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In this photo released on April 14, 2025, NASA's James Webb Space Telescope revealed the gas and dust ejected by a dying star at the heart of NGC 1514. Using mid-infrared data showed the “fuzzy” clumps arranged in tangled patterns, and a network of clearer holes close to the central stars shows where faster material punched through.

This scene has been forming for at least 4,000 years — and will continue to change over many more millennia. At the center are two stars that appear as one in Webb's observation, and are set off with brilliant diffraction spikes. The stars follow a tight, elongated nine-year orbit and are draped in an arc of dust represented in orange.

One of these stars, which used to be several times more massive than our Sun, took the lead role in producing this scene. “As it evolved, it puffed up, throwing off layers of gas and dust in in a very slow, dense stellar wind,” said David Jones, a senior scientist at the Institute of Astrophysics on the Canary Islands, who proved there is a binary star system at the center in 2017.

Link : https://www.nasa.gov/image-article/fuzzy-rings-of-a-dying-star/

Bulletin of The Indian Association of Physics Teachers

http://www.indapt.org.in

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Chief Editor (IAPT Bulletin), Dept. of Physics, P.U., Chandigarh – 160 014

Email: iapt@pu.ac.in

Editorial

150 Years of BIPM: A Journey in Evolving the New Vistas in Metrology

Not many well-known international bodies have their names in French. *Federation de Internationale Football Association* (abbreviated as FIFA) that oversees the world football is one in this category. Among the others that had got the immense responsibility for the standardization of measurements and their maintenance among other tasks, is known as *Bureau Internationale des Poids et Mesures (BIPM)* is an intergovernmental body. The role of this is not only significant for science and technology but also for international trade, space travel and the futuristic plan of colonization of other planets. Because all these activities demand accurate standards in measurements that do not change with time and space. BIPM, originated from Meter Convention began its journey in a modest way on May 20, 1875, and 20th May is internationally celebrated as the World Metrology Day. In last 150 years it has undertaken many path breaking initiatives to make us learn many basic things afresh.

In 1967, BIPM changed the definition of one of the SI base units. Concerned people knew that this is just a first step to carry out a significant change that would be of far-reaching consequences. Through this action the well-known unit of time or the time interval 'second' got fixed up in a completely different way, bidding farewell to the innocuous spinning motion of the earth as a standard reference. The length of the mean solar could be detected changing slowly. In the 1950s atomic clock could be used to define second and it was based on the number of periods of transition taking place between the two hyperfine levels of the ground state of cesium 133 atoms. That brought out second from the clutches of a changing natural phenomenon and made that based on a natural constant instead. The name 'second' did not change but the duration of a second got changed, albeit very, very, slightly without affecting our everyday time measurements. However, for the measurements in the fields of S&T and industrial manufacturing this proved to be significant.

The units of length and mass began to feel the heat from that time. After all, two artefacts, one Pt-Ir rod and a small solid cylindrical piece of the same alloy were providing the representative SI base units of length and mass respectively. These prompted the scientists looking for some other suitable natural constants to derive these two SI base units. In 1983 the precise measurement of the speed of light in free space (c) led to the new definition of meter, using, of course, the definition of second that was kept waiting to perform more important duties. So, meter got defined based on c and the definition of second.

However, the kilogram took time to formally abdicate its throne and that happened only in 2019. The precise measurement of Planck's constant 'h' led to a new definition of kilogram based only on the constants fixed by nature. Now we have all the base units defined with the help of precisely measured some natural constants like the electronic charge, Avogadro constant, Boltzmann constant and luminous efficacy of a particular monochromatic radiation. The natural constants can only be measured through well-designed experiments and these constants have been provided to us by nature. Work of number of Nobel laureates in Physics have contributed in this journey of metrology. BIPM headquarters are very much there in Paris, but the specially designated artefacts are now the parts of history.

Bhupati Chakrabarti

Physics News

It's about (space-time) : Scientists explore new dimension for light

By breaking a decades-old paradigm and rethinking the role that the dimension of time plays in physics, researchers from the University of Rostock, Germany and the University of Birmingham, UK have discovered novel flashes of light that come from and go into nothingness—like magic at first glance but with deep mathematical roots that protect against all kinds of outside perturbations. Recently though, rapid progress in the research on so-called spatiotemporal crystals, objects with repeating patterns in time and space, has inspired a rethinking of the role that time should play in our understanding of physics. These findings prove the potential that reconsidering the role of time in space-time, in physics, in general, as well as in its interplay with topology, has for both fundamental science as well as potential applications. Crucially, they open the door to a much wider field of potential discoveries enabled by directing research into this new-old dimension.

Read more at: https://phys.org/news/2025-04-space-scientists-explore-dimension.html

Original Paper: Nature Photonics (2025). DOI: 10.1038/s41566-025-01653-w

The first experimental observation of Dirac exceptional points

Exceptional points (EPs) are unique types of energy-level degeneracies that occur in non-Hermitian systems. Since their existence was first proposed more than a century ago, physicists have only been able to experimentally observe two types of EPs, both of which were found to give rise to exotic phases of matter in various materials, including Dirac and Weyl semimetals. Dirac EPs are degeneracies theorized to blend two different physical concepts, namely Dirac points observed in Hermitian systems and EPs, which pertain to non-Hermitian systems. The primary objective of the recent work by Rong and his colleagues was to successfully construct and observe these energy-level degeneracies leveraging nitrogen-vacancy defects in diamond, which are atomic-scale quantum systems within a solid-state material. Rong and his colleagues hope that their study will spark further advances in the field of non-Hermitian and quantum physics. In the future, their experimental observation of Dirac EPs could provide quantum physicists and engineers with a promising avenue to achieve greater control over various cutting-edge quantum technologies, including quantum sensors and quantum computers.

