



Physics Pulse

IIT (ISM) DHANBAD

VOL.II No.12

DECEMBER 31, 2025

PHYSICS NEWSLETTER*

IN MEMORIAM: PROF. NARESH DADHICH (1944–2025)

By SANCHARI BISWAS

It is with profound sadness that we share the news of Prof. Naresh Dadhich passing away. He has been a pioneer of General Relativity and Cosmology. Earlier this year we also mourned the loss of Prof. Narlikar. It is a very heartbreaking coincidence that two consecutive Directors of IUCAA left us the same year. Prof. Naresh Dadhich took the torch in his hands after Prof. Narlikar and spread his light not only in school academics but also to science outreach. Today IUCAA is one of most important centres of science outreach and he has to be one of the most important contributors.



Picture Courtesy: IUCAA Acknowledgements: Intellectual Rigour, The Indian Express, Wikipedia

Prof. Dadhich's journey is a story of remarkable perseverance. He grew up in a small village in Rajasthan with no schooling system. Before fourth standard, he went to school four miles away with a few others. And from the age of 10, he lived in a hostel near the school. He was also involved in drama and music throughout school. He got excited about physics for the first time in the 11th grade by his physics teacher, Mr. KC

Saxena. Everyone at his home wished for him to be an engineer but he didn't secure first class, so he turned towards science.

Physics News

On November 2, 2025, the Indian Space Research Organisation (ISRO) launched the advanced communication satellite CMS-03 for the Indian Navy using the LVM3-M5 heavy-lift vehicle. The satellite, weighing approximately 4,400 kg, is India's heaviest domestically launched communication satellite to date.

Designed to provide secure and reliable multi-band connectivity over oceanic regions and the Indian landmass, CMS-03 will enhance the Navy's maritime communication and situational awareness capabilities. The mission also demonstrated ISRO's growing precision in orbital injection, highlighting advanced heavy-lift launch and geosynchronous transfer orbit (GTO) insertion expertise.



This is actually the story of a lot of academicians and one might have sometimes

felt demotivated about not so perfect scores in the past. But looking at his life, we should remember that we can all emerge out of failures. He then went on to receive National Integration Scholarship, a 100 rupees per month prize, with which he completed his Bachelor's. He has also spoken about his weakness in chemistry and mathematics but was so interested in physics, that it didn't stop him from studying quantum gravity. So we learn again that even if we aren't experts, it is only our interests that will always fuel us to pursue what we want. His PhD guide was Prof. Vishnu Vasudev Narlikar, father of Prof. Jayant Narlikar. He completed his PhD in 1969 working in equations of motion with mass of particles dependent on position and velocity in curved spacetime. He then went on to become a professor at Pune University from 1971 before joining IUCAA in 2003. He was one of the three founding members of IUCAA, besides Prof. Jayant Narlikar and Prof. Ajit Kembhavi. He worked in Braneworld Cosmology, Wormholes and Gravitational collapse. His first paper, jointly written with JV Narlikar and KMV Appa Rao, "High Energy Radiation from white holes" was published in Nature in 1974.

From humble beginnings, his journey remains an inspiration. He is someone we should look upto while facing hardships. After all his origins are from a village with no school - to the director of IUCAA! With over 150 published papers and more than 5000 citations, he has been a leading voice in Gravitational Physics and Relativistic Astrophysics. He always believed that to be a good researcher, we must be unhappy with textbook explanations and understand concepts in our own ways. He always encouraged young researchers to work slowly and deeply and never to rush.

*Send your feedback to: physicspulse@iitism.ac.in

He believed that the best physics comes from thinking cleanly. He said "one good idea is worth ten papers". Students of IUCAA often recall him saying "Curiosity is the only thing that matters, not results".

In his last few days, he was on a lecture tour in China. On feeling unwell, he was hospitalized in Beijing. After a few days in hospital, he passed away on 6th November, 2025.

