iacs.res.in)	Mr. Sanjay Sarkar	bcdks@ics.res.in	Room 14 Biological Chemistry Bldg. 1 st floor (1106)
4.	Confocal FLIM (Olympus IX71 & Picoquant)	Prof. Deepak Kr Sinha (bcdks@iacs.res.in)	Mr. Sanjoy Sarkar	bcdks@iacs.res.in	Room No. 93 Main Bldg. 1 st Floor (1106)

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
5.	Optical Microscope & Micro hardness Test	Dr. Subhadeep Datta (sspsdd@iacs.res.in)	Operated by student	ommd@iacs.res.in	Room No. M-120 Main Bldg. 1 st Floor (1260)
6.	Olympus Upright Microscope [Model BX53M with MAC. Range 50X-1000X]	Dr. Subhadeep Datta (sspsdd@iacs.res.in)	Operated by student	ommd@iacs.res.in	Room No. M-120 Main Bldg. 1 st Floor (1260)
7.	FE-SEM (JEOL MAKE, Model: JSM7500F)	Prof. Tarun K. Mandal (psutkm@iacs.res.in)	Mr. Rabindranath Banik and Smt. Saumita Das Kar.	sem@iacs.res.in	Room No. M-018 Main Bldg. Gr. Floor (1181)
8.	AFM (OXFORD)	Prof. Somobrata Acharya (camsa2@iacs.res.in)	Mr. Sanjib Naskar	afm@iacs.res.in	Computer Center Bldg. 1 st Floor (1586)
9	AFM (OXFORD) (New)	Prof. Somobrata Acharya (camsa2@iacs.res.in)	Mr. Subir Sikdar	afm@iacs.res.in	Computer Center , Ground Floor.
10	UHR-FEG-TEM	Prof. Narayan Pradhan (camnp@iacs.res.in)	Mr. Arunim Paul Mr. Suman Guchhait	fegtem@iacs.res.in	Room No. M-015 Main Bldg. Bldg. Ground Floor (1251)
11	CRYO-TEM	Prof. Prasanta K Das (bcpkd@iacs.res.in)	Mr. Supriya Chakraborty	bcpkd@iacs.res.in	Room No. M-049 Main Bldg. Gr. Floor (1373)
12	Thermal System for Optical Imaging Devices (Purchased for Olympus upright Microscopemachine no. 5 in this list)	Dr. Subhadeep Datta (sspsdd@iacs.res.in)	Operated by Student	ommd@iacs.res.in	Room No. M-120 Main Bldg. 1 st Floor (1260)
13	High Resolution TRANSMISSION Electron Microscope With Probe Corrector (Model: JEM-ARM 300F2)	Prof. Narayan Pradhan (camnp@iacs.res.in)		(camnp@iacs.res.in)	Room No. T-005 CRAFT Bldg. Ground Floor

Magnetic Measurement Units

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
1.	Dielectric setup measurement system (previously Mini VSM [4 Tesla])	Prof. Subham Majumdar (sspsm2@iacs.res.in)	Mr. Prasad Modak	sspsm2@iacs.res.in	Room No. 16B [Main Bldg.] (1172)
2.	Squid VSM MPMS (3)	Dr. Devajyoti Mukherjee (sspdm@iacs.res.in)	Mr. Prasad Modak	sspsm2@iacs.res.in	Room No. M-011 Main Bldg. Grd. Floor

Electrical/Electrochemical Measurement Units

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
1.	Cryogen Free CFMS Cryomagnetic system with DC resistivity and Hall Effect module.	Prof. Subham Majumdar (sspsm2@iacs.res.in)	Mr. Prasad Modak	sspsm2@iacs.res.in	Room No. M-028 Main Bldg. Ground floor

Furnaces and Deposition Units

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
1.	Vacuum Coating Unit (OLD)	Dr. K.D.M Rao (trckdmr@iacs.res.in)	Operated by students	vcu@iacs.res.in trckdmr@iacs.res.in	Room No. M-117 Main Bldg. 1 st . Floor (1203)
2.	PLD (Pulsed Laser Deposition Chamber with in-situ RHEED facility System.	Dr. Devajyoti Mukherjee (sspdm@iacs.res.in)	Operated by Student	pld@iacs.res.in	Room No. 101 ERU Bldg. Grnd. Floor (1616)
3.	RF/DC Sputtering System	Dr. Devajyoti Mukherjee, (sspdm@iacs.res.in)	Mr. Ranojit Sardar	sputter@iacs.res.in	Room No. M-112 Main Bldg. 1 st Floor (1220)
4.	Vacuum Coater (New)	Dr. K.D.M Rao (trckdmr@iacs.res.in)	Operated by students	trckdmr@iacs.res.in vcu@iacs.res.in	in Room No. M-117 Main Bldg. 1 st Floor (2177)

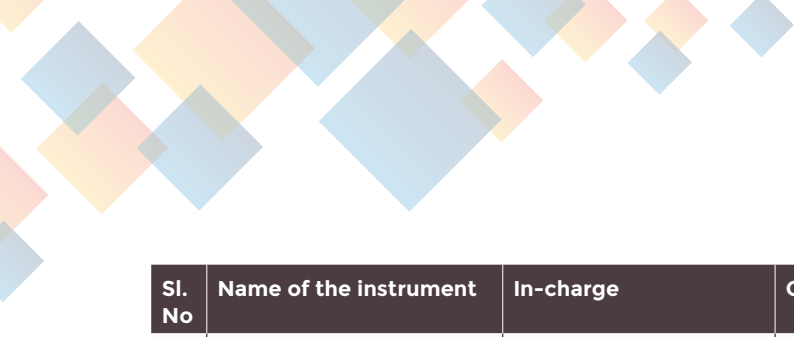
Structural/Elemental Characterization Units

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
1.	XPS	Prof. Sugata Ray (mssr@iacs.res.in)	Mr. Amar Nath Dey	xps@iacs.res.in	Room No. M-019 Main Bldg. Gr. Floor (1253)
2.	XRD (Micro Focus Single Crystal X-ray Diffractometer) [NEW]	Prof. Amit Majumdar (icam@iacs.res.in)	Dr. Bhola Nath Mondal	sxrd@iacs.res.in	Room No. M-061, Main Bldg. Gr. Floor (1368)
3.	Old XRD (BRUKER) [D8 advance]	Dr.Mintu Mondal (sspmm4@iacs.res.in)	Mr. Subrata Ghosh	xrdbruker@iacs.res.in	Room No. M-066 Main Bldg. Gr. Floor (1365)
4.	New Automated XRD Bruker	Dr.Mintu Mondal (sspmm4@iacs.res.in)	Mr. Subrata Ghosh	xrdbruker@iacs.res.in	Room No. M-066 Main Bldg. Gr. Floor (1365)
5.	HR-XRD (Rigaku)	Prof. Sugata Ray (mssr@iacs.res.in)	Mr. Ananda Karmakar	mssr@iacs.res.in	Room no. M-009 Main Bldg. Gr. Floor. (1215)
6.	Wavelength Dispersive X-Ray Spectrometer System (WDXRF)	Prof. Asim Bhaumik	(msab@iacs.res.in)	Mr. Amarnath Dey	Room no. M-009 Main Bldg. Gr. Floor. (1215)
7.	UHV-Moke System)	Dr. Devajyoti Mukherjee (sspdm@iacs.res.in)	Mr. Ranojit Sardar	sspdm@iacs.res.in	Room No. M-112 Main Bldg. 1 st Floor (1220)
8.	BET (Surface area analyzer)	Prof. Ashim Bhaumik (msab@iacs.res.in)	Mrs. Sujata Gupta.	bet@iacs.res.in	Room No. 11 Main Bldg. Ground Floor (1710)

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
9.	DSC 8000 (Perkin Elmer Make)/ Diamond DSC (Perkin Elmer Make)/DSC Q 2000 TA	Prof. Sudip Malik (psusm2@iacs.res.in)	Mr. Arup Bandyopadhyay	thermal@iacs.res.in	Room No. M-116 Main Bldg. 1 st Floor (1262)
10.	(TGA 4000) [Perkin Elmer Make] (NEW)	Prof. Sudip Malik (psusm2@iacs.res.in)	Mr. Arup Bandyopadhyay	thermal@iacs.res.in	Room No. M-116 Main Bldg. 1 st Floor (1262)
11.	Rheometer with Dynamic Mechanical Thermal Analysis System (Model No.: MCR 702e MultiDrive, Anton Paar Pvt. Ltd.)	Prof. Sudip Malik (psusm2@iacs.res.in)	Operated by students	psusm2@iacs.res.in	Room No. M-258 Main Building 2 nd floor
12.	CHNS Analyzer	Prof. Amit Majumdar (icam@iacs.res.in)	Mr. Srideep Bera	chns@iacs.res.in	Room No. M-143 Main Bldg. 1 st . Floor (1370)