Read more at: https://phys.org/news/2025-04-experimental-dirac-exceptional.html

Provided By: Physical Review Letters (2025). DOI: 10.1103/PhysRevLett.134.153601

Scientists develop low-cost liquid lenses

Filipino scientists have discovered a simple, affordable way to make dynamically adjustable water-based lenses that have a wide variety of potential future applications. By placing droplets of different sizes on this surface and shining a laser through them, the researchers observed that the light beam widened or narrowed depending on the droplet's size. Larger droplets acted like lenses with longer focal lengths, while smaller droplets behaved like close-up lenses, with the laser maintaining a clean and undistorted beam. Because it is low-cost, simple to make, and easy to use, this discovery has multiple potential practical applications: it could be used in science classrooms to teach optics, particularly in schools with limited lab equipment; in remote or low-resource areas. It could help build basic optical tools for experiments or diagnostics; and even in research labs, it offers a quick way to adjust laser beams. It also lays the groundwork for more advanced liquid lenses for possible use in cameras, microscopes, and even wearable tech. With further development, it might also be used in portable diagnostic devices or small projection and lighting systems.

Read more at: https://phys.org/news/2025-04-scientists-liquid-lenses.html

Original paper: Results in Optics (2025). DOI: 10.1016/j.rio.2025.100824

Soumya Sarkar
IISER PUNE

The Infinite Allure of Physics: Reflections on a Discipline that Shapes Our World

Arvind G Kulkarni
Email: arvindkulakarni90@gmail.com

1. Curiosity, Beauty and Fascination of Physics

Physics is a subject that often evokes a sense of **curiosity**, reveals profound **beauty**, and inspires deep **fascination**. These three aspects are intrinsically linked and are what draw many people to explore the fundamental laws governing our universe.

Curiosity: The Driving Force

● **The "Why" Questions:** Physics at its core is about asking "why." Why does an apple fall? Why is the sky blue? What is the universe made of? This inherent curiosity about the natural world is the engine that drives scientific inquiry in physics.

● **Unravelling Mysteries:** Physicists are driven by the desire to unravel the mysteries of the cosmos, from the smallest subatomic particles to the largest structures in the universe. This quest for understanding fuels groundbreaking research and discoveries.

● **Exploring the Unknown:** Physics constantly pushes the boundaries of our knowledge, venturing into the realms of the unknown, such as dark matter, dark energy, and the nature of consciousness. This exploration of the frontier sparks immense curiosity.

● **Practical Applications:** Curiosity-driven research in physics often leads to unexpected technological advancements that benefit society, further highlighting the power of simply asking "what if?"

Beauty: The Elegance of Laws

● **Mathematical Harmony:** Many physicists find a deep sense of beauty in the mathematical elegance of physical laws. Equations like $E=mc^2$ or Maxwell's equations are concise yet incredibly powerful in describing fundamental aspects of reality.

● **Symmetry and Patterns:** The universe exhibits remarkable symmetries and patterns, from the intricate designs of snowflakes to the spiral arms of galaxies. Physics helps us understand the underlying principles that give rise to this order and beauty.

● **Unification of Concepts:** The quest to unify seemingly disparate phenomena under a single theoretical framework, like the ongoing pursuit of a "Theory of Everything," is driven by the aesthetic appeal of a complete and elegant description of nature.

● **The Wonder of Simplicity:** Sometimes, profound truths are revealed through surprisingly simple principles. This simplicity, underlying complex phenomena, is often seen as a mark of beauty in physics.

Fascination: The Mind-Blowing Nature of Reality

● **Counterintuitive Concepts:** Physics often presents ideas that challenge our everyday intuition, such as quantum entanglement, the curvature of spacetime, and the wave-particle duality of light. These mind-bending concepts are a source of deep fascination.

● **Scale of the Universe:** From the infinitesimally small quantum realm to the vastness of the cosmos, physics deals with scales that are difficult for the human mind to grasp, inspiring awe and wonder.

● **Fundamental Forces:** The four fundamental forces that govern all interactions in the universe – gravity, electromagnetism, strong nuclear force, and weak nuclear force – are themselves objects of intense fascination, as physicists strive to understand their origins and relationships.

● **Our Place in the Cosmos:** Physics helps us understand our place in the grand scheme of the universe, from the formation of stars and planets to the evolution of life. This cosmic perspective is inherently fascinating. In essence, the curiosity to know more, the appreciation for the inherent beauty in the laws of nature, and the sheer fascination with the workings of the universe are what make physics such a compelling and enduring field of study. It's a journey of continuous discovery that constantly reveals new wonders and deepens our understanding of the reality we inhabit.

2. Observations of the natural phenomena for development of Physics

Observations of natural phenomena are the very **starting point and a continuous driving force** behind the development of physics. They are the raw data, the puzzles, and the inspiration that fuel our understanding of the universe. Here's how these observations contribute to the progress of physics:

1. Identifying Patterns and Regularities:

● **Early Astronomy:** Ancient civilizations observed the predictable movements of celestial bodies (sun, moon, stars, planets). These regularities led to the development of early astronomical models and eventually Newton's law of universal gravitation.

● **Weather Patterns:** Observing recurring weather phenomena (wind, rain, temperature changes) led to early attempts at meteorology and eventually to more sophisticated atmospheric physics.

● **Simple Mechanics:** Observing how objects fall, roll, or swing led to the initial understanding of motion and forces, culminating in classical mechanics.

2. Uncovering New Phenomena:

● **Lightning:** The observation of lightning sparked curiosity about electricity and eventually led to the understanding of electric charge, current, and electromagnetic forces.

● **Magnetism:** The natural occurrence of magnetic rocks (lodestones) led to the investigation of magnetic forces and the eventual unification of electricity and magnetism by Maxwell.

● **Radioactivity:** The unexpected emission of radiation from certain elements, observed by Becquerel, led to the discovery of radioactivity and the development of nuclear physics.

● **Cosmic Rays:** The detection of high-energy particles from space opened up new avenues in particle physics and astrophysics.

3. Identifying Anomalies and Challenging Existing Theories:

● **The Anomalous Precession of Mercury's Orbit:** Careful astronomical observations revealed a slight discrepancy in Mercury's orbit that couldn't be fully explained by Newtonian gravity. This anomaly was a key piece of evidence supporting Einstein's theory of general relativity.

