# Physics Pulse

IIT (ISM) DHANBAD

VOL.II No.7 JULY 29, 2025 PHYSICS NEWSLETTER*


## *New Faculty Members*

**Prof. Samapika Mallik** joined the department as an Assistant Professor on 16 July, 2025.

Prof. Mallik brings with her a rich background in experimental physics and emerging technologies. She earned her Ph.D. from IIT Patna in 2021 under the guidance of Prof. Alpana Nayak. After her doctoral work, she gained valuable international research experience as a postdoctoral fellow at the National Institute for Materials Science (NIMS), Tsukuba, Japan, and later at the Research Center for Neuromorphic AI Hardware, Kyushu Institute of Technology, Japan.

### Interview | Prof. Bobby Antony

The Newsletter Team interviewed **Prof. Bobby K. Antony**, following the completion of his term as HOD. Read more »

Prof. Mallik's research interests lie in the areas of resistive switching devices, ion-gated neuromorphic devices, artificial neural networks, and physical reservoir computing for artificial intelligence (AI) applications. Her research publications can be found here.

We are excited about the expertise she brings to our department!

Welcome aboard, Prof. Mallik!

**Prof. Sumit Kumar** joined the department as an Assistant Professor on 14 July, 2025.

Prof. Kumar completed his Ph.D. at Institut Néel CNRS, Grenoble, France (2017–2021), where he worked on superconducting microwave optomechanics. His doctoral research focused on ground-state cooling of macroscopic mechanical resonators for applications in quantum sensing and quantum information processing.

### Visiting Professor | UoK

**Prof. Bobby Antony** has been honored with a Visiting Professorship at the University of Kent, United Kingdom.

He earned his Master's degree in Nanoscience and Engineering from Indian Institute of Science (IISc) Bengaluru (2015–2017), and his undergraduate degree in Engineering Physics from Indian Institute of Technology, Delhi (2010–2014).

Following his Ph.D., Prof. Kumar worked as a postdoctoral researcher at Royal Holloway, University of London (2021–2025). There, he was part of the UKRI-funded QSimFP (Quantum Simulations for Fundamental Physics) project under the Quantum Technologies for Fundamental Physics (QTFP) programme. His work involved developing superfluid optomechanical platforms using helium-4 films coupled to high-impedance superconducting microwave resonators. He also explored experimental analogues of gravity using third sound

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modes, with potential applications in quantum sensing, analogue cosmology, and quantum field theory in curved spacetime.

Prof. Kumar's research lies at the fascinating intersection of quantum optomechanics, superconducting circuits, and superfluid hydrodynamics. His interests extend to analogue gravity simulations using superfluid helium, with the goal of probing quantum field dynamics in curved spacetime. These novel platforms hold promise for precision sensing, quantum information science, and foundational tests of physics.

We extend a warm welcome to Prof. Kumar and look forward to his contributions to our academic community!

# *International Visits*

**Prof. Ritwik Mondal** visited Uppsala University, Sweden and attended the conference: Trends in Magnetism 2025 where many theorists and experimentalists presented their recent developments.

This conference was organized by IEEE Magnetism at the Ångström Laboratory, Uppsala, from 16 to 19 June, 2025. Prof. Ritwik presented an invited talk on "Inertial Magnons and Their Topology". In this talk, he discussed the differences between precessional magnons and inertial magnons, with a focus on the unique properties of the latter. He and his group, the Ultrafast Terahertz Spintronics Group (UTSG) at IIT (ISM) Dhanbad, have developed a linear response and linear spin wave theory to describe inertial magnons. Mr. Subhadip Ghosh from UTSG has contributed to this work. Ritwik also elaborated on the topology of inertial magnons and how it differs from that of precessional magnons.

**Prof. Ritwik Mondal** visited the University of Konstanz, Germany as part of the PECFAR Fellowship awarded by the Indo-German Science Technology Centre (IGSTC), New Delhi. He delivered an invited talk titled "Field-Derivative Torque: Modifying the Landau-Lifshitz-Gilbert Equation for Magnetic Systems," at the SFB 1432 Colloquium.