Awards and Recognitions

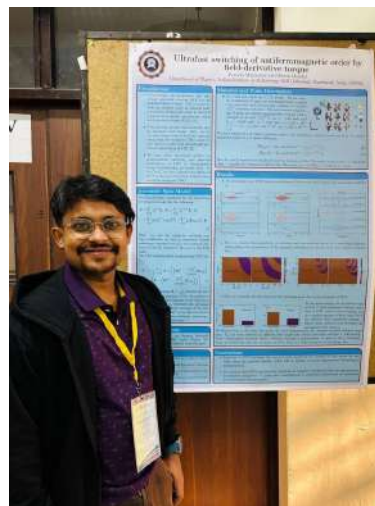
Congratulations to **Ms. Priyanshu Chaubey**, Research Scholar, Department of Physics, IIT (ISM) Dhanbad, for her successfully PhD thesis defense titled, **"Development of Bi-functional Nanocomposites for Electrocatalytic Water Splitting Applications."** Heartiest congratulations to Dr. Chaubey and her supervisor **Prof. Prashant Kumar Sharma**, and best wishes for her future endeavors!



Heartiest congratulations to **Mr. Priyadarshi Sahoo** on the successful defense of his PhD thesis, **"Probing the Nonlinear Photophysics of Biopolymers for Biomedical Applications"**. Congratulations as well to his supervisor **Prof. Umakanta Tripathy** for his guidance and mentorship throughout this journey. Wishing Dr. Priyadarshi every success in his future endeavors!



Mr. Pratyay Mukherjee has won the best poster prize in a recently concluded "Indo-Italy Joint Workshop" on Emergent Magnetic Storage Devices and Sensors at IIT (BHU) Varanasi. He presented the poster on "Ultrafast switching of antiferromagnetic order by field-derivative torque", where he discussed his research on the magnetization switching mechanisms in antiferromagnetic spintronics driven by THz pulse and its derivative components.



Physics in History

- **2 December 1942:** Enrico Fermi and his team achieved the first controlled nuclear chain reaction at the University of Chicago (Chicago Pile-1), marking the birth of nuclear reactor physics.
- **14 December 1900:** Max Planck proposed that energy is emitted and absorbed in discrete packets called quanta, solving the blackbody radiation problem and marking the birth of quantum mechanics. This work became the foundation of modern physics, including atomic, nuclear, and solid-state physics.
- **24 December 1968:** NASA's Apollo 8 mission became the first crewed spacecraft to orbit the Moon, sending back the iconic Earthrise photograph.
- **25 December 2004:** The Huygens probe separated from the Cassini spacecraft, later making the first successful landing on Saturn's moon Titan on 14 January 2005.
- **31 December 1879:** Thomas Edison publicly demonstrated the practical incandescent light bulb, revolutionizing artificial lighting and applied physics.

Academic Visits

Prof. Ritwik Mondal was invited to deliver a talk at the Indo-Italy Joint Workshop on Emergent Magnetic Storage Devices and Sensors at IIT (BHU) Varanasi. The workshop was organised by the School of Materials Science and Technology (SMST), IIT (BHU) Varanasi, in collaboration with the Istituto Nazionale di Ricerca Metrologica (INRiM), Italy. He delivered a talk titled **“Field-Derivative Torque as an Enhancer of Ultrafast Magnetization Switching.”** In his presentation, he discussed ferrimagnetic switching as well as antiferromagnetic switching, emphasizing their relevance for ultrafast and energy-efficient spintronic devices. Prof. Ritwik further explained how field-derivative torque can enable deterministic switching in these complex magnetic systems with reduced power consumption.



The talk stimulated engaging discussions among participants on the prospects of ferri- and antiferromagnetic materials for next-generation magnetic memory and sensor technologies. The work presented was carried out by **Mr. Pratyay Mukherjee** at the Ultrafast Terahertz Spintronics Group (UTSG), IIT (ISM) Dhanbad.



Prof. Soumya Bagchi was invited to deliver a talk at the ANPC 2025 conference held at iThemba Laboratory for Accelerator

Based Sciences (iThemba LABS), Cape Town, South Africa. The conference was organised from November 24–28, 2025. He delivered a talk titled **“Collective Excitations in Rare-Earth Nuclei: Insights from Isoscalar Giant Resonances.”**

Prof. Bobby Antony, participated in **The Centennial of Quantum Theory: Progress in Atomic and Molecular Structure (CEQPAS)** held during the first week of November 2025 at the Institute of Physics Belgrade. The prestigious event marked 100 years of quantum mechanics, bringing together leading researchers from across Europe and beyond. The gathering reflected on a century of quantum theory while showcasing cutting-edge research shaping the next hundred years.