● **The Ultraviolet Catastrophe:** Classical physics predicted an infinite amount of energy in high-frequency electromagnetic radiation from a blackbody, which was clearly not observed. This discrepancy led to the development of quantum mechanics by Planck.

● **The Expansion of the Universe:** Hubble's observations of the redshift of distant galaxies revealed that the universe is expanding, a phenomenon that revolutionized cosmology and led to the Big Bang theory.

4. Guiding the Formulation of New Theories:

● **The Photoelectric Effect:** Einstein's explanation of the photoelectric effect, based on the observation that electrons are emitted from a metal surface when light shines on it, but only above a certain frequency, was a crucial step in the development of quantum theory.

● **Brownian Motion:** Einstein's theoretical explanation of the random movement of particles suspended in a fluid, observed by botanist Robert Brown, provided strong evidence for the existence of atoms and molecules.

5. Setting Constraints for Theories:

● **Conservation Laws:** Observing that certain quantities like energy, momentum, and charge remain constant in isolated systems led to the formulation of fundamental conservation laws in physics.

● **Symmetry Principles:** Observing symmetries in natural phenomena (e.g., the isotropy of space) has led to the formulation of powerful symmetry principles that underlie many physical theories.

The Importance of Careful and Precise Observation:

The progress of physics relies heavily on the accuracy and precision of observations. Technological advancements in telescopes, microscopes, particle detectors, and other scientific instruments have enabled us to probe the universe at increasingly smaller and larger scales, leading to new discoveries and a deeper understanding of natural phenomena.

In essence, the natural world is the ultimate laboratory for physicists. By carefully observing its behaviour, identifying patterns, uncovering new phenomena, and grappling with anomalies, we continually refine our understanding of the fundamental laws that govern the universe. The cycle of observation, hypothesis, experimentation (often designed to test observations), and theory development is the core of the scientific method in physics.

3. The role of experiments in the development of physics

The role of experiments is absolutely fundamental to the development of physics. Physics, at its core, is an empirical science, meaning that its theories and understanding of the natural world are ultimately based on observation and experimental evidence. Here's a breakdown of the crucial roles' experiments play:

1. Providing the Foundation for Theories:

● **Observation and Discovery:** Many significant physics discoveries originated from careful observation and experimentation. For example, the observation of the photoelectric effect by Heinrich Hertz laid the groundwork for Einstein's theory of photons and quantum mechanics.

● **Identifying Phenomena:** Experiments allow physicists to identify and characterize new phenomena that existing theories cannot explain. This often sparks the development of new theoretical frameworks.

2. Testing and Validating Theories:

● **Crucial Tests:** Experiments are designed to test the predictions of existing theories. If experimental results consistently agree with theoretical predictions, it strengthens our confidence in the theory.

● **Falsification:** A key aspect of the scientific method is the ability to falsify theories. A single well-designed and reproducible experiment that contradicts a theory can led to its modification or even rejection.

● **Refining Theories:** Even if a theory is not entirely overturned, experiments can reveal limitations or inaccuracies, prompting scientists to refine and improve the existing models.

3. Guiding the Development of New Theories:

● **Anomalies and Puzzles:** When experiments produce results that deviate from current theoretical understanding, these anomalies act as puzzles that drive the development of new and more comprehensive theories.

● **Providing Clues:** Experimental data can offer hints and constraints that guide the formulation of new theoretical concepts and mathematical structures.

4. Measuring Fundamental Constants and Quantities:

● **Determining Values:** Experiments are essential for accurately measuring fundamental physical constants like the speed of light, the gravitational constant, Planck's constant, and the charge of an electron. These values are crucial for making quantitative predictions and for the consistency of physical laws.

5. Driving Technological Advancements:

● **Applied Physics:** Many physics experiments have direct applications in technology. Understanding the principles of electromagnetism through experiments led to the development of electricity generation and transmission. Research in semiconductor physics, driven by experimentation, led to the invention of transistors and modern electronics.

Examples of Landmark Experiments:

● **Galileo's experiments with falling objects:** Challenged Aristotelian ideas about motion and laid the foundation for classical mechanics.

● **Newton's prism experiments:** Demonstrated that white light is composed of a spectrum of colours.

● **Young's double-slit experiment:** Provided compelling evidence for the wave nature of light.

● **Faraday's experiments on electromagnetic induction:** Demonstrated the relationship between electricity and magnetism, leading to the development of electric generators and motors.

● **Rutherford's gold foil experiment:** Led to the discovery of the atomic nucleus.

● **Michelson-Morley experiment:** Failed to detect the luminiferous ether, a crucial result that paved the way for Einstein's theory of special relativity.

● **The discovery of the cosmic microwave background radiation:** Provided strong evidence for the Big Bang theory.

In conclusion, experiments are not merely a way to confirm what we already know in physics. They are the driving force behind progress, leading to new discoveries, the validation or rejection of theories, the precise measurement of fundamental quantities, and ultimately, the development of new technologies that shape our world. The interplay between theoretical ideas and experimental investigation is the heart of the scientific method and the engine of physics.

4. Mathematics in relation to physics

The relationship between mathematics and physics is a deep and fundamental one. Mathematics provides the language, tools, and framework for expressing and understanding the laws and principles of physics. Conversely, physics often inspires new mathematical concepts and theories. Here's a breakdown of their interconnectedness:

Mathematics as the Language of Physics:

● **Describing Physical Quantities:** Physics deals with measurable quantities like distance, time, mass, force, energy, etc. Mathematics provides the system of numbers, units, and symbols to quantify these concepts precisely.

● **Formulating Laws and Theories:** Physical laws and theories are often expressed as mathematical equations. For example, Newton's second law of motion (F=ma) uses algebraic symbols to relate force, mass, and acceleration. Maxwell's equations, describing electromagnetism, are a set of partial differential equations.