In his talk, Prof. Mondal discussed recent advancements from his Ultrafast Terahertz Spintronics Group (UTSG), focusing on extensions of the Landau-Lifshitz-Gilbert (LLG) equation to better describe light-spin interactions in magnetic systems. A deeper understanding of these interactions is crucial for manipulating magnetization through optical methods on ultrafast timescales.

He highlighted that while the conventional Zeeman torque induced by terahertz (THz) electromagnetic fields has been effective in controlling magnetic excitations, it alone cannot fully explain the observed magnetization dynamics. Prof. Mondal introduced the concept of a relativistic field-derivative torque, which plays a critical role in accurately capturing the spin dynamics. This work is a collaborative effort between the experimental group at NISER, Bhubaneswar, and the theoretical group at IIT (ISM), Dhanbad.

In addition to the colloquium, Prof. Mondal actively interacted with both theoretical and experimental research groups at the University of Konstanz. These discussions spanned a wide range of topics related to ultrafast magnetism, spin dynamics, and light-matter interactions, providing a platform for the exchange of ideas and mutual insights. The visit exemplified the spirit of international scientific cooperation fostered by the PECFAR Fellowship and the IGSTC initiative.

**Prof. Binata Panda** visited the Division of Chemical Physics at Lund University, Sweden, from 21 May to 20 June 2025. The primary aim of the visit was to explore academic collaborations with various divisions at Lund University.


During the visit, she delivered a seminar as part of the

Science Coffee Seminar series titled "Transport Phenomena in Hot and Dense QCD Matter Using Novel Relaxation Time Models" at the Division of Particle and Nuclear Physics, Lund University. The talk highlighted the results of her group's recent research on transport coefficients—such as electrical conductivity, thermal conductivity, and thermoelectric coefficients—of a Quark-Gluon Plasma (QGP) system using improved kinetic theory approaches, including a novel relaxation time approximation and a novel BGK model.

These results are crucial for understanding the QGP's response to external perturbations and are significant in the context of current experimental and theoretical studies in High Energy Physics.

This research is a collaborative effort between the experimental high energy physics group led by Prof. Sadhana Dash at IIT Bombay and the theoretical high energy physics group led by Prof. Binata Panda at IIT (ISM) Dhanbad.

During her visit, Prof. Panda also engaged with both theoretical and experimental high energy physics groups at the Division of Particle and Nuclear Physics, Lund, advancing discussions on QCD matter, LHC physics, and dark matter physics.

## Interview with Prof. Bobby Antony

**By NEWSLETTER TEAM**

In this edition, we are delighted to feature an interview with **Prof. Bobby K. Antony**, immediate past HOD of the Department of Physics.

**Q.** *Can you take us back to the first day you assumed the role of Head of the Department? How did it feel stepping into this position of leadership? Did you ever aspire to become the Head of the Department someday?*

**A.** As a matter of fact, I never thought that I would be considered for this position. I was visiting University of Kent, UK, in an exchange program when I received a call from the then Director about the position. After a moment of thinking, I accepted the role as I believed that I could bring a new perspective to the vision of our department.

**Q.** *What were your key priorities when you first took over as the Head of the Department? Looking back, how many of those goals have you been able to accomplish?*

**A.**The department has progressed steadily in the last decade. However, we still lacked in a few aspects in 2022: (1) faculty members in some key specializations, (2) sitting chambers for existing and future faculty colleagues, (3) sitting places for research scholars, (4) opportunity for our students to listen and interact with the experts in varied fields, (5) a chemical laboratory for the experimentalists who required wet lab for their reactions, (6) our presence on social media, (7) an alumni network, etc. I am happy that with the help of my faculty and staff colleagues, we have achieved these goals in the last 3 years.