Prof. Antony delivered an invited lecture highlighting advancements in atomic and molecular collision processes and their implications for modern plasma physics and chemical sciences. The report of the meeting was published in the **(Journal of the Serbian Chemical Society)**. The conference provided an excellent platform for scientific exchange, fostering discussions on future directions in quantum science and strengthening international collaborations.



Research scholars **Prashant Singh Lohiya** and **Mohd Qaisar Hayat**, working under the supervision of **Prof. S. K. Sharma**, visited IIT Delhi (Sonapat Campus) from 10 to 14 November to attend **SPECTRA-2025**, an intensive five-day hands-on training workshop on advanced characterization techniques. During the workshop, they received practical training in operating and analyzing data from STM, HR-TEM, SAXS, SSPL, and VSM

(PPMS) instruments, thereby acquiring essential skills relevant to research in nanotechnology, materials science, and applied physics.



Rajdeep Sarkar, a first-year Ph.D student working under the supervision of **Prof. Esha Kundu**, had been competitively selected to attend the **10th Indo-French Astronomy School** that took place at IUCAA, Pune, between 3rd and 10th November 2025. In this workshop, Rajdeep was part of the project titled **"Identifying strongly lensed galaxy candidates from MUSE/VLT observations"**, under project guide Prof. Johan Richard, from Centre de Recherche Astrophysique de Lyon, France. In this workshop, most of the participants were Ph.D. scholars from around the globe. On the final day, Rajdeep and his team presented their project, which showcased their teamwork and the results they got. As it was an Indo-French collaboration program, it gave Rajdeep a platform to communicate with faculty from both IUCAA and Université de Lyon, France, and share their expertise with him, which will help him in his Ph.D work. From breakfast to dinner, it was an environment where lots of scientific discussions were going on. Being there for nearly 8 days and working with some brilliant minds made the workshop a scientifically fruitful and memorable event for Rajdeep.

Dr. Aditya Singh, a postdoctoral scholar at the Indian Institute of Technology (ISM), working in the group of **Prof. Binata Panda**, attended the Indian Strings Meeting (ISM) 2025. This biennial international conference held from December 9–14, 2025, at the Indian Institute of Technology (IIT) Bhubaneswar and the National Institute of Science Education and Research (NISER), Bhubaneswar, brings together researchers from around the world working in string theory, quantum field theory, and related areas of theoretical high-energy physics. The meeting



features a week-long program of plenary talks and poster presentations, highlighting the latest developments in areas such as string theory, quantum gravity, supersymmetric gauge theories, conformal field theories, and the AdS/CFT correspondence.

In addition to presenting new research, the conference serves as a forum for in-depth discussions, cross-disciplinary engagement, and the exchange of ideas between established scientists, postdoctoral researchers, and graduate students. Aditya presented a poster titled **"Thermodynamic Curvature and Topological Insights of Hayward Black Holes with String Fluids"**. It was a proud, joyful, and highly motivating experience to participate in this vibrant and collaborative conference, enriched by stimulating discussions in the presence of leading string theorists including Prof. Ashoke Sen, R. Loganayagam, Aninda Sinha, Arjun Bagchi, Renann Lipinski, Euwoon Lee, Arnab Kundu, Sandip Trivedi, Sunil Mukhi, and many others. He gratefully acknowledges his collaborators and CSIR–HRDG for financial support to attend this conference.



Research scholars **Arkaprava Sil** and **Prasant Mallik** visited the Department of Mathematics at BIT Mesra to attend the one-day International Symposium on **"Emerging Frontiers in Quantum Science and Technologies"**, on 27th November, 2025. They presented flash talks on their ongoing research.

Prof. Sudipto Singha Roy and **Prof. Avijit Misra** also attended the conference and presented their research seminar there titled, **"Entanglement and its role in efficient representation of quantum states"** and **"Quantum sensing and localization in dipole-dipole interacting networks"**, respectively.

Events Oraganized



The ANRF Two-Day National Workshop: The Anusandhan National Research Foundation (ANRF) workshop, **“Wide Bandgap Semiconductors for Power Electronics”** was inaugurated on 13th November morning having Prof. R. Thangavel, workshop coordinator, Prof V. K. Rai, HOD Department of Physics, IIT (ISM) Dhanbad, Dr. Asokan, Ex-scientist of Inter-University Accelerator Centre (IUAC) New Delhi, Dr. Senthil Kumar, senior scientist at the National Physical Laboratory (NPL) New Delhi, as chief guests.