● **Making Predictions:** Mathematical models based on physical theories allow physicists to make predictions about the behaviour of systems. These predictions can then be tested through experiments.

● **Analysing Data:** Mathematical tools like statistics and calculus are essential for analysing experimental data, identifying patterns, and drawing conclusions in physics research.

Key Mathematical Concepts Used in Physics:

● **Calculus:** Essential for describing motion, rates of change, accumulation, and fields (e.g., velocity, acceleration, work, energy, electromagnetic fields).

● **Linear Algebra:** Used in quantum mechanics, vector analysis (forces, fields), and representing transformations in space and time.

● **Differential Equations:** Describe how physical systems evolve over time or space (e.g., wave equations, heat equations, Schrödinger's equation).

● **Probability and Statistics:** Crucial in statistical mechanics, quantum mechanics (interpreting probabilities of particle behaviour), and analysing experimental uncertainties.

● **Geometry and Topology:** Important in areas like general relativity (spacetime curvature), condensed matter physics (crystal structures), and particle physics.

● **Fourier Analysis:** Used to analyse waves and oscillations, and in signal processing.

● **Complex Numbers:** Essential in quantum mechanics and AC circuit analysis.

Physics as a Source of Inspiration for Mathematics:

● **Calculus:** Isaac Newton developed calculus partly to describe motion and gravity.

● **Differential Geometry:** Einstein's theory of general relativity, which describes gravity as the curvature of spacetime, heavily relied on and further spurred the development of differential geometry.

● **Quantum Mechanics and String Theory:** These areas of physics have introduced new mathematical concepts and challenges, leading to advancements in fields like functional analysis, operator theory, and topology.

Different Approaches but Intertwined Goals:

While both fields are closely linked, their approaches and goals can differ:

● **Physics:** Focuses on understanding the fundamental laws of nature through observation, experimentation, and the development of theories that explain these observations. Mathematics is a crucial tool in this process.

● **Mathematics:** Focuses on abstract structures, patterns, and logical reasoning. While it can be inspired by the physical world, its primary goal is to establish truths through rigorous proofs.

In summary, mathematics is indispensable to physics, providing the framework for expressing, analysing, and predicting physical phenomena. Conversely, physics often presents new problems and inspires the development of new mathematical ideas. This symbiotic relationship has been crucial for the progress of both fields.

The interrelation between philosophy and physics is a rich and enduring one, evolving throughout history and continuing to shape our understanding of reality. They are not entirely separate disciplines but rather engage in a complex dialogue, with each influencing the other in significant ways.

Historical Intertwining:

● **Natural Philosophy:** Historically, physics was a branch of what was known as "natural philosophy." Thinkers like Aristotle explored questions about the natural world that we would now categorize as both physics and philosophy. His work "Physics" dealt with motion, change, and the elements.

● **The Scientific Revolution:** The Scientific Revolution saw a gradual separation, with figures like Galileo Galilei and Isaac Newton establishing more quantitative and experimental methods for studying nature. However, even Newton's work had philosophical underpinnings concerning the nature of space, time, and causality.

● **Continuing Dialogue:** Throughout history, major physicists have often engaged with philosophical questions arising from their work. Einstein's reflections on space, time, and the nature of reality are prime examples.

5. <u>Interrelation between Philosophy and Physics</u>

Philosophy's Influence on Physics:

● **Conceptual Foundations:** Philosophy provides the framework for critically examining the fundamental concepts of physics, such as space, time, matter, causality, and determinism. Philosophical inquiry can help clarify ambiguities, expose hidden assumptions, and suggest new ways of thinking about these concepts.

● **Epistemology and Methodology:** Philosophy of science, a branch of philosophy, scrutinizes the methods and justifications used in physics. It asks questions about the nature of scientific explanation, theory confirmation, and the relationship between theory and observation.

● **Interpretation of Theories:** As physics develops new and often counter-intuitive theories (like quantum mechanics and relativity), philosophy plays a crucial role in interpreting their meaning and implications for our understanding of reality. Different philosophical interpretations of quantum mechanics, for example, attempt to make sense of its strange predictions.

● **Ethics and Societal Implications:** While less direct, philosophical ethics can engage with the broader societal implications of physics and its technological applications (e.g., nuclear weapons, artificial intelligence).

Physics' Influence on Philosophy:

● **Providing Empirical Data:** Physics, as an empirical science, provides a vast amount of data and well-tested theories that philosophy must consider when formulating its understanding of the world. Philosophical claims about reality need to be consistent with our best scientific knowledge.

● **Challenging Philosophical Assumptions:** Groundbreaking physics theories have often challenged long-held philosophical assumptions. For example, the theory of relativity challenged Newtonian notions of absolute space and time, forcing philosophers to rethink these fundamental concepts. Quantum mechanics challenged classical determinism and our understanding of causality.

● **Inspiring New Philosophical Concepts:** Physics can inspire new philosophical ideas and frameworks. Concepts like spacetime, quantum entanglement, and the holographic principle have spurred philosophical discussions about the nature of reality, consciousness, and information.

● **Methodological Insights:** The success of the scientific method in physics has influenced philosophical methodology, particularly in areas like epistemology and metaphysics, leading to more naturalistic approaches.

Areas of Overlap and Current Engagement:

Today, the interrelation between philosophy and physics is particularly active in areas such as:

● **Philosophy of Space and Time:** Examining the nature of space, time, and spacetime, influenced by relativity theory and cosmology.

● **Foundations of Quantum Mechanics:** Investigating the conceptual problems and interpretational challenges of quantum theory (e.g., the measurement problem, non-locality).

● **Philosophy of Statistical Mechanics and Thermodynamics:** Exploring the relationship between microscopic and macroscopic descriptions, the nature of entropy, and the arrow of time.

● **Philosophy of Cosmology:** Considering the philosophical implications of theories about the origin and evolution of the universe.

● **Quantum Gravity:** Philosophers and physicists grapple with the conceptual challenges of unifying quantum mechanics and general relativity.