**Q.** *Researchers often consider administrative roles as additional burdens. How did you manage to strike a balance between research and administration?*

**A.** I agree that it is a burden and often considered a thankless job! However, as a family member of the department, it is our duty to support the department in its growth and shape our students to be the best citizens of tomorrow. I tried my best to balance teaching, research and administration during the last 3 years. However, I am sure that there were some unintentional lapses, which my students have accepted wholeheartedly. I thank all of them for their support so that I could manage these roles smoothly.

**Q.** *During your tenure as HoD, what initiatives or improvements within the department are you most proud of?*

**A.** I am proud of many things. One of the foremost is the selfless backing of my colleagues and students on many avenues we introduced, even though it was a burden on them. With their constant support we could make a few improvements in the department, viz., (1) revamping of UG/PG courses, (2) introduction of BS-MS in physical sciences, (3) recruitment of faculty members in specialized areas like, quantum computation, biophysics, particle physics, astrophysics and cosmology, (4) introduction of science day celebration with lectures, debates, quizzes and research conclave, Science fest for 3 consecutive years, which earned praise from The Director and invited speakers, (5) establishment of wet chemical laboratory, (6) modernization of UG and PG laboratory with air conditioning and modular tables, (7) refurbishment of Raman Hall (Situation Room), and the Department office (8) establishing research scholar sitting room, (9) conversion of store room and computer lab to faculty chambers, (10) introduction of alumni meet, etc. Besides, with the help of my colleagues we invited senior researchers/professors to visit the department for extended periods (Prof. Nigel Mason, University of Kent, UK; Dr. Alexander Mook, Johannes Gutenberg University of Mainz, Germany, Prof. Bijay Kumar Agarwalla, IISER Pune). Finally, a team from department defended our proposal for DST FIST grant and got sanctioned Rs. 207 lakhs.

**Q.** *What steps did you take to enhance the visibility and academic output of the Department of Physics at IIT (ISM) Dhanbad?*

**A.** With the help of our faculty and student team we regularly updated our website, social media handles and released our achievements through monthly newsletters. We invited many tall figures in research from India and abroad to give talks and interact with students. We encouraged our faculty colleagues to visit labs abroad to establish collaborations and sign MOUs (we signed an MOU with the Graduate School of Science and Technology, Meijo University, Japan), which was a great success. Thus, we connected with many institutes and personnels in India and abroad and shared our achievements by connecting with them through social media. We created an alumni network and started alumni meet in January (2024).

**Q.** *How did you ensure smooth coordination and communication among faculty members, staff members and students, particularly during crucial periods such as admissions, examinations and institutional reviews?*

**A.** This was probably easier than I expected. When it comes to the development and growth of the department and institute, we all had one voice. I realized that if you talk to your colleague or student straight from your heart and frankly, they understand and accept it, even if it is bitter in taste.

**Q.** *Could you share some of the most challenging decisions you had to make as the Head of the Department? How did you approach and resolve those situations?*

**A.** I don't think there were any difficult situations or decisions I have taken alone as Head of the department. All critical or important decisions were taken together with the support of all faculty colleagues in the departmental meetings. We resolved all issues by discussing them in the meeting and coming to a common ground.

**Q.** *Were there any specific initiatives you introduced to support young faculty members or early-career researchers/ Post Doc fellows in the department?*

**A.** Other than sharing my experience, supporting them as much as I could and guiding them towards opportunities, I haven't done anything special. In this regard I made sure that young faculty colleagues get lab space and other essential things to start their research. I encouraged them to apply for external funding and build collaborations in India and abroad. Whenever they faced any issues, I tried my best to solve them with help from the institute administration. Currently we are hosting an inspire faculty in our department. We supported the application of several young and excellent candidates for their Ramanujan, Inspire and NPDF fellowships.

**Q.** *Over your tenure as the HoD, what are some of the key lessons you've learned as an academic leader?*

**A.** No matter what, believe in yourself and your team. Never hesitate to learn and change for the good!

**Q.** *As you pass on the baton, what are your hopes for the future of the Department of Physics?*

**A.** The department has the potential to grow as one of the best physics departments in the country. Our faculty strength has grown to 31 and our young colleagues are working in research areas that are unique and very interesting. All of them have excellent experiences from the top institutes in India and abroad. They are the future of the department. I am sure that they will take it to the next level.