A total of eight technical sessions, tutorials, and lab visits were carried out successfully. Guest speakers from academia, research, and industry presented informative talks. Faculty members and students from various institutions actively participated. This two-day workshop finished with a valedictory session on 14th evening with Prof. Pathik Kumbhakar, from National Institute of Technology Durgapur (NIT Durgapur) as a guest speaker. We wholeheartedly thank all the participants for their active involvement and valuable contributions.

Centenary Lecture – Department of Physics

Prof. Amit Agarwal (IIT Kanpur), recipient of the Rashtriya Vigyan Puraskar – Vigyan Yuva–Shanti Swarup Bhatnagar Award 2025, delivered an inspiring lecture titled **“Importance of Science and Technology in Daily Life.”** on 27th November, at Golden Jubilee Lecture Theatre, IIT(ISM) Dhanbad. The event was organized by Department of Physics, welcomed by Prof V. K. Rai, HOD physics and Prof R. Thangavel, Program Coordinator, Prof Dheeraj Kumar, Deputy director as chief guest of the event. Prof. Agarwal highlighted how scientific thinking drives innovation and societal progress, encouraging young minds to pursue curiosity-driven research.

As part of the centenary outreach, students from Kendriya Vidyalaya, Dhanbad, toured department laboratories and engaged in hands-on learning. The event reinforced the department’s commitment to inspiring the next generation of scientists.



Visitors

We were pleased to host Dr. Sreetama Das, Postdoctoral Fellow at the IFISC Institute for Cross-Disciplinary Physics and Complex Systems (CSIC-UIB), Palma de Mallorca, Spain, for a seminar titled, **“Quantum Reservoir Computing in the Jaynes–Cummings Model.** Dr. Das introduced key concepts of quantum reservoir computing and discussed its implementation using a hybrid qubit–boson system, highlighting memory capacity and applications to chaotic time-series prediction. We thank her for an engaging session.



REVISITING THE NANO FRONTIER AT MY ALMA MATER – A PROUD HOMECOMING

By PROF. BEAUTY PANDEY

(Alumnus, M.Phil. 2007-08, Ph.D. 2008-13. Currently Associate Professor and Associate Dean, School of Sciences, Woxsen University, Hyderabad)

Returning to Indian Institute of Technology (Indian School of Mines), Dhanbad, Department of Physics, IIT (ISM) Dhanbad, my alma mater, dated 12/11/2025, to deliver a seminar on **“Harnessing the Nano Frontier: Solutions for Global Challenges”**, as an invited speaker, was not just an academic engagement – it was an emotional homecoming filled with pride and nostalgia not only for me but for my family as well. Including local hospitality, I was welcomed with a bouquet and a memento. Moments before presenting the talk in the Raman Hall, I exclaimed “But I still feel myself like a student here!”

My talk explored how nanomaterials can revolutionize energy conversion, environmental sustainability, and biomedical sensing, covering strategies like photoelectrochemical hydrogen generation, biocompatible nanosensors, and nanoparticle-enhanced biodiesel production – areas that hold immense promise for addressing global challenges.



I am profoundly grateful to Prof. Asit Kar, my Ph.D. supervisor, who was instrumental in channelizing and initiating this event. His thoughtful care – from planning the seminar to arranging group lunch, being felicitated with a specially designed memento for me embossed with a message of love from my alma mater laboratory and spending fruitful time in warm conversations – made me feel so valuable and truly at home. His words, “She is a big madam now, but she was my first student and your senior here,” while introducing me to his current students, were both humbling and heartwarming.

Walking through the familiar corridors, revisiting old places, and recounting cherished memories was overwhelming. Meeting my former professors, who were pleasantly surprised and genuinely proud to see me rise in my professional journey as Associate Dean and Associate Professor, was an unforgettable moment.

Special thanks to Prof. Bobby Antony and Prof. Shailendra Sharma, who took time out of their busy schedules to meet me. Their happiness and pride in seeing one of their previous students grow in her career made this visit even more exceptional. Thanks to all my professors and Prof. Avijit Misra for organizing the event!