In Conclusion:

Philosophy and physics are engaged in a continuous feedback loop. Philosophy provides the critical and conceptual tools to analyse and interpret physics, while physics offers empirical data and theoretical frameworks that challenge and inform philosophical inquiry. This interrelation is essential for a deeper and more comprehensive understanding of the universe and our place within it. While their methods and primary goals may differ, their shared pursuit of fundamental questions ensures an ongoing and fruitful dialogue.

6. Need of a strong leadership in India for Research

A strong leadership in India is crucial for the advancement of physics across research, education, and public communication. Here's a breakdown of the necessity in each domain:

Research

● **Visionary Direction:** Strong leaders can formulate a long-term vision for physics research in India, identifying key areas of focus that align with national needs and global advancements. This involves setting ambitious goals and creating a roadmap to achieve them.

● **Resource Mobilization:** Effective leaders can advocate for increased funding for basic and applied physics research from governmental and private sectors. They can also facilitate collaborations between institutions and industries to optimize resource utilization.

● **Fostering Collaboration:** Leadership is needed to break down silos between different research institutions, universities, and national laboratories, encouraging interdisciplinary collaborations and the sharing of knowledge and resources.

● **Promoting Excellence:** Strong leaders can establish mechanisms to identify and support talented researchers, create centres of excellence, and promote a culture of high-quality research output and ethical practices.

● **Translational Research:** Leadership can bridge the gap between fundamental research and practical applications, encouraging innovation and the development of technologies based on physics principles for societal benefit.

Education

● **Curriculum Reform:** Strong academic leaders are needed to modernize physics curricula at all levels (school, undergraduate, postgraduate) to make them more engaging, relevant, and aligned with contemporary research and technological advancements. This includes incorporating computational skills, experimental techniques, and interdisciplinary approaches.

● **Quality Enhancement:** Leadership is essential to improve the quality of physics education through better teacher training programs, development of innovative teaching methodologies, and ensuring adequate infrastructure like well-equipped laboratories and digital resources.

● **Attracting Talent:** Inspiring leaders can attract bright young minds to pursue physics by highlighting its intellectual challenges, career opportunities, and societal impact. This involves effective mentorship and guidance at early stages.

● **Industry-Academia Linkage:** Strong leadership can foster stronger ties between educational institutions and industries, ensuring that physics graduates possess the skills and knowledge required for the job market and promoting collaborative research projects.

● **Promoting Inclusivity:** Leaders can champion initiatives to make physics education accessible to all, irrespective of socio-economic background or geographical location, addressing disparities in access to quality education.

Public Communication

● **Raising Awareness:** Strong leaders can champion efforts to raise public awareness and appreciation of physics and its role in everyday life and technological advancements. This can be achieved through various outreach programs, science centres, and media engagement.

● **Combating Misinformation:** Effective communication strategies led by knowledgeable figures are crucial to counter scientific misinformation and promote evidence-based understanding of physics-related issues.

● **Inspiring the Next Generation:** By communicating the excitement and wonder of physics, strong leaders can inspire young students to consider careers in science and technology.

● **Building Public Trust:** Transparent and accessible communication about publicly funded physics research can build public trust and support for scientific endeavours.

● **Engaging Policymakers:** Strong leaders in the physics community can effectively communicate the importance of physics research and education to policymakers, leading to informed decision-making and sustained support.

In summary, strong leadership in India for Research, Education & Public Communication of Physics is vital for fostering a vibrant scientific ecosystem, producing skilled human capital, and ensuring that the benefits of physics reach all sections of society. It requires individuals with vision, expertise, and the ability to inspire and mobilize stakeholders across different domains.

7. Physics and Nation Building

Physics plays a fundamental and multifaceted role in nation-building. It provides the bedrock for technological advancements, drives economic growth, improves quality of life, and fosters a scientifically literate society. Here's a breakdown of its importance:

1. Technological Advancement:

● **Foundation of Modern Technology:** The principles of physics underpin most technologies we use daily, from electricity and telecommunications to transportation, computers, and the internet. These technologies are crucial for a nation's infrastructure, communication networks, and economic activities.

● **Driving Innovation:** Physics research leads to new discoveries and innovations that can revolutionize industries, create new markets, and improve efficiency across various sectors.

● **Defence and Security:** Physics is essential for developing and maintaining a nation's defence capabilities, including aerospace, missile technology, and surveillance systems.

2. Economic Growth:

● **Industrial Development:** Physics-based industries, such as electronics, materials science, and energy, contribute significantly to a nation's GDP and create employment opportunities.

● **Increased Productivity:** Technologies developed through physics research improve efficiency in agriculture, manufacturing, and logistics, leading to higher productivity and economic output.

● **Global Competitiveness:** A strong foundation in physics and technology enables a nation to compete effectively in the global market, attract investment, and foster international collaborations.

3. Improved Quality of Life:

● **Healthcare:** Physics plays a vital role in medical imaging (X-rays, MRI, ultrasound), radiation therapy, and the development of medical devices, leading to better diagnostics, treatment, and overall public health.

● **Energy Security:** Physics research contributes to developing sustainable and efficient energy sources, reducing dependence on fossil fuels and mitigating climate change. This ensures energy security and a healthier environment for citizens.

● **Communication and Connectivity:** Physics principles are the backbone of modern communication technologies, connecting people, businesses, and governments, facilitating social and economic development.

● **Disaster Management:** Understanding physics helps in predicting and mitigating natural disasters through weather forecasting, remote sensing, and the development of resilient infrastructure.

4. Scientific Literacy and Education:

● **Understanding the World:** Physics education equips citizens with a fundamental understanding of the natural world, fostering critical thinking, problem-solving skills, and scientific reasoning.

● **Creating a Skilled Workforce:** A strong physics education system produces a skilled workforce essential for research and development, technological innovation, and various technical professions.

● **Informed Decision-Making:** A scientifically literate population can make informed decisions on issues related to science, technology, and public policy, contributing to a more engaged and responsible citizenry.