**Q.** *Are there any decisions made during your term that you regret in hindsight? If so, could you share what they were and why?*

**A.** I don't think so. Whatever decision we made during my tenure was always taken keeping the best interest of the department. Hence, I don't regret any decision I made during my term.

**Q.** *Is there anything you had wished to accomplish as HoD but couldn't, due to unforeseen or unfortunate circumstances? Would you be comfortable sharing what and why?*

**A.** One of my first initiatives was to create research groups in the department, where a group of faculty colleagues work together towards a common goal. The idea was to create national-level laboratories wherein the research will be top-notch and will be followed by researchers across the globe. However, this remains a dream.

**Q.** *If you were to evaluate your performance as the Head of the Department, how would you rate yourself on a scale of 1 to 10? What justifies that score?*

**A.** I aspired to give my 100% and would have been happy to say 10! However, it is not so. There are many things to be done and many things I couldn't do. I think we should give the charge to all the stakeholders of the department to rate me as head of the department, rather than me.

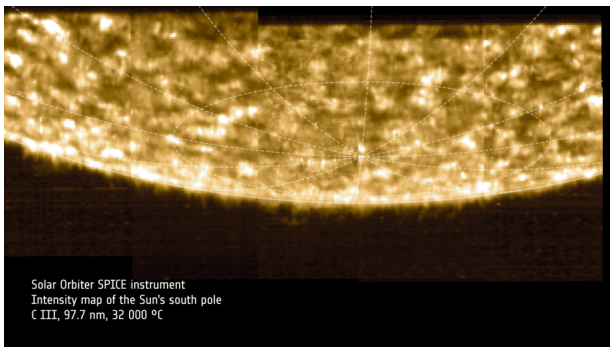
The interview was conducted by **Aminul Hussain, Sanchari Biswas, and Prashant Singh Lohiya** (Research Scholars).

## Physics in History

- 5 July 1687 –Newton published Principia, introducing the three laws of motion and universal gravitation.
- 10 July 1962 – Telstar, the world's first communications satellite, was launched, revolutionizing global communication.
- 16 July 1945 – The Trinity Test : The first-ever detonation of a nuclear bomb took place in New Mexico.
- 18 July 1898 – Marie and Pierre Curie reported the discovery of Polonium.
- 21 July 1969 – Neil Armstrong and Buzz Aldrin became the first humans to walk on the Moon during Apollo 11.

# *Physics News*

### Solar Orbiter Captures First Images of Sun's South Pole




On 11 June 2025, the European Space Agency released the first images of the Sun's south pole, taken by Solar Orbiter between mid-March (at 15° below the ecliptic) and early June (17° below). This joint ESA–NASA mission, launched in 2020 at a cost of about $1.3 billion, dove beneath the solar equator to photograph the poles for the first time. The snapshots reveal a chaotic mosaic of north and south magnetic patches, offering

key clues to how the Sun's magnetic field flips every 11 years. Captured during the current solar maximum, when sunspots and flares peak, these data will improve our understanding of polar magnetic dynamics and space weather forecasting. Solar Orbiter will boost its tilt to 24° by December 2026 and to 33° by mid-2029.

# *National Visits*

**Deep Karmakar**, an M.Sc. Physics student visited the Indian Institute of Space Science and Technology (IIST), Thiruvanatapuram to attend 13th IIST Astronomy and Astrophysics School - 2025 (IAAS-2025) held from 30 June to 09 July 2025.


Participants in the summer school explored core topics in astrophysics—such as the interstellar medium, star formation, galaxies, and cosmology—through expert lectures and hands-on sessions using tools like VIREO, Aladdin, and DS9. A night sky observation of the Moon, Jupiter, and Saturn added to the immersive learning experience.