Bio-Science Characterization Units

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
1.	20 degree C Deep Freezer	Prof. Prosenjit Sen (bcps@iacs.res.in)	Operated by students	bcps@iacs.res.in	Room no. 5 Biological Chem. Bldg. 1 st . Floor. (1518)
2.	FACS-Cell Sorter	Prof. Benu Brata Das (pcbbsd@iacs.res.in)	Mr. Chanchal Kumar Das	pcbbsd@iacs.res.in	Room no. 14 Biological Chemistry Building 1 st . Floor. (1508/9)
3.	Deep Freezer (-80°C)	Prof. Prosenjit Sen (bcps@iacs.res.in)	Operated by students	bcps@iacs.res.in	Room no. 13 Biological Chemistry Bldg. 1 st . Floor (1266)
4.	Microplate Spectrophotometer	Dr. Ritesh Ranjan Pal (ritesh.pal@iacs.res.in)	Operated by students	ritesh.pal@iacs.res.in	Room No. M-059 ain Building Gr. Floor (2202)
5.	Micro Volume UV-VIS Spectrophotometer (Model- Nano Drop One C with Cuvette)	Dr. Ritesh Ranjan Pal (ritesh.pal@iacs.res.in)	Operated by students	ritesh.pal@iacs.res.in	Room No. 5 Biological Chemistry Bldg. 1 st floor (2202)
6.	PCR Instrument (T100TM Thermal Cycler)	Prof. Prosenjit Sen (bcps@iacs.res.in)	Operated by students	bcps@iacs.res.in	Room No. 5 Biological Chemistry Bldg. 1 st . Floor. (1518)
7.	Ultra Centrifuge Instrument	Prof. Prosenjit Sen (bcps@iacs.res.in)	Operated by students	bcps@iacs.res.in	Room No. 5 Biological Chemistry Bldg. 1 st . floor (1518)
8.	Bench Top Shaker Incubator with Temp. Control.	Dr. Ritesh Ranjan Pal (ritesh.pal@iacs.res.in)	Operated by students	ritesh.pal@iacs.res.in	Room No. 5 Biological Chemistry Bldg. 1 st floor (2202)
9.	Spectra Max ID5 Multi-Mode Microplate Reader Platform	Dr. Deepak Sinha (bcdks@iacs.res.in)	Operated by students	bcdks@iacs.res.in	Room no. 5 Biological Chemistry Bldg. 1 st Floor (1106)
10.	Ultra Microtome for Biological Samples including EMUC7 module with Cryo upgradation facility	Prof. Benu Brata Das (pcbbsd@iacs.res.in)	Mr. Ranojit Sardar	pcbbsd@iacs.res.in	Room No. M-017 Main Bldg. Gr. Floor (2108)
11.	Table Top Centrifuge System	Prof. Prosenjit Sen (bcps@iacs.res.in)	Operated by students	bcps@iacs.res.in	Room No. 23B Main Bldg. (1266)



Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
12.	Chemidoc Multiplexing Imaging system	Prof. Prosenjit Sen (bcps@iacs.res.in)	Operated by students	bcps@iacs.res.in	Room no. 5 Biological Chemistry Bldg. 1 st Floor (1518)
13.	Real-Time PCR	Prof. Prosenjit Sen (bcps@iacs.res.in)	Operated by students	bcps@iacs.res.in	Room No. 13 Biological Chemistry Bldg. 1 st Floor (1518)
14.	High Performance Centrifuge System	Prof. Benubrata Das (pcbhd@iacs.res.in)	Operated by students	pcbhd@iacs.res.in	Room No. 13 Biological Chemistry Bldg. 1 st floor (1266)
15.	Bacterial Culture System (incubator and shaker)	Prof. Deepak K Sinha (bcdks@iacs.res.in)	Operated by students	bcdks@iacs.res.in	Room No. 13 Biological Chemistry Bldg. 1 st floor (1266)
16	Seahorse Analyzer	Dr. Ritesh R Pal (ritesh.pal@iacs.res.in)	Operated by students	ritesh.pal@iacs.res.in	Room No.M017 Main Bldg. Ground floor (2202)

Common Facilities

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
1.	Water Plant. Type-I & Type-II icad@iacs.res.in Workshop	Prof. S.S.Jana (bcssj@iacs.res.in)	Mr. Thakurdas Biswas	bcssj@iacs.res.in Workshop	icad@iacs.res.in Workshop
2.	Liq. N2 Plant	Prof. Subhadeep Dutta Prof. Devajyoti Mukherjee (sspsdd@iacs.res.in) (sspsdm@iacs.res.in)	Mr. Pijush Das & Mr. Ramesh Pratap Singh	sspsdd@iacs.res.in	front of workshop [Behind MLS Hall] (1171)
3.	Table Top Mini He Liq. System	Prof. Subham Majumdar (sspsm2@iacs.res.in)	Mr. Subrata Ghosh	sspsm2@iacs.res.in	Room No. 14 Main Bldg. Ground floor

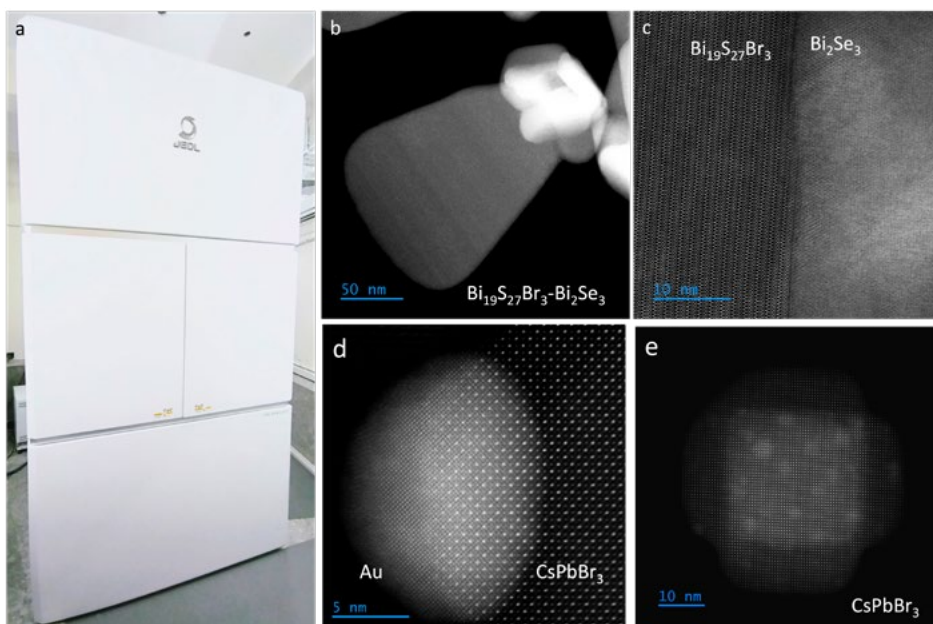
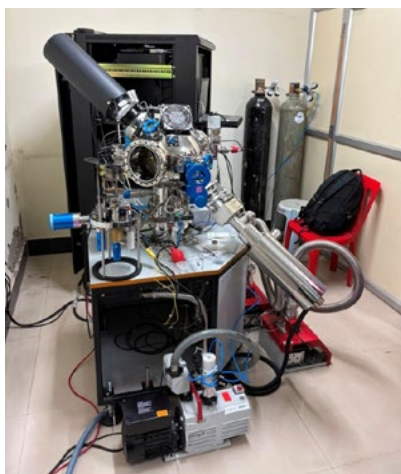
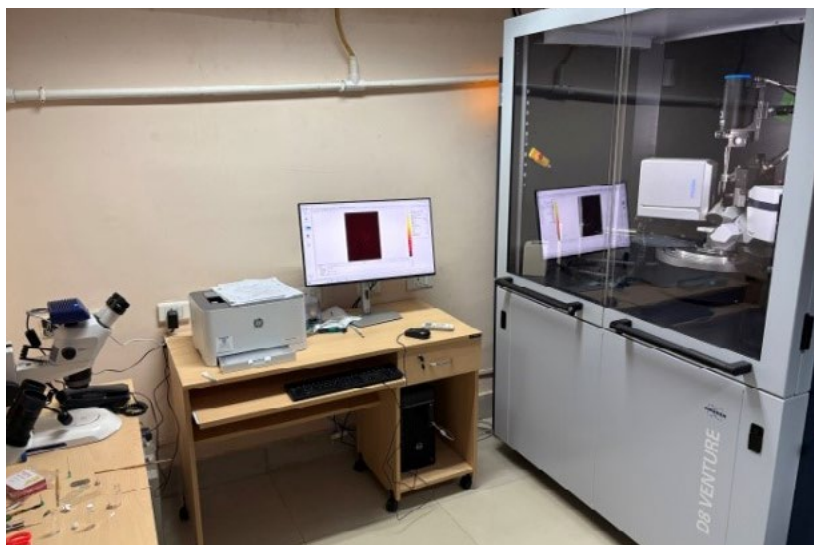
CSS Small Equipments