5. National Pride and Inspiration:

● **Scientific Achievements:** Breakthroughs in physics and related fields can inspire national pride and encourage young people to pursue careers in science and technology.

● **International Recognition:** Contributions to fundamental physics research and technological innovation enhance a nation's global standing and influence.

Examples of Physics in India's Nation Building:

● **Space Program:** India's advancements in space exploration, satellite technology (for communication, weather forecasting, and remote sensing), and rocketry are all based on fundamental physics principles.

● **Nuclear Program:** India's nuclear capabilities, both for energy and defence, rely heavily on nuclear physics.

● **Information Technology:** The booming IT sector in India is built upon the principles of solid-state physics, electronics, and electromagnetism.

● **Renewable Energy:** India's growing focus on solar, wind, and other renewable energy sources utilizes principles of thermodynamics, electromagnetism, and materials science.

● **Medical Technology:** The development and manufacturing of medical imaging devices and other healthcare technologies in India rely on physics.

In conclusion, physics is not just an academic discipline; it is a powerful engine for national progress. By investing in physics education, research, and its applications, a nation can drive technological innovation, achieve economic prosperity, improve the well-being of its citizens, and secure a prominent place in the global community. For a nation like India, with its aspirations for a "Viksit Bharat" (Developed India), a strong emphasis on physics and its integration across various sectors is crucial for realizing its goals.

Celebration of National Science Day 2025

The Department of Physics, Aligarh Muslim University (AMU), celebrated National Science Day 2025 with enthusiasm and scientific fervour on February 28. This occasion commemorated the discovery of the Raman Effect by the eminent physicist Sir C.V. Raman, whose ground breaking work earned him the Nobel Prize. Notably, Sir C.V. Raman was also conferred the D.Sc. (Honorius cause) degree by AMU on November 20, 1931, adding to the university's rich academic heritage. The event served as a tribute to scientific excellence, motivating students, researchers, and faculty to pursue knowledge and innovation.

The program was presided over by Prof. A.K. Chaubey, Former Chairman, Department of Physics, who highlighted the significance of National Science Day and lauded the department's pursuit of academic excellence. He encouraged faculty and students to cultivate perseverance and determination in overcoming challenges and shared his experiences from his tenure at AMU.

The Chief Guest, Prof. Saibal Ray, FRAS and Associate Director, Centre of Cosmology, Astrophysics, and Space Science, GLA University, Mathura, emphasized Sir C.V. Raman's commitment and vision. He delivered a special lecture titled ***"Raman's Musicals: A Retrospective of EKTARA Research and Development."***

The Guest of Honour, Prof. Rajendra Singh Dhaka from IIT Delhi, provided a discourse on the impact of the Raman Effect on materials research and its benefits to society. He also detailed Raman's journey from London to India, where he made his seminal discovery.

Prof. Ateeq Ahmad, Dean, Faculty of Science, highlighted the importance of scientific exploration and encouraged students to dedicate themselves to research. Prof. Anisul A. Usmani, Chairman, Department of Physics, welcomed the dignitaries and highlighted the department's recent achievements and initiatives. He reaffirmed its commitment to inspiring future generations in advancing science and technology.

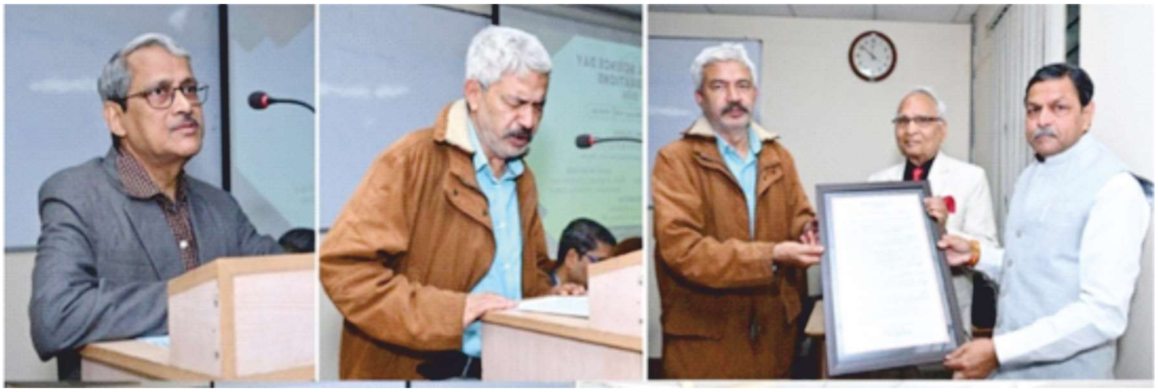
A significant highlight of the event was the conferral of the Lifetime Achievement Award upon Prof. A.K. Chaubey in recognition of his contributions to physics. The citation was presented by Prof. B.P. Singh, the senior-most faculty member of the department.

The celebrations also featured a series of competitive events designed to foster scientific creativity and engagement among students and research scholars. In the Science Quiz Competition, Mr. Samveel Ansari (Research Scholar) secured the first position, followed by Mr. Mohd Raza Khan (M.Sc. IV Semester) in second place, while Mr. Lalit Bhardwaj (M.Sc. IV Semester) and Mr. Suhaib Khan (Research Scholar) jointly claimed the third spot. The Essay Writing Competition witnessed impressive analytical writing, with Mr. Ezaj Ahmad (B.Sc. VI Semester) taking the first prize, Mr. Asif Shahriyar (B.Sc. IV Semester) securing second, and Mr. Nadeem Parvez Khan (M.Sc. IV Semester) placing third. In the Slogan and Poster Making Competition, the top honour was awarded to Mr. Mohammad Sahil Khan (B.Sc. II Semester) for his impactful creative expression.

Among research scholars, the Poster Presentation category saw Mr. Daud Ahmad Ansari winning first place, followed by Mr. Aquib Siddiq in second and Ms. Nida Malik in third. The Oral Research Paper Presentation showcased rigorous academic work, where Mr. Syed Mohd. Shariq Tahir earned the first prize, Mr. Daud Ahmad Ansari came second, and the third position was jointly shared by Mr. Mohammed Ashahar Ahamad and Ms. Naureen. These competitions provided a platform for students and scholars to demonstrate their knowledge, originality, and scientific communication skills, adding vibrancy and academic depth to the day's celebrations.