**Swaraj Mahata**, an M.Sc. Physics student, interned at the Saha Institute of Nuclear Physics (SINP), Kolkata from May to July 2025 under Prof. Arka Santra. His project, "Dark Photon at Direct Detection Experiments," focused on the potential detection of spin-1 dark matter via interactions in underground detectors.


**Anirbit Mulo**, an M.Sc. Physics student, completed a summer research internship at S.N. Bose National Centre for Basic Sciences, Kolkata, under the Summer Research Fellowship 2025 awarded by the Indian Academy of Sciences (IASc), jointly with INSA and NASI. The fellowship provided a monthly stipend and travel support. During his visit, he also attended a Workshop on High Performance Computing Technologies held from 18–20 June 2025.

**Shreya Dey**, an M.Sc. Physics student, completed a summer research internship at IISER Kolkata on "Collective Dynamics of Active Particles: Insights from the Vicsek Model." She used computational simulations to study phase transitions, alignment, and collective motion in self-propelled particle systems.

**Mohana Priya.T, Fathima Minha, and Vaidehi Hegde** pursuing B.Tech in Engineering Physics, visited the International Centre for Theoretical Sciences (ICTS) - TIFR, Bangalore to attend the Summer School for Women in Physics held from 16 to 27 June 2025.

The summer school aimed to strengthen foundational knowledge in physics while providing hands-on experience in experimental techniques. It brought together like-minded peers from across the country and offered a platform for students to interact with PhD scholars, postdoctoral researchers, and professors from various institutes.

**Upasana Das**, an M.Sc. Physics student, completed a summer research project at SN Bose National Centre for Basic Sciences (SNBNCBS) under Prof. Manik Pradhan, funded by the INSPIRE program. Her project, "Photonic Spin Hall Effect and Quantum Weak Measurement," involved studying spin-orbit interaction of light, photonic spin Hall shift, and sub-wavelength beam shifts at interfaces. She explored Weak Value Amplification (WVA) and its experimental realization,

focusing on optimizing post-selection angles for maximum amplification in monolayer $WS_2$ using vortex beams.

**Aparna Bhunia**, an M.Sc. Physics student, completed a summer internship at S.N. Bose National Centre for Basic Sciences on "Observation of Additive Interfacial DMI in Monolayer–Trilayer Systems." She studied the Dzyaloshinskii-Moriya Interaction (DMI) in ferromagnet–nonmagnet interfaces, focusing on how additive DMI enhances chiral spin textures like skyrmions, which are promising for data storage. Her work involved experimentally investigating whether increasing the number of interfaces leads to stronger DMI, using materials chosen to ensure additive DMI vectors.


# *Research Publications*

1. **Smruti Ranjan Parida**, Amrutha M., and **Sridhar Sahu**, Brahmananda Chakraborty, *Density functional theory and ab initio molecular dynamics calculations for reversible hydrogen storage in yttrium-decorated azatriphenylene COF*, Fuel

2. **Moushila Bayen, Anupam Kumar**, and **Pankaj Mishra**, *Freezing transitions in colloidal nanoparticles Interplay of dispersive and electrostatic interactions in confined two-dimensional systems*, Fluid Phase Equilibria

3. Debasish Paul, Priyadarshi Sahoo, Amit K. Pradhan, Prasanta K. Datta, Arunava Sengupta, **Umakanta Tripathy**, and Soumit Chatterjee, *Revealing the Importance of the C(1) position to modulate the photophysics and Z-scan responses of o-locked GFP chromophores*, Journal of Chemical Physics

4. **Sudhanshu Arya**, and **Bobby Antony**, *Electron scattering from oxetane and thietane and their isomers*, Journal of Applied Physics

5. Sunny Kumar Singh, Samapan Bhadury, **Manu Kurian**, and Vinod Chandra, *Particle number diffusion in second-order relativistic dissipative hydrodynamics with momentum-dependent relaxation time*, Physical Rev. D

6. **Soubhik Bhattacharyya, R Thangavel**, and **P M Sarun**, *Dependence of electronic and superconducting properties of barium antimonate superconductor on the hydrostatic pressure: A first-principles study*, Physica Scripta