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
1.	Mobile Spectrofluorometer System.	Prof. Narayan Pradhan (camnp@iacs.res.in)	No operator	camnp@iacs.res.in	Room No. M-215 Main Bldg. 2 nd Floor
2.	Cary 60 Spectrophotometer Bundle Instrument.	Prof. Narayan Pradhan (camnp@iacs.res.in)	No operator	camnp@iacs.res.in	Room No. 17 Main Bldg. Gr. Floor (1218)
3.	Image Analysis Workstation for JEOL TEM JEM-F200	Prof. Narayan Pradhan ((camnp@iacs.res.in))	No operator	camnp@iacs.res.in	N/A
4.	Source Measure unit	Dr. Subhadeep Datta. (sspsdd@iacs.res.in)	No operator	sspsdd@iacs.res.in	
5.	Interactive Digital Source Meter (Keithley make)	Dr. Mintu Mondal (sspsmm4@iacs.res.in)	Operated by Student Sk. Kalimuddin. intdydt@gmail.com	sspsmm4@iacs.res.in	Room No. 81 Main Bldg, 1 st Floor; (1320)
6.	Battery Cycler.	Dr. Urmimala Maitra. (urmimala.maitra@iacs.res.in)	No operator	"urmimala.maitra@iacs.res.in"	Room No. M-222 Main Bldg. 2 nd Floor (1216)

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
7.	SR830 DSP Dual Phase Lock in amplifier, SR554 Lock in Transformer preamplifier, SIM900 mainframe with RS232 Computer interface SR540 Optical Chopper.	Dr. Mintu Mondal (sspmm4@iacs.res.in)	No operator	sspmm4@iacs.res.in	Room No. 81 Main Bldg, 1 st Floor; (1320)
8.	HP Z4 Workstation.	Prof. Narayan Pradhan (camnp@iacs.res.in)	No operator	camnp@iacs.res.in	Room No. M-215 Main Bldg. 2 nd floor (1208)
9.	GPU Workstation. Supermicro 7049AT (Model SuperServe7049A.T.)	Prof. Narayan Pradhan (camnp@iacs.res.in)	No operator	camnp@iacs.res.in	Room No. M-215 Main Bldg. 2 nd floor (1208)
10.	HP Workstation [Installed 22-03-2021] (FEG TEM)	Prof. Narayan Pradhan (camnp@iacs.res.in)	No operator	camnp@iacs.res.in	Room No. M-215 Main Bldg. 2 nd floor (1208)
11.	USB-2405 [4CH 24 Bit128Ks/s Dynamic Signal acquisition USB 2.0 module]	Dr. Mintu Mondal (sspmm4@iacs.res.in)	Operated by Student :Mr. Deep Singha Roy deep. rkmrc97@gmail.com	sspmm4@iacs.res.in	Room No. 81 Main Bldg, 1 st Floor; (1320)
12.	Muffle Furnace (working Temp. 1250 Degree C Temp	Dr. Urmimala Maitra. (urmimala.maitra@iacs.res.in)	No operator	urmimala.maitra@iacs.res.in	Room No. M-222 Main Bldg. 2 nd Floor (1216)
13.	Vacuum Oven	Dr. Urmimala Maitra. (urmimala.maitra@iacs.res.in)	No operator	urmimala.maitra@iacs.res.in	Room No. M-222 Main Bldg. 2 nd Floor (1216)
14.	1200 degree C High temp Horizontal Split Tube Furnace.	Dr. Subhadeep Datta (sspsd@iacs.res.in)	No operator	sspsd@iacs.res.in	Room No. M-222 Main Bldg. 2 nd Floor (1607)
15.	1200 Degree C Tubular furnace.	Dr. Urmimala Maitra. (urmimala.maitra@iacs.res.in)	No operator	urmimala.maitra@iacs.res.in	in Room No. M-222 Main Bldg. 2 nd Floor (1216)
16.	Double Zone 1400 degree C Tubular Furnace.	Dr. Mintu Mondal (sspmm4@iacs.res.in)	Operated by Student: Deep Singha Roy deep. rkmrc97@gmail.com	sspmm4@iacs.res.in	Room No. 76 Main Bldg, 1 st Floor
17.	Nabertherm High Temp. Lab Furnace.	Dr. Devajyoti Mukherjee (sspdm@iacs.res.in)	No operator	sspdm@iacs.res.in	Room No. M-112 1 st Floor of Main Bldg. (1220)
18.	20 Ton Pellet maker with 10mm and 13mm Die.	Dr. Urmimala Maitra (urmimala.maitra@iacs.res.in)	No operator	urmimala.maitra@iacs.res.in	Room No. M-222 Main Bldg. 2 nd Floor (1216)
19.	Lab Compact Manual Roller Press for Battery Electrode Sheet Calendaring.	Dr. Urmimala Maitra (urmimala.maitra@iacs.res.in)	No operator	urmimala.maitra@iacs.res.in	Room No. M-222 Main Bldg. 2 nd Floor (1216)
20.	Planetary Ball Mill	Dr. Urmimala Maitra. (urmimala.maitra@iacs.res.in)	No operator	urmimala.maitra@iacs.res.in	Room No. M-222 Main Bldg. 2 nd Floor (1216)

Sl. No	Name of the instrument	In-charge	Operator	Contact	Location (Extn. No.)
21.	BIOVIA Materials Studio research Suit [BIOVIA, Materials Studio Academic Research Suit (2020)	Prof. Narayan Pradhan (camnp@iacs.res.in)	No operator	camnp@iacs.res.in	Room No. M-215 Main Bldg. 2 nd Floor Installed with GPU Workstation (1208)
22.	Impedance Analyser.	Dr. Kunala Durga Mallikharjuna Rao. (trckdmr@iacs.res.in)	No operator	trckdmr@iacs.res.in	Room No. 19, Main Bldg, Gr.Floor (1735)
23.	Glove Box I & Glove Box II	Prof. Pradyut Ghosh (icpg@iacs.res.in)	Operated by student	icpg@iacs.res.in	Room No. M-065, Ground Floor of Main Bldg.
24.	Surface Tensiometer	Prof. Prashant C. Singh (sspcs@iacs.res.in)	Operate by Student Ms. Asim Bisoi	(prashantchem@gmail.com)	Room Number 80 1 st floor, Main Bldg
25.	Liquid He4 flow Cryostat	Dr. Mintu Mondal (sspm4@iacs.res.in)	Operate by student Sk. Kalimuddin intdydt@gmail.com	(sspm4@iacs.res.in)	Room No. M-031ain Building, Gr. Floor (1320)
26.	Ice Flake Instrument (NEW)	Prof. Tapan Kanti Paine (ictkp@iacs.res.in)	Operated by student	ictkp@iacs.res.in	Room No. 93 Main Bldg. 1 st Floor
27.	Ice Flake Instrument (OLD)	Prof. Tapan Kanti Paine (ictkp@iacs.res.in)	Operated by student	ictkp@iacs.res.in	Room No. 93 Main Bldg. 1 st Floor
28.	Autoclave (Vertical) Pressure Cut	Prof. Prosenjit Sen (bcps@iacs.res.in)	Operated by student	(bcps@iacs.res.in)	Biological Chemistry Bldg. 1 st . Floor. (1518)
29.	Worthington LS3000 Dewars with canister Storage System	Prof. Prosenjit Sen (bcps@iacs.res.in)	Operated by student	(bcps@iacs.res.in)	Room No. M-132 Main Bldg. 1 st Floor (1518)
30.	Worthington LS3000 Dewars with canister	Prof. Prosenjit Sen (bcps@iacs.res.in)	Operated by student	(bcps@iacs.res.in)	Room no. M-134 ain Bldg. 1 st Floor (1518)
31.	CO2 Incubator.	Prof. Deepak Sinha (bcdks@iacs.res.in)	Operate by student Ms. Priyanka Ray	bcdks@iacs.res.in	Biological Chemistry Bldg. 1 st Floor
32.	High Performance Liquid Chromatography	Prof. Surajit Sinha (ocss5@iacs.res.in)	Operated by student	(ocss5@iacs.res.in)	Room No. M-154 Main Bldg. 1 st floor (1400)
33.	Maskless Lithography System	Dr. Subhadeep Datta (sspsdd@iacs.res.in)	Operated by student	(sspsdd@iacs.res.in)	Room No. M-120 Main Bldg. 1 st . Floor (1260)

CSS Instruments



Centre for Computer Research, Education and Services (CCRES)



The IACS Computer Centre provides all network related services to its Faculty Members, Staffs and Students. It has a state of the art Data Centre (DC) with well maintained servers in a cluster environment. Email services (SMTP and IMAP) are running on Exchange server with fail-over mode to minimise the downtime and Proxy servers run on Red Hat Enterprise Linux platform. In the Data Centre we have high end Firewall, Router, WLC (Wireless Controller) and Core switches. Computer Centre manages the mail system for IACS with SAN (Storage Area Network) storage for authorised users including web-mail facility. All incoming mails are filtered through FortiMail Gateway (Email security). The Web-server and day-to-day maintenance of IACS Website is done by CCRES. The cluster of servers includes proxy-servers for authentication which adds to security and accountability. Other servers in the cluster are being used for local DNS (Domain Name System). Mail services are integrated with Active Directory (AD) for seamless use. Institutional Repository (IR) for IACS is implemented and being maintained by the

Computer Centre in which research publications, theses and reports are uploaded either in pre-print or post-print form adhering the copyright policy of the publishers as per the mandate from NKN (National Knowledge Network) and NKRC (National Knowledge Resource Consortium). The IR of IACS is implemented with handle registration for interoperability. The documents are globally searchable with DOI (Digital Object Identifier) and other key words. Back volumes of Indian Journal of Physics are available in the IR. Management with multi-ISP (Internet Service Provider) configuration setup in failsafe mode with preferential load balancing is done by the Computer Centre. The Centre runs on a dual bandwidth setup for better reliability. One Gbps link from NKN is primarily used for internet, online journals and video conferencing etc. The other link from Tata Communications (500 Mbps) with filtered bandwidth is being used for IACS mail system, IACS Website and Gateway server. The Centre is connected through Fiber Optic cable with ISPs for better stability. Campus-wide Wi-Fi services are provided with adequate network security. The



Computer Centre also provides remote connectivity via Virtual Private Network (VPN). LAN has been extended to Rangit and Churni Hostels during 2019-20. Eduroam, an international roaming service has been implemented at IACS during this period.