Thank you, Department of Physics, IIT (ISM) Dhanbad!
The day was enriched by:

- Bonding with new faculty and students, exchanging ideas and exploring collaborative possibilities.
- Interacting with my supervisor’s current lab members, who welcomed me with warmth and curiosity.
- A delightful surprise – meeting one of my previous students, now pursuing higher education at IIT (ISM).

This visit strengthened old bonds, rekindled cherished memories, and opened exciting avenues for future collaborations and impactful research – a true reminder that academic journeys come full circle.

AN INTERVIEW WITH PROF. GNIEWOMIR SARBICKI

From Nicolaus Copernicus University, Toruń, Poland,

By NEWSLETTER TEAM

Q: Welcome to our institute. Is this your first time here?

A: In this institute, yes.

Q: And in India?

A: In India, no. This is my third time. In 2022 and 2024, I visited IIT Madras and also the Institute of Mathematical Sciences because it is very close.

Q: Seems like you love India.

A: Yes, yes, the food is very good. The weather is also very good.

Q: Please tell us how a day in your office looks like.

A: I come after 8 to my office. It depends—if I teach, then I have some teaching duties or faculty councils. If not, I sit to calculate something or have some online connection with collaborators.

Q: And how do you spend your evenings?

A: In the evenings, first I have to go home, take children from school and so on. I usually stay home. Nothing special.

Q: Can you share with us your hobbies?

A: Fishing is one of them. I used to fish more often, but with family and children, there is less time now. I also like sailing—rowing a boat, fishing on the sea, all possible things. And riding a bike, but bike in the European sense, a bicycle. I come from a place with a lot of lakes, swamps, and streams. Probably that’s why I love swimming. Even though I look like a moose a little bit, with long legs. It is, I think, an evolutionary adaptation to living on swamps.

Q: Where are you originally from?

A: Originally, I am from Prussia, a historical region now divided between Poland and Russia. We are close to the Russian border.

Q: How did you get into the field of Mathematics and Physics?

A: I was always interested in mathematics, physics, biology—natural sciences. I didn’t know what to study. I started physics, then mathematics, then engineering like computer methodology—building devices. I was interested in many things. Often an accident decides, like possible master projects. Quantum information is a good choice because it

connects quantum physics, mathematics, and computer science.

Q: Was there one turning point that made you decide to stay in academics?

A: I don't know if there was a turning point. It just came with life.



Q: Can you explain your work non-technically?

A: This is like the foundation of quantum mechanics, but with finite-dimensional systems. Even atoms, when exposed to a spectrally limited laser radiation, are effectively two- or three-level systems in many cases. Two-level systems are interesting because we can easily illustrate all quantum phenomena, especially entanglement (when considering many of them). When systems interact with the environment, we consider different types of open-system dynamics and noise in quantum information processing. I also work a bit in quantum optics, with people from IIT Madras—on NV centers in diamond. We tried to explain some experimental data using open quantum dynamics. So, I do a lot of things.

Q: You work a lot in entanglement I suppose. Can you explain entanglement for us in simple terms?

A: Yes, yes. Entanglement is everywhere. If you have an open quantum system and you use master equations, your system is constantly being entangled with the environment. If you use the Schrödinger equation (closed system), there is no such entanglement, but that is rare. Even light-matter interaction means your atom becomes entangled with the electromagnetic field. For a composite quantum system, the Hilbert space is a tensor product. Pure states don't have to be a product of vectors from each subsystem—they can encode correlations between subsystems. Classically, pure states have no correlations; you need randomness. Quantumly, even pure states can have correlations. That is what entanglement gives us.

Q: Is entanglement a property of a state itself or of the tensor factorization we impose?

A: It is a property of the system being in that state. If the system is in an entangled state, we can use some Bell-type measurements to observe non-classical correlations, violations of Bell inequalities, etc. But entanglement is hard to keep. There is something called entanglement monogamy: if a system becomes entangled with a third system, its entanglement with

the second becomes weaker. In open quantum systems, entanglement spreads into the environment and becomes useless for us. We want long coherence time, error correction, special dynamics - many technical things to make entanglement useful.