The event witnessed the participation of a large number of faculty members, including retired and current professors, along with students and research scholars. Notable attendees included Prof. Isar Ahmad Rizvi, Prof. Shakeel Ahmad, Prof. Shahid Hussain, Prof. Shabbir Ahmad, Prof. Mohd Shoeb, Prof. Tauheed Ahmad, Prof. M. Afzal Ansari, Prof. Zafar Ali Khan, Prof. S.S.Z. Ashraf, Prof. Wasi Khan, and Prof. Tufail Ahmad, among others.

The event concluded with a vote of thanks by Dr. Jai Prakash, Convener of National Science Day celebrations, who also conducted the proceedings. The celebration reinforced a spirit of scientific curiosity and excellence among students, researchers, and faculty members.



A view of the poster presentation by research scholars

B. P. Singh
Department of Physics

Report (RC-12A)

Faculty Development Program

An eight day Faculty Development Program on "**Emerging Trends in Quantum Computing and AI for Academia and Research**" by department of Physics in cluster with ECE, EEE, ETE, EIE departments from 3rd to 10th March. Executive Council Member of RC (12A) Dr. Meera R Gumaste was the Convener from the Department of Physics. Dr. Namrata Yaduvanshi, Life Member of IAPT was the coordinator of the FDP. Various Resource Persons like Prof T Shrinivas, IISc, Bangalore and Dr. Soujanya Y from CSIR-IICT Hyderabad delivered an insightful talk on the theme of the FDP. Industry persons from

Cybersena, Kodecraft Academy, IBM also delivered the talk on the theme.

Meera R Gumaste

Report (RC-07)

First Annual Convention-2025

(Theme: IYQ 2025)

Department of Physics, Hemchandracharya North Gujarat University, Patan

RC– 07 (Gujarat, Diu and Daman) held its first regional annual convention on Sunday,09-02-2025 at the Department of Physics, Hemchandracharya North Gujarat University, Patan. The theme of the convention was IYQ -2025 in line with the declaration of the United Nations (UN) for year 2025 to be the International Year of Quantum Science and Technology (IYQ).

The event, attended by over 140 participants, comprised of invited talks, state level Competition for Physics Experiments (CPEx) and panel discussion. The inauguration ceremony took place at 9:30 am in august presence of Prof. K. C. Poria, Honorable Vice Chancellor, Hemchandracharya North Gujarat University (HNGU), Patan, Prof. R. V. Upadhyaya (Provost, Charotar University of Science and Technology, Changa), Prof. P.C. Vinodkumar (President, RC07 and Fromer Head, Department of Physics, Sardar Patel University, Vallabh Vidyanagar), Prof. K. N. Joshipura (Former General Secretary, IAPT and Former Head, Department of Physics, Sardar Patel University, Vallabh Vidyanagar Mr. Jaimin Desai (Technical advisor, Government of Gujarat and Ex Deputy Director, SAC – ISRO), Dr. Rohit N. Desai (Registrar,

Hemchandracharya North Gujarat University, Patan) and Dr. Darshan Vyas (Head, Department of Physics, Hemchandracharya North Gujarat University, Patan).There were three invited expert talks:

1. "Platonic love at a distance: Quantum Entanglement" By Dr. Pruthul Desai, Principal, Sir P. T. Sarvajanik College of Science (Autonomous), Surat and Secretary, IAPT RC07
2. "Historical Developments in Quantum Mechanics" Mr. Viresh H. Thakkar, Sir P.T. Sarvajanik College of Science (Autonomous), Surat
3. "Physics in Satellites" by Mr. Jaimin Desai, Technical Advisor, Govt. of Gujarat and Ex Deputy Director, SAC – ISRO

Following lunch, the state level Competition for Physics Experiments (CPEx) was held where the winners of the respective cluster level CPEx participated. The competition was held in four categories: 1. School level 2. UG level 3. PG level and 4. Teacher level.

Winners are listed below.

Rank	Name of the students	Institution	Category
1	Lumbhani Divya Vijaykumar and Parmar Harsh Bhaveshbhai	Shri G.T. Sheth Vidyalaya, Rajkot	School
2	Aniket Solanki	Zenith School, Vadodara	
1	Suryaprakash S. Chaturvedi and Shreya Ramani	Sir P. T. Sarvajanik College of Science, Surat	UG
2	Shobhana R Solanki and Janki R Talpada	Shri R K Parikh Arts & Science College, Petlad	
1	Devansh D. Bhutwala,	Sir P. T. Sarvajanik College of Science, Surat	UG (Comp.)
2	Pradhyuman P. Patel and Parth L. Solanki	Navyug Science College, Surat	
1	Bhavishya Tepan and Akash Parmar	PDPIAS, Charusat, Changa	PG
2	Kishan Chauhan and Niraj Parekh	Christ College, Rajkot	
1	Salmankhan M. Luhar	Department of Physics, Shri Govind Guru University, Godhra	PG (Comp.)
2	Mistri Himanshi Narayandas and Khant ShraddhabenSubhasbhai	Sir P. T. Science College, Modasa	
1	Dr. Shehara S Patel	Department of Electronics, Sardar Patel University, Vallabh Vidyanagar	Teacher

The focus of the panel discussion was on the following points:

1. Concerns for receding strength of Physics students in UG programs
2. Design of syllabi to include topics on quantum science and technology and its application for secured cryptography etc.
3. Medium of instruction
4. Concern about the curriculum and topics at school level Mathematics and Physics
5. Emphasis on Physics experiments for better understanding of the topic and skill development
6. NEP implementation
7. Role of IAPT as an organization etc.

It was decided that these concerns would be shared with appropriate authorities. As a conscious decision the organizers did not use single-use plastic during the entire day event.