The list of services provided by CCRES is as follows:

1. Provides Internet (through Ethernet as well as Wi-Fi) in the entire IACS campus for Faculty Members, Staffs, Scholars and all bonafide users including visitors and guests.
2. Web-mail facility.
3. Remote connectivity through VPN and gateway server.
4. Secure web access through proxy authentication.
5. Design and day-to-day maintenance of IACS website (www.iacs.res.in).
6. Maintains and uploads tenders in CPP Portal.
7. Implementation and maintenance of Institutional Repository (Under reconfiguration).
8. Configuration and maintenance of network equipment like Router, Firewall, WLC, Core Switch and L2/L3 switches.
9. Regular Back-up of user Emails data.
10. FTP service for sending/receiving large sized files (If required).
11. Gateway service to faculty members and students to access remote servers.
12. Eduroam service for users
13. Provides online teaching platform to the students for online classes through Zoom software.

Workshop

Engineering, Workshop and Stores

Workshop	Civil and Plumbing	Electrical	Liquid N ₂	Stores
» Carpentry » LV and MV Electrical » Electronics » Glass Blowing » Mechanical » Refrigerator and AC		» 3 MVA Substations with DG set (24×7) » Electromechanical Services » EPABX » Scientific and Graphic Design		» Electrical » Civil » Mechanical

The Civil Engineering Section is located at the ground floor of the Engineering-Workshop Building in IACS, Jadavpur campus. It's playing an important role in maintenance and upkeep of campus including repairing, renovation and sanitary & plumbing works of building, laboratories, hostels, guest houses, auditorium, conference halls etc. Day-to-day cleaning and housekeeping of the campus area is supervised by the Civil Engineering section. Fire fighting, detection and alarm system for the Centenary Building, Lake View Academic Building, Rangit & Churni Hostel Buildings and Fire extinguishers for various buildings, laboratories, seminar halls, library, guest house, hostels are provided by the Civil Engineering Section. Maintenance of the chemical Fume Hoods at various laboratories including installations of new Fume Hoods are also executed by the Civil Engineering Section. In order to ensure clean and pure drinking water to the students, scholars, staffs and inmates, IACS installed Industrial R.O. water treatment plants on various buildings which are supervised by the Civil Engineering Section. The department is also maintains the kitchen equipment, kitchen hoods, LP Gas Bank manifold system for the IACS Canteen which cater the food of around 700 users daily.

The expenditure made for the financial year 2024-25 was of Rs. 344.88 Lakhs.





Activities of the Electrical Engineering Section :

- » Round the clock (24x7) operation & maintenance of 6KV, 4.2 MVA Indoor type Substation and DG sets including operation of Drinking Water Pumps. The above job includes monitoring of energy in regard to various electrical parameters viz. Voltage, Current, Power factor, Demand, Core Temperature of Dry Type Transformer etc. so that, quality power can be delivered. Intensive monitoring of the power system helps the consumer to maintain the desired power factor for earning power factor rebate (PFR) to the maximum possible extent.
- » Day-to-Day maintenance of various Electro-Mechanical services (viz. Internal & external Electrical installation), Air-Conditioning Systems (viz. Package, VRF & Precision), Passenger lifts, Addressable Automatic Fire Detection System etc.
- » Day-to-Day Operation & maintenance of EPABX cum Reception Centre/c Up-gradation of the same.
- » Providing Electrical Infrastructure for laboratories & Offices.
- » Recording of Energy meter readings for IACS Staff Quarters, SBI ATM, Construction Power etc. and preparation & distribution of monthly electricity bills thereon.
- » Planning, Design, Estimation & Costing including preparation of Tender documents, calling of tender, award of work, execution of work, recording of measurements, bill certification etc..
- » Liaison with Government & Statutory Bodies, Supply Company etc. viz. Central Electricity Authority (CEA), West Bengal Pollution Control Board, CESC Ltd.
- » Introduction of Solar PV Standalone LED Street Lighting System in the campus of IACS, Jadavpur.

Non Faculty Members as on 31st March, 2025

Administration

Smt. Sarbani Saha Registrar	Smt. Purbasha Banerjee Deputy Registrar
Smt. Suchismita Mallik Asst. Registrar	Shri Amit Kr. Sarkar Asst. Engineer
Shri Arup Kr. Saha Office Supdt. (F&A)	Shri Abhijit Basak Assistant
Shri Soumen Kr. Ghosh Assistant	Shri Sujit Kr. Biswas Asst. (F&AO)
Smt. Ankeeta Chakraborty Upper Division Clerk	Shri Gopal Krishna Manna Tech. Asst. B
Shri Tapan Sardar Upper Division Clerk	Shri Arka Mukherjee Technical Officer
Shri Soumik Mitra Assistant	Shri Swapan Thakur Office Supdt. (F&A)
Smt. Sohinee Motilal Upper Division Clerk	Shri Sohag Kumar Patra Assistant
Shri Soumyadip Ghosh Assistant	Shri Sanjib Chongdar Sr. Doc. Assistant
Shri Gopal Gond Assistant	Shri Satinath Paul Tech. Asst. B
Shri Sandip Mukherjee Junior Store Keeper	Shri Manoj Kr. Behura Upper Division Clerk
Shri Suresh Ch. Ghosh Upper Division Clerk	Shri Prabir Das Senior Technician
Shri Prithu Singha Roy Multi Tasking Staff (General)	Shri Pritam Ghosh Upper Division Clerk
Shri Raj Kumar Routh Helper B	Shri Prolay Mondal Upper Division Clerk
Shri Raju Mondal Multi Tasking Staff (General)	Shri Rajesh Mondal Upper Division Clerk
Shri Samir Kr. Barua Helper A	Shri Rana Biswas Multi Tasking Staff (Technical)
Smt. Debdutta Mitra Multi Tasking Staff	Shri Madhab Pusti Multi Tasking Staff (General)
Shri Sanjoy Prasad Multi Tasking Staff (General)	Shri Soumen Mandi Assistant
Shri Gautam Chakraborty Helper B	Shri Sanjit Roy Staff Car Driver
Smt. Sakhi Mondal Jamader	Shri Gopal Ghosh Multi Tasking Staff (General)

Shri Rakesh Kr. Balmiki

Sweeper

Shri Subrata Naskar

Multi Tasking Staff (General)

Shri Swapan Majumdar

Senior Technician

Shri Sweta Kishor Behura

Senior Record Keeper-A

Shri Sailendranath Bhowmik

Multi Tasking Staff (General)

Shri Sujit Bag

Helper-F

Shri Shauryadip Das

Multi Tasking Staff (General)

Shri Anil Harijan

Helper-F

Shri Hari Kishan Ray

Head Jamadar

Shri Soumen Seal

Helper B

Shri Debasish Banerjee

Helper A

Shri Subrata Basu

Junior Technician

Shri Srimanta Dutta

Multi Tasking Staff (General)

Shri Pranab Chakraborty

Multi Tasking Staff (Technical)

Shri Amit Kr. Harijan

Sweeper

Academic Office/School of Undergraduate

Shri Prabir Manna

Assistant

Smt. Basudha Mukherjee

Upper Division Clerk

Shri Pranab Ch. Kar

Upper Division Clerk

Shri Sujit Kr. Das

Tech. Supdt.

Dr. Saumita Das Kar

Technical Asst.-B

Shri Bijan Krishna Chandra

Helper A

Shri Swastik Sinha

Tech. Asst. B

Smt. Saswati Bhattacharya

Upper Division Clerk

Shri Pramod Kumar Balmiki

Multi Tasking Staff (General)

Shri Chanchal Banerjee

Multi Tasking Staff

Shri Mithun Sardar

Multi Tasking Staff

School of Applied and Interdisciplinary Sciences

Shri Amit Chakraborty

Office Supdt.