Q: Quantum information and Quantum Computation binds many different areas of science like physics, mathematics, computer science, etc. How do you think people from different branches have helped us to shape the direction?

A: Of course. People from different backgrounds see the same problem differently. Sometimes we get some results, but we don't know why they simplify so much (miraculously for us at first glance). Maybe someone of different background would immediately see it as an obvious consequence of a mathematical theory (for example representation theory). Quantum information conferences connect people from quantum optics, trapped ions, solid-state physics, computer science, mathematics. Together they create something.

Q: What mathematical tools do you use?

A: Mostly algebra—Lie groups, representation theory, sometimes functional analysis. Nothing extremely sophisticated. No heavy topology. Mostly algebra rather than calculus.

Q: How do you decide which research problem is worth solving?

A: Maybe some experience or intuition. I like problems based on mathematical structure. For example, I saw some interesting structure in randomized measurements, so I followed that direction.

Q: Quantum theory has a strong geometric component - do you think geometry is the right language for future Quantum Information theory?

A: Some people say physics is just geometry because symmetries are at the heart of physics. Physical quantities are invariants of symmetry groups. That is geometric language. Different observers get different numbers, but a symmetry transformation connects them. So yes, geometry is central.

Q: You were saying that entanglement detection requires positive maps. We have graph representation and positive maps for entanglement detection. Are these two tools enough for entanglement detection?

A: There are many entanglement criteria, but every criterion corresponds to a family of entanglement witnesses. A witness is positive on all separable states but negative for some entangled state. These witnesses are connected to positive maps—maps that take positive operators to positive operators. The useful ones are positive but not completely positive, like transposition. Completely positive maps are physical; positive maps (without Kraus representation) are unphysical, but are a mathematical tool useful for entanglement detection. Graph representations can show multipartite structures. There are also criteria using correlation tensors - norms of correlation tensors detect entanglement. Everything connects to families of witnesses and positive maps, even if not written explicitly.

Q: Where do you see quantum information theory in the next 10 years?

A: I'm not a wizard to predict the future (laughs). We will work, discover new things. Experimentalists will observe more, implement more protocols, error correction, coherence detection. Step by step, better implementation.

Q: How do you think we as researchers should deal with frustrations and setbacks?

A: This is the risk. People who force us to write grants don't understand that science is discovery - you go to the unknown sea. Sometimes we work and obtain nothing. Sometimes intuition misleads us. Research is like fishing, the fish is not important; fishing is important. Working on a problem improves intuition and experience. Even if the result is not striking, the time was properly spent. Follow your intuition and curiosity. Be interested in many fields. Choose problems that are most interesting for you. People have natural abilities and preferences. The field that gives the most joy - that is where you should go.



Placement News

The Department of Physics, IIT (ISM) Dhanbad congratulates our final-year Engineering Physics students on their outstanding placement achievements. We are proud to acknowledge Aaditya Jain (Standard Chartered Bank), Sanidhya Niranjana (Accordion), Mohit Ghosh (Bain Company), Zain Rashid (Accordion), Pranav Jha (Meesho), Sarvagya Kaushik (Axxela), Shubham Das (Tredence Analytics), Priyanshu Mohapatra (mCaffeine), and Harshit Kumar (Flipkart) for securing positions in leading national and international organizations across finance, consulting, analytics, and technology sectors. These accomplishments reflect their hard work, technical excellence, and the strong academic foundation provided by the Engineering Physics program. The department extends its best wishes to all the students for a successful and impactful professional journey ahead.

Research Publications

1. Sunny Kumar Singh, Samapan Bhadury, Ritesh Ghosh, **Manu Kurian**, Quarkonium in a QCD medium with momentum-dependent relaxation time, **Physical Review D** **112**, 094056 (2025).
2. **Sheetal Sharma**, **Vinod Kumar Singh**, Manoj Kumar Gupta, Physics-Guided high performance N-TiO₂@MXene-PVA nanocomposite based Triboelectric Nanogenerators for Self-Powered UV-Sensor Sensors and Actuators, **Sensors and Actuators A: Physical**, 399, 117376 (2026).
3. **Subhadip Ghosh**, **Darpa Narayan Basu**, **Ritwik Mondal**, Engineering spin-wave spectrum via the magnetization inertia tensor, **J. Phys.: Condens. Matter** **38**, 015803 (2026).

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