Shri Kamal Das

Book Sorter

Shri Siddhartha Mistry

Helper A

Shri Subir Sikder

Tech. Asst.-B

School of Biological Sciences

Shri Shovon Mallick

Upper Division Clerk

Shri Ashok Kumar

Multi Tasking Staff

Shri Gour Chandra Bairagi

Helper B

Shri Prosenjit Ghosh

Multi Tasking Staff (General)

School of Chemical Sciences

Smt. Dipanwita Chakraborty

Assistant

Smt. Mahua Bhattacharya

Assistant

Shri Sajal Barua

Wash Boy Cum Bearer

Shri Tarak Nath

Helper B

Shri Ashis Kr. Pal

Tech. Asst. B

Smt. Ujjwala Das

Tech. Asst. A

Shri Amit Kr. Ghosh

Multi Tasking Staff (Tech.)

School of Mathematical and Computational Sciences (SMCS)

Smt. Mridula Majumdar

Assistant

Shri Partha Ganguly

Multi Tasking Staff

School of Materials Sciences

Shri Subhasish Guha Roy

Helper B

Shri Mahadev Das

Multi Tasking Staff (General)

School of Physical Sciences

Shri Tarun Kr. Kabasi

Office Supdt.

Shri Niranjan Kurmi

Technical Asst-A

Smt. Suman Sharma

Upper Division Clerk

Shri Prabir Kr. Roy

Tech. Supdt.

Shri Ajit Pandit

Helper-A

Shri Bikash Darjee

Helper-A

Library/Indian Journal of Physics

Shri Debojyoti Nath

Asst. Librarian

Dr. Gayatri Paul

Doc. Asst.

Shri Sankar Kr. Chanda

Doc. Assistant

Smt. Suhita Neogi

Tech. Asst. - A

Shri Basudev Dafadar

Doc. Asst.

Smt. Mallika Bala (Mondal)

MTS (General)

Central Scientific Services

Shri Supriya Chakraborty

Tech. Asst.-B

Shri Arup Kr. Banerjee

Tech. Supdt.

Smt. Champa Bag

Tech. Asst. - B

Shri Pijush Kumar Das

ech. Asst. - B

Smt. Sujata Gupta

Tech. Asst. - A

Shri Ranajit Sardar

Tech. Asst. - B

Shri Chanchal Kr. Das

Tech. Asst. - B

Shri Ramesh Pratap Singh

Multi Tasking Staff (General)

Dr. Sasanka Maji

Tech. Officer

Shri Tapas Kr. Das

Helper-B

Shri Gour Gopal Paul

Tech. Assistant-B

Shri Suman Guchhait

Multi Tasking Staff (Technical)

Shri Subrata Ghosh

Tech. Asst.-A

Shri Ananda Karmakar

Technical Asst. A

Shri Sumanta Bagchi

Multi Tasking Staff (General)

Dr. Bholanath Mondal

Technical Supdt.

Shri Sachin Das

Technical Supdt.

Shri Sanjib Naskar

Tech. Asst. - B

Shri Sumit Ray

Tech. Asst. - B

Shri Goutam Biswas

Tech. Asst. - A

Shri Sridip Kumar Bera

Tech. Asst.-A

Shri Arunim Pal

Tech. Asst. - A

Shri Rabindra Nath Banik

Tech. Asst.-B

Shri Partha Kumar Rana

Senior Technician

Shri Sanjoy Kumar Sarkar

Tech. Asst.-A

Shri Mithu Mondal

Helper-B

Smt. Sunita Mondal

Multi Tasking Staff (General)

Shri Prasad Kr. Modak

Tech. Asst.-A

Shri Amarnath Dey

MTS (Technical)

Centre for Computer Research, Education and Services (CCRES)

Shri Abhra Paul

Technical Asst.-B

Ms. Rimi Chakraborty

Tech. Asst-B

Shri Asish Dhar

Assistant

Shri Rajesh Sharma

Multi Tasking Staff (General)



Workshop

Shri Dharmendra Singh Yadav

Senior Technician

Shri Pratap Tarafdar

Senior Technician (Electrical)

Shri Ramesh Kumar

Senior Technician

Shri Manoj Saha

Helper-A

Shri Prabir Kr. Debnath

Helper-B

Shri Subhas Bose

Multi Tasking Staff (General)

Shri Thakur Das Biswas

Helper-A

Shri Goutam Das

Helper-A

Shri Shekhar Mallik

Tech. Supdt.

Shri Rajib Debnath

Junior Engineer (Civil)

Shri Dibakar Majumdar

Junior Engineer (Civil)

Shri Samar Krishna Paul

Senior Technician

Shri Prabir Mondal

Helper-A

Shri Biswajit Saha

Helper-B

Shri Khageswar Karan

Helper-A

Canteen

Shri Sambhu Nath Mitra

Wash Boy cum Bearer

Smt. Bishaka Barik

Helper-E

Shri Biswarup Ghosh

Multi Tasking Staff (General)

Shri Tapan Kr. Bera

Cook-I

Shri Arindam Sarkar

Multi Tasking Staff (General)

Shri Surya Prakash Yadav

Multi Tasking Staff (General)

Annual Accounts, Audit Report & Budget



BALANCE SHEET

AS AT MARCH 31st, 2025

PARTICULARS	SCHEDULE	Current Year (Rs.)	Previous Year (Rs.)
CORPUS/CAPITAL FUND AND LIABILITIES			
Corpus/Capital Fund	1	2,322,806,802.00	2,249,548,412.00
Reserves and Surplus	2	326,989,831.00	328,317,930.00
Earmarked/Endowment Fund	3	459,928,306.00	410,823,800.00
Secured Loans and Borrowings	4	-	-
Unsecured Loans and Borrowings	5	-	-
Deferred Credit Liabilities	6	-	-
Current Liabilities and Provisions	7	84,406,975.00	102,879,082.00
Total :		3,194,131,914.00	3,091,569,224.00
ASSETS			
Fixed Assets at written down value	8	2,448,632,699.00	2,151,492,007.00
Investments - For Earmarked/Endowment Fund	9	143,430,284.00	71,363,486.00
Investments - Others	10	-	-
Current Assets, loans, Advances etc	11	602,068,931.00	868,713,731.00
Miscellaneous Expenditure (to the extent not written off or adjusted)			
Total :		3,194,131,914.00	3,091,569,224.00

Significant Accounting Policies Note. 1

Schedule 1 to 23 forming Part of Accounts

As per our attached report of even date.

For Span & Associates

(Chartered Accountants)

Firm's Registration No : 302192E



(S. Palit, Partner)

Membership No : 057072

UDIN : 24057072BHJM2567



Sarbani Saha

Registrar

IACS, Jadavpur, Kolkata - 700 032



Kalobaran Maiti

Director

IACS, Jadavpur, Kolkata - 700 032

INCOME AND EXPENDITURE ACCOUNT

FOR THE YEAR ENDED MARCH 31st, 2025

INCOME	Schedule	Current Year (Rs.)	Previous Year (Rs.)
Income form Sales/Services	12	4,000.00	155,050.00
Grants/Subsidies	13	1,466,783,017.00	1,343,557,532.00
Fees/Subscriptions	14	36,087.00	163,900.00
Income from Investments (Income on Investment from Earmarked/Endowment Funds transferred to funds)	15	2,993,400.00	3,813,379.00
Income from Royalty, publication, etc.	16	7,960,731.00	6,976,093.00
Interest Earned	17	9,142,479.00	6,910,403.00
Other Income	18	38,142,301.00	1,960,796.00
Increase/Decrease in stock of Finished goods and work-in-progress	19	-	-
Overhead money transferred from Overhead account		-	-
Overhead money received from Project		49,500.00	-
TOTAL (A)		1,525,111,515.00	1,363,537,153.00
EXPENDITURE			
Establishment Expenses	20	1,033,329,953.00	925,036,323.00
Other Administrative Expenses etc.	21	311,624,885.00	241,064,800.00
Expenditure on Grants & Subsidies	22	-	-
INTEREST	23	-	4,910,245.00
Consumables		61,258,567.00	48,513,168.00
Prior Period Expenses			
Annual Maintenance Expenses		30,739,539.00	25,140,700.00
Overhead money received from Project		-	-
Depreciation (Net total at the year end-corresponding to Sch.8)		221,524,677.00	166,882,680.00
Overhead Money Transferred to IACS Overhead A/C as per Sch 3		-	-
TOTAL (B)		1,658,477,621.00	1,411,547,916.00
Balance being excess of Income over Expenditure (A-B)		(133,366,106.00)	(48,010,763.00)
Transfer to Special Reserve (Specify)			
Transfer to/from General Reserve			
Balance being Surplus (Deficit) Carried to Corpus/Capital Fund		(133,366,106.00)	(48,010,763.00)

For Span & Associates

(Chartered Accountants)

Firm's Registration No : 302192E

(S. Palit, Partner)

Membership No : 057072

UDIN : 24057072BHJM2567

Sarbani Saha

Registrar

IACS, Jadavpur, Kolkata - 700 032

Kalobaran Maiti

Director

IACS, Jadavpur, Kolkata - 700 032

RECEIPTS AND PAYMENTS ACCOUNT

FOR THE YEAR ENDED MARCH 31st, 2025

Receipts	Current Year (Rs.)	Payments	Current Year (Rs.)
1. Bank Balances :		Expenses	
With Scheduled Banks:		a) Establishment Expenses	
a) General :		(corresponding to Schedule-20)	1,033,329,953.00
Current Account with :		b) Administrative Expenses	
SBI, Jadavpur Univ.	95,335,747.21	(corresponding to Schedule-21)	311,322,555.68
SBI, Kolkata Main	-	c) AMC for Laboratories - General	30,739,538.80
SBI, Jadavpur Univ. Flexi A/C	-	d) Consumables - General	61,258,567.33
Union Bank Ballygunj Br.		e) Revenue Expenses on A/C of Project	142,062,789.13
Union Bank Main Branch	220,795.15	f) Revenue Expenses on A/c of TRC	-
Reserve Bank of India A/C-General	-	Contribution to Medical Scheme : TRC	-
		Income Tax Deducted (194C) : TRC	246.00
		Sales Tax Deducted At Source : TRC	-
		Labour Welfare Cess : TRC	-
		Security Deposit : TRC	-
		Income Tax Deducted From Salary : TRC	-
		Professional Tax - TRC	-
b) Project Fund:		Payments made against fund for various projects	
Current Account with:		Expenses incurred for Spl. End. Fund - IACS	
SBI, Jadavpur Univ.	3,482,506.42	(corresponding to Schedule-22)	-
Cheques in hand	-	Interest	
Union Bank - Ballygunj Br.	5,049,685.80	(corresponding to Schedule-23)	-
Union Bank - TDR A/c Project	88,000,000.00	Refunded to DST on A/c of TRC Project	-
SBI-SERB Account, Jadavpur University	58,059,906.37		
SBI IACS A/C ITDD, Project	8,414,509.31	Opening Balance	
Bank of Maharashtra A/C 2562	-	1. Bank Balances :	
Bank of Maharashtra A/C 8238	-	Bank Balance - Union Bank Flexi A/C (Opening)	4,503,978.63
Bank of Maharashtra A/C 3033	1,695,863.00		
ICICI Bank Ltd A/C 3674	-		
Reserve Bank of India A/C 1304 - Project	-		
Union Bank Ballygaunge Branch	-		
Unon Bank Flexi A/C	-		
Union Bank A/C 8585 - Project	7,467,352.98		
c) TRC A/c:		Investments and Deposits made	
Union Bank Ballygaunge Branch	-	Out of Earmarked/Endowment funds	
Union Bank Ballygaunge Branch -Flexi A/C	-	Others (to be specified)	
Union Bank A/C 8585 - Project	-		
		TDR with SBI -(Fixed Deposit with Bank)	
2. Cash Balances :			
a) General :		Out of Own funds (Investments-Others)	
Imprest Cash	750,185.94	TDR with Union Bank	
Cash in hand	-	Income Tax Receivable A/c TRC	
Sundry Debtors	51,700.00		
Grants Received :		Expenditure on Fixed Assets & Capital Work-in-Progress	
1. Central Government - Plan	1,678,783,017.00	Purchase of Fixed Assets	507,282,058.44
Non-Plan	-	Expenditure on Capital Work-in-Progress	5,750,000.00
2. State Government - Plan	-	Capital Expenditure Account Project	0.02
Non-Plan	-		
Total of Page 01	1,947,311,269.18	Total of Page 01	2,096,249,687.03
Balance B/F Page 01	1,947,311,269.18	Balance B/F Page 01	2,096,249,687.03

RECEIPTS AND PAYMENTS ACCOUNT

FOR THE YEAR ENDED MARCH 31st, 2025

Receipts	Current Year (Rs.)	Payments	Current Year (Rs.)
Grant received on account of Project	176,632,169.21	Refund of Surplus Money/Loan	
IACS Supporting Grant received on account of Project	16,600,076.00	To the Government of India (General Fund Interest)	-
Grant received on A/C TRC	-	To the State Government	
		To the other providers of funds	
		Infrastructure A/c TRC (Deposit with CPWD)	-
		Equipment A/c TRC	-
Interest Received :			
General A/C's:		Amount Borrowed	
Interest on TDR (Project)	3,311,755.05	Term Deposit	
Interest on Fixed Deposit	-		
Interest received from SBI IACS A/C ITDD	168,848.00		
Interest on House Building	868,746.00	Any other receipts	
Interest on Research Endowment Fund	-	General A/C's : (Loans and Advances)	
Interest on Vehicle Advance	1,367.00	Advance - General	9,301,750.00
Interest on TDR against Margin Money	7,830,543.00	Advance - LTC	1,231,912.00
Interest on Computer Advance	44,294.00	Advance - Medical	-
Interest on Security Deposit (CESC)	-	Advance - Vehicles	-
Interest on TDR on Short Term Deposit	264,829.00	Advance - Computer	-
Interest on Term Deposit A/c - TRC	-	Advance - Puja	-
Interest on TDR against Margin Money - TRC	-	Advance - House Building	-
		Advance against Consumables	-
Other Income: Income from Sales and Services		Advance - A/c TRC	-
		Other Current Assets / Liabilities	21,052,551.00
General A/C's :		Accounts Receivable	-
Analytical Charges	4,000.00	Contribution to GSLI	141,430.00
Sale of Liquid Nitrogen	-	Security Deposit by IACS	-
Photo Copy charges	-	TDR with Union Bank	-
Income from Liquidated damage	-	TDR with SBI	-
Miscellaneous Income	1,893,360.50	Margin Money A/c TRC	-
Hall Rent	-	Receivables	-
Admission Fees For Int. Ph.D.	-	Accounts Receivable - Project	12,030,151.05
S & T Consultancy	36,087.24	Overhead money transferred from Overhead account	-
Garage Rent (Basundhara)	-	Overhead money received from Project	-
Ordinary Membership Subscription	-	Imprest Cash addition	-
Income from TDS Refund	132,700.00	Margin Money	-
Intellectual Fees	-	GST ITC Receivable	1,393,145.00
Overhead money transferred from Overhead account	-	GST Adjustment	-
Creche Receipts	-	Income Tax Receivable (TDS on A/C of S&T Consultancy)	-
Rent For Guest House	(302,329.00)	Advance - Project	999,446.50
Overhead from Project	49,500.00	Income Tax receivable A/C TRC	-
		Performance Security Deposit - Project	-
Total of Page 02	2,154,847,215.18	Total of Page 02	2,142,400,072.58
Balance B/F Page 02	2,154,847,215.18	Balance B/F Page 02	2,142,400,072.58

RECEIPTS AND PAYMENTS ACCOUNT

FOR THE YEAR ENDED MARCH 31st, 2025

Receipts	Current Year (Rs.)	Payments	Current Year (Rs.)
Income from Technopreneurship	-	TDR - Project	-
Hostel seat rent	2,993,400.00	Margin Money (Project)	-
Publication Income - IJP	-	Unclaimed GPF	-
Income from Scientific & Technical Consultancy	-	Advance for TRC Project A/C CPWD	148,185,072.00
Analytical Charges - Project	-	Prior Period Income	-
Analytical Charges - TRC	-	Income Tax Refund	-
Income Tax Refund	570,502.56	Credit Liabilities Written Back	-
Scientific & Technical Consultancy - TRC	-	General A/C's (Current Liabilities)	
Income from Royalty	7,960,730.95	Caution Money - Integrated Phd.	20,000.00
Prior Period Income	194,907.00	Earnest Money written back	98,840.00
Credit Liabilities Written Back	33,566,620.45	Earnest Money	782,411.00
Amount Borrowed	-	Security Deposit from Contractors	4,973,176.00
Any Other Receipts		Security Deposit written back	-
General A/C's (Loans and Advances)		Security Deposit A/C Project:	-
Advance General	9,158,564.00	IISF A/c (2019)	-
Advance - LTC	1,231,872.00	Earnest Money A/c TRC	-
Advance - Medical	-	Secutiry Deposit A/c TRC	-
Advance - Vehicles	3,000.00	Contribution towards Corpus/Capital Fund Govt. of W.B Plan Grant	-
Advance - Computer	17,961.00	General A/C's (Other Liabilities)	
Advance - Puja	-	General Fund	-
Advance - House Building	200,516.00	GST Liability of other A/C paid from general fund	-
Advance against Consumables	-	Advance received on other A/C of General fund	-
		House Building Loan from Union Bank	1,964,657.00
Margin Money A/C TRC	-	Income Tax Deducted from Salary	80,603,838.00
Receivables	-	Income Tax Deducted U/S 194C	2,107,228.00
Other Current Assets / Liabilities	6,917,744.00		
Accounts Payable	-	Income Tax Deducted U/S 194J	4,443,733.00
Contribution to GSLI	142,620.00	Income Tax Deducted U/S 195	-
Security Deposit by IACS	-	Insurance Premium under SS Scheme	2,380,435.00
TDR with Union Bank	2,000,000.00	Professional Taxes	537,280.00
TDR with SBI	-	Profession Tax (Project)	968.00
Accounts Payable - Project	-	SAE Co-operative Credit Society	22,410,116.00
Imprest Cash A/C TRC	-	SAE Benefit Society	-
Margin Money	319,094,854.00	SAE Provident Fund	23,837,000.00
GST ITC Receivable	2,786,290.00	Income Tax Deducted from Pension	25,927,561.00
GST Adjustment	-	TDS on GST (TRC)	10,833.00
Income Tax receivable A/C TRC	2,082,383.00	GST Liability (TRC)	-
Performance Security Deposit - Project	-	Sales Tax Deducted from Contractors	270,656.00
Advance - Project	-	Labour Welfare Cess	364,026.00
TDR - Project	-	Attachment of Pay	-
Margin Money (Project)	10,711,690.00	Service Tax	-
		Goods & Service Tax	202,049,528.54
Deposit Account	64,090,686.00	Deposit Account	59,911,600.00
Total of Page 03	2,618,571,556.14	Total of Page 03	2,723,279,031.12
Balance B/F Page 03	2,618,571,556.14	Balance B/F Page 03	2,723,279,031.12

RECEIPTS AND PAYMENTS ACCOUNT

FOR THE YEAR ENDED MARCH 31st, 2025

Receipts	Current Year (Rs.)	Payments	Current Year (Rs.)
Contribution to GSLI - Project	-	Income Tax Receivable	573,002.56
		RCM GST	301,004.00
Outstanding Liabilities	15,520,238.00	Deputation Remittance	-
Hostel Seat Rent - Project	27,420.00	Outstanding Liabilities	9,453,907.00
		Hostel Seat Rent - Project	-
General A/C's (Current Liabilities)		Income Tax (Project)	-
Caution Money - Integrated Phd.	-	Contribution to GSLI - Project	-
Earnest Money	591,692.00	Unallocated Payments - Project	-
Earnest Money written back	-	CMS (Project)	-
Security Deposit from Contractors	3,062,037.40	Grant transferred to TRC from Project	-
Security Deposit written back	-	Capital Grant transferred to IACS Project	16,446,676.00
IISF A/c (2019)	-	Accrued Income from Publication	-
Contribution towards Corpus/Capital Fund Govt. of W.B Plan Grant	-	Life Membership Fees	-
General A/C's (Other Liabilities)		Loan Received From Corporate Accounts	-
General Fund	-	Closing Balances:	
GST Liability of other A/C paid from general fund	-		
House Building Loan From Union Bank	1,952,976.00	1. Bank Balances:	
Income Tax Deducted from Salary	80,660,282.00	With Scheduled Banks:	
Income Tax Deducted U/S 194C	2,066,799.00		
Income Tax Deducted U/S 194J	4,595,894.00		
Income Tax Deducted U/S 195	-	a) General :	
Income Tax Deducted from Pension	31,932.00	Current Account with:	
Insurance Premium under SS Scheme	2,380,435.00	SBI, Jadavpur Univ.	83,332,292.11
Professional Taxes	537,280.00	SBI, Main Br.	-
SAE Co-operative Credit Society	22,410,116.00	Union Bank Ballygunj Br.	2,360,012.30
SAE Benefit Society	22,970.00	Union Bank Main Branch	220,795.15
SAE Provident Fund	23,837,000.00	SBI, Jadavpur Univ. Flexi A/C	-
		Reserve Bank of India A/C-General	-
Sales Tax deducted from Contractors	270,656.00		
Labour Welfare Cess	378,174.00	b) Project Fund:	
Attachment of Pay	-	SBI, Jadavpur Univ. Branch	9,158,161.64
Profession Tax (Project)	-	Union Bank - TDR A/c Project	91,000,000.00
Service Tax	-	Union Bank Ballygunj Br.	2,907,616.84
Loan Received From Corporate Accounts	1,760,832.00	SBI-SERB Account, Jadavpur University	53,562,291.76
		SBI IACS A/C ITDD, Project	5,059,802.31
		Bank of Maharashtra A/C 2562	-
		Bank of Maharashtra A/C 8238	-
		Bank of Maharashtra A/C 3033	-
		ICICI Bank Ltd A/C 3674	-
Goods & Service Tax	243,556,585.50	Reserve Bank of India A/C 1304 - Project	-
		Union Bank Ballygaunge Branch	-
		Unon Bank Flexi A/C	-
		Union Bank A/C 8585 - Project	27,921,913.31
TDS on GST (Project)	207,778.00	c) TRC A/c:	
Deputation Remittance	-	Union Bank Ballygunj Br.	-
Income Tax Receivable	3,656,350.00	Union Bank Flexi	-
RCM GST	88,632.00	Union Bank A/C 8585 - Project	-
CMS - TRC	-		
Income Tax Salary TRC	153,107.00	Grant Receivable from Govt. of W.B.	-
Income Tax U/s 194C - TRC	-	Grant Receivable from Central Government A/c	-
Total of Page 04	3,026,340,742.04	Total of Page 04	3,025,576,506.10
Balance B/F Page 04	3,026,340,742.04	Balance B/F Page 04	3,025,576,506.10

RECEIPTS AND PAYMENTS ACCOUNT

FOR THE YEAR ENDED MARCH 31st, 2025

Receipts	Current Year (Rs.)	Payments	Current Year (Rs.)
TDS on GST (TRC)	-		
GST Liability (TRC)	-		
Income Tax (Project)	5,823.00		
Income Tax U/s 194J - TRC	(1,923.00)	2. Cash Balances:	
Grant Receivable from Govt. of West Bengal	-	a) General:	
Grant Receivable from Central Government A/c	-	Imprest Cash	730,185.94
Income Tax Receivable S & T	-	Cash in hand	-
Accrued Income from Publication	-	Imprest Cash TRC	-
Life Membership Fees	-	Sundry Debtors	51,700.00
Outstanding Liabilities	-		
CMS (Project)	13,750.00		
Closing Balances:		3. Bank Balance - General (O/D)	
1. Bank Balances:			
Bank Balance - Union Bank Flexi A/C (Closing)		SBI - JU (Opening)	
		Union Bank Ballygunj Br.	
	3,026,358,392.04		3,026,358,392.04

Schedule 1 to 23 forming part of Accounts as per our attached report of even date

For Span & Associates

(Chartered Accountants)

Firm's Registration No : 302192E

Sarbani Saha

Sarbani Saha

Registrar

IACS, Jadavpur, Kolkata - 700 032

S. Palit

(S. Palit, Partner)

Membership No : 057072

UDIN : 24057072BHM2567

Kalobaran Maiti

Kalobaran Maiti

Director

IACS, Jadavpur, Kolkata - 700 032

SCHEDULES FORMING PART OF BALANCE SHEET

AS AT MARCH 31st, 2025

SCHEDULE 8 : FIXED ASSETS

SL No	Particulars	GROSS BLOCK		DEPRECIATION			NET BLOCK AS ON 31.03.25
		Balance as on 01.04.2024	Addition during the year	Deduction during the year	Total	Depreciation as on 01.04.24 Depreciation for the year	
1	Land (Jadavpur)	315,511,000.00	-	-	315,511,000.00	-	315,511,000.00
2	Land (Baruipur)	347,082,598.00	-	-	347,082,598.00	-	347,082,598.00
3	Software - Oracle	107,023,225.51	19,399,082.10	-	126,422,307.61	21,431,335.34	105,972,082.11
4	Building and Sheds	551,877,611.00	20,197,370.00	-	572,074,981.00	273,444,574.57	302,298,646.71
5	Building and Sheds (Baruipur)	-	-	-	-	-	-
6	Residential Building	1,734,000.00	-	-	1,734,000.00	34,438.50	1,079,668.55
7	Plant & Machinery	1,442,336,424.26	451,015,179.85	-	1,893,351,604.11	898,475,070.32	1,032,982,055.67
8	Computers	225,101,088.21	14,188,769.95	-	239,289,858.16	209,801,707.61	15,890,817.53
9	Electrical Installation	103,715,160.38	1,040,840.80	-	104,756,001.18	81,904,641.86	225,692,525.14
10	Vehicles	4,073,545.00	-	-	4,073,545.00	3,292,835.35	85,303,964.23
11	Tubewell & W. Supply	6,705,845.40	909,000.10	-	7,614,845.50	117,106.45	3,409,941.80
12	Capital Work-in-progress (CPWD)	445,708,561.90	5,750,000.00	-	451,458,561.90	3,369,069.20	3,793,646.58
						-	451,458,561.90
	Sub Total	3,550,869,059.66	512,500,242.80	-	4,063,369,302.46	1,555,874,875.73	2,507,494,426.73
13	Furniture & Fixture (Incl. other Furniture & Fixture)	42,227,000.80	4,176,237.60	-	46,403,238.40	25,017,995.58	21,385,242.82
14	Office Equipment	24,835,994.60	561,082.30	-	25,397,076.90	18,336,650.19	7,060,426.71
	Sub Total	67,062,995.40	4,737,319.90	-	71,800,315.30	43,354,645.77	28,445,669.53
15	Books	511,993,204.42	130,985.00	-	512,124,189.42	408,729,358.89	103,394,830.53
16	Subscription to e-journal	46,683,174.07	708,010.74	-	47,391,184.81	17,157,545.82	30,233,638.99
	Sub Total	558,676,378.49	838,995.74	-	559,515,374.23	425,886,904.71	133,628,469.52
	Sub Total					13,320,897.38	120,307,572.14

SCHEDULES FORMING PART OF BALANCE SHEET

AS AT MARCH 31st, 2025

SCHEDULE 8 : FIXED ASSETS

SL No	Particulars	GROSS BLOCK		Total	DEPRECIATION		NET BLOCK AS ON 31.03.25
		Balance as on 01.04.2024	Addition during the year		Depreciation for the year	Total Depreciation	
	Cumulative Total	4,176,608,433.55	518,076,558.44	4,694,684,991.99	220,935,866.48	2,246,052,292.69	2,448,632,699.30
	Previous Year	3,930,052,082.98	246,556,349.57	4,176,608,432.55	168,357,253.85	2,025,116,426.21	2,151,492,007.00

Note:

- On the basis of the decision of the Finance Committee of IACS in its meeting held on 19.06.2007, the updated value of Fixed Assets has been adopted in the Final Accounts of 2006-07
- Total amount of Depreciation calculated during the year has been charged to Income & Expenditure A/C Rs. 221524677/- and Rs. 1328099/- against Revaluation Reserve.
- Depreciation other than Books has been charged at the rate as provided by the Income Tax Act, Depreciation on books has been charged @ 10% p.a.

Sarbani Saha

Sarbani Saha
Registrar
IACS, Jadavpur, Kolkata - 700 032

For Span & Associates

For Span & Associates
(Chartered Accountants)
Firm's Registration No : 302192E

Kalobaran Maiti

Kalobaran Maiti
Director
IACS, Jadavpur, Kolkata - 700 032

BUDGET AT A GLANCE

				(Rupees in Lakhs)	
EXPENDITURE	Actual Expenditure 2024-25	Projected Budget 2024-25 as approved by F.C. Dt. 30.7.2024	Projected Budget 2025-26	Projected Revised Budget 2025-26	Projected Budget 2026-27
Revenue	Total	Total	Total	Total	Total
Establishment ,Salary,Fellowship, Pension, Superannuation etc.	10,333.30	11,845.47	12933.08	13433.29	15499.95
ESTABLISHMENT Other essential Establishment expenditure (electricity, telephone, medical, etc.)	1,388.45	1,475.45	1526.25	1804.99	2082.68
CONTINGENCIES (Office Expenses)	2,434.89	1,288.74	1155.74	3165.36	3652.34
CONSUMABLES (Laboratory Expenses, Library, Workshop, Research Publication, Civil Maintenance,etc.)	612.59	1,190.94	3205.92	796.37	918.89
TOTAL	14,769.23	15800.60	18820.99	19200.01	22153.86
Capital					
Books	8.39	130.05	130.05	10.91	12.59
Equipment & Research Facilities	3,806.29	2,426.00	2426.00	4948.18	5709.44
Building (Works with CPWD and Development of Present campus & Baruipur Campus)	1,354.70	2,001.00	3501.00	1761.11	2032.05
Electrical augmentation ,etc.	10.41	100.00	100.00	13.54	15.62
Implementation of Open Access Publication					
Office Computerisation,Software/ Digitisation of Old Record	143.55	300.00	300.00	186.62	215.33
Installation of Safety Measures	-	100.00	100.00	100.00	100.00
Science Outreach	-	50.00	50.00	50.00	50.00
Solar Panel at present Campus	-	100.00	100.00	100.00	100.00
GRAND TOTAL	20,092.57	21,007.65	25528.04	26370.37	30388.89

BUDGET AT A GLANCE

RECEIPTS	Actual Receipt (Audited) 2024-25	(Rupees in Lakhs)		
	Total	Projected Budget 2025-26	Projected Revised Budget 2025-26	Projected Budget 2026-27
Opening Balance	0.00			
Government of India Grant received for 2024-25 (Fund Utilised)	16788.00	25528.04	26370.37	30388.89
Government of West Bengal	0.00			
IACS Income	132.02			
Loan from project	0.00			
Add : Decrease in Margin Money	3172.55			
	20092.57	25528.04	26370.37	30388.89

Note : Received from University amounting to Rs. 277 lakhs and Overhead money transferred from Overhead Account amounting to Rs. 19.75 lakhs for the F.Y. 2024-25

Sarbani Saha

(Sarbani Saha)

Registrar

Kalyan Maiti

Professor K.B. Maiti

Director

Independence Auditor's Report

To the Members of the Council

Qualified Opinion

We have audited the accompanying financial statements of Indian Association for Cultivation of Science – (IACS) which comprise the Balance Sheet at 31st March, 2025, and the Income & Expenditure Account, Receipts & Payment Account for the year then ended, together with 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, except for the effect of the matter described in the Basis for Qualified Opinion section of our report, the accompanying financial statements give a true and fair view of the financial position of the Institute as at 31st March, 2025, and of its financial performance for the year then ended.

Basis for Qualified Opinion

1. A pending CBI Case for fraudulent legal payment amounting to Rs. 57.00 lakhs is going on against which Rs. 57.00 lakhs of Gratuity & Leave Salary Encashment of concerned employee has been withheld by the organisation.

We conducted our audit in accordance with the Standards on Auditing (SAs) issued by ICAI. 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 Institute in accordance with the ethical requirements that are relevant to our audit of the financial statements in India, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our qualified opinion.

Emphasis of Matter

We draw attention to the following matters:

1. Advance to CPWD to the tune of Rs. 16,11,68,433.10 & Rs. 12,00,000.00 was appearing in the books of

accounts as on 31.03.2025. As per CPWD Form 65 till March, 2025 IACS deposited a total of Rs. 17,50,88,800.00 to CPWD for 5 nos of projects out of which total expenditure incurred by CPWD till 31.03.2025 was Rs. 2,45,18,057.00. Balance fund available with CPWD as on March, 2025 is of Rs. 15,05,70,743.00. As per the status report, capital work related to 5 projects are under progress as 31.03.2025. IACS is yet to reconcile the Advance to CPWD appearing in books of accounts as on 31.03.2025 with the balance fund available with CPWD as on March, 2025.

2. Physical verification of Fixed Assets has not been carried out during the year. Fixed Assets Register has not been properly maintained.
3. Referring to clause 46 of MOA which inter-alia includes that the "Accounts shall be subject to Internal Audit by an Independent Qualified Chartered Accountants or a firm of Chartered Accountants". No such Internal Audit was conducted during 2024-25.
4. The following balances have been written-off/adjusted by IACS during FY 2024-25 based on approval given by Competent Authority:
 - a. A debit balance of Rs. 153107.00 against GL code - 2070225 "Income Tax recovered from Salary".
 - b. A credit balance of Rs. 3,35,66,620.50 against GL code 2070502 "Suspense Account-Project".
 - c. A balance of Rs. 20,82,383.00 against Income Tax Receivable A/C TRC.
 - d. Long pending wrong debit by Bank to the tune of Rs. 84507.23.
 - e. Negative balance to the tune of Rs. 12140819.68 relating to 127 nos of Projects & Unspent balance to the tune of Rs. 13098610.10 relating to 132 nos of dormant Projects be adjusted under Contingency Head.
5. Accounting Software run in Oracle, operated by an outside agency needs substantial improvement. Concept of Audit Trail is not available in the system.



Our opinion is not modified in respect of these matters.

Key Audit Matters

Key audit matters are those matters that, in our professional judgment, were of most significance in our audit of the Financial Statements of the current period. In this audit we have not determined any specific Key Audit Matter to be addressed separately.

Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with the aforesaid Accounting Standards, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error. In preparing the financial statements, management is responsible for assessing the Institute's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Institute or to cease operations, or has no realistic alternative but to do so. Those charged with governance are responsible for overseeing the Institute's financial reporting process.

Auditor's Responsibilities 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.

Meaning of Internal Financial Controls over Financial Reporting

An organisation's internal financial control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. An organisation's internal financial control over financial reporting includes those policies and procedures that

- (1) pertains to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the organisation;
- (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the organisation are being made only in accordance with authorisations of management and directors of the organisation; and
- (3) provide reasonable assurance regarding prevention or timely detection of unauthorised acquisition, use, or disposition of the organisation's assets that could have a material effect on the financial statements.

Inherent Limitations of Internal Financial Controls Over Financial Reporting

Because of the inherent limitations of internal financial controls over financial reporting, including the possibility of collusion or improper management override of controls, material misstatements due to error or fraud may occur and not be detected. Also, projections of any evaluation of the internal financial controls over financial reporting to future periods are subject to the risk that the internal financial control over financial reporting may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Opinion

In our opinion such internal financial controls over financial reporting needs improvement considering the essential components of internal control stated in the Guidance Note on Audit of Internal Financial Controls Over Financial Reporting issued by the Institute of Chartered Accountants of India.

Place: Kolkata
Date:

For, **S P A N & Associates**
Chartered Accountants
FRN: 302192E



(S. Palit)

Partner
Membership No: 057072

Photo Gallery







Indian Association for the Cultivation of Science

Deemed to be University under section 3 of UGC act, 1956

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