Prof. K.C. Poria (Hon. VC, HNGU)

Dr. Pruthul Desai

Chetan G. Limbachia

Report (RC-07)

A brief expedition into Atomic Universe

7th PRL-IAPT Dr. Vikram Sarabhai Lecture (April 9th, 2025)

PRL-IAPT Dr. Vikram Sarabhai Lecture, organized regularly every year is a flagship activity of RC-07 (Gujarat, DD-DN). On the afternoon of Wednesday April 9th, the seventh lecture of the series was organized at K. R. Ramnathan auditorium, Physical Research Laboratory Ahmedabad. The invited speaker was Prof. Bijaya Sahoo from the Atomic, Molecular and Optical Physics division, PRL. Listed as one of the Top 2% of Scientists in the world in the respective research fields since 2020, he is a recipient of NASI Fellowship, Buti Foundation Award (2018), and S.N.Ghosh Young Scientist Award from the Indian Society of Atomic & Molecular Physics (2010) together with other laurels from abroad. Prior to joining PRL, Prof. Sahoo worked at leading research organizations in Germany and The Netherlands.

Atomic physics is one of the oldest and the longest scientific endeavours in the history of mankind that spans from the time of the ancient philosophical ideas to the modern fundamental researches today. The notion of atom evolved gradually from the idea of indivisible particles to explaining the concept of quantum mechanics and subatomic structures. The 7th annual lecture was in a way an on-going celebration of the worldwide IYQ2025, as the inner secrets of the atom were revealed about a hundred years ago through quantum mechanics and quantum principles.

The programme began with a welcome address by Prof. Anil Bhardwaj, Director – PRL. He briefed about the annual PRL-IAPT Dr. Vikram Sarabhai Lecture series being jointly organized since 2019. Dr. Chetan Limbachiya, Head, Department of Applied Physics, MS University, Vadodara introduced the speaker who delivered the lecture on “A brief expedition into an Atomic Universe”.

Prof. Bijaya Sahoo very lucidly outlined how Atomic Physics goes beyond the usual Physics of atoms! The speaker discussed numerous atomic processes to show pathways for exploring natural treasures of various facets of fundamental Physics. He started with the familiar periodic table and the electronic configurations in atoms as taught in the school level science, giving an overview of matter from macroscopic entity down to quarks. He then dwelt upon the multi-electron atoms and outlined how atomic structure grows into theoretical complexities and offers computational challenges. An important consideration here is the dimensional and the energy hierarchy involved. Quantum mechanics plays a crucial role everywhere. He explained electro-magnetic, weak and strong interactions within an atom and touched upon the Physics 'beyond standard model' such as Lorentz symmetry violation, neutrino interactions, dark matter candidate mediating interactions, CP/T violation etc. He touched upon topics such as new vector bosons and nuclear structure from isotope studies and atomic parity violation. In that way, Prof. Sahoo vividly portrayed atomic systems as natural laboratories to study fundamental physics.

What are the applications of the fundamental knowledge like this? One would ask.

Prof. Sahoo turned to this important question and outline how the atomic knowledge is useful in the emerging science and technologies. Atomic clock plays important roles in very many ways today. Mentioning the success of our Chandrayaan -3 mission, he explained how the mission payloads have succeeded in detecting various chemical elements on the lunar surface. Advanced atomic physics is also important in the Aditya L1 data analysis. A fundamental role is also played in identifying various interstellar objects through atomic spectra these days. Atomic knowledge works for us through lasers of different types.

The speaker highlighted the role of many-body theories in the test for quantum mechanics on one hand and that of atomic physics in exploring nuclear knowledge though the studies of isotopic shifts etc. Current studies involve the synergy between high-precision measurements and three different theoretical areas -- particle, nuclear and atomic physics. Atoms provide natural laboratories for studying fundamental physics, he said, and emphasised in conclusion, on developing accurate relativistic many-body methods.

Thanking the speaker, Prof. P. C. Vinod kumar President IAPT RC-07, conducted the Q-A session and mentioned about the relevant quantum technologies. He gave an outline of the national and RC-level activities of IAPT. Dr. Bhushit Vaishnav of PRL was the programme anchor. The crowd applauded when Prof. K. N. Joshipura mentioned that our Indian students encouraged by IAPT always win medals in various science Olympiads year after year. He also recalled the previous speakers of the lecture series from 2019 onwards, and presented to Prof. Bijaya Sahoo a beautifully illustrated mug memento. RC-07 treasurer Dr. Punit Suthar proposed a vote of thanks. The audience comprising of students PRL scientists, IAPT members and also those viewing the YouTube live enjoyed the entire programme.

Now as per the RC-07 tradition, the article to be written by the speaker on the lecture topic will be published in the vol/ issue 17th of the annual magazine *Pragaami Tarang* 2025.

The speaker Prof. Bijaya Sahoo

K. N. Joshipura
(Anand, Gujarat)

Report (SRC-08E)

Quantum Doodles

De Broglie's Matter Wave Hypothesis Leading to the Electron Microscope

Date: 8th April 2025

Time: 12:30 PM – 2:00 PM

Venue: Department of Physics, RTMNU, University Campus

Resource Person: Prof. P. K. Ahluwalia,

President, IAPT

As part of the celebrations marking 100 years of Quantum Science and Technology, a special out- reach lecture titled **"Quantum Doodles: De Broglie's Matter Wave Hypothesis Leading to the Electron Microscope"** was organized by SRC-08E, in collaboration with, Post Graduate Teaching Department of Physics, RTM Nagpur University, Shri Shivaji Science College, Nagpur. Vidarbha University Physics Teachers Association (VUPTA)

The event took place at the PGTD Physics, RTMNU and was also broadcast live on **Zoom**, reaching over 150 postgraduate students across various institutions in Vidarbha, including:

(i) PGTD Physics, Gondwana University

(ii) PGTD Physics, SGB Amravati University (iii) Shivaji Science College, Nagpur

(iv) M. P. Deo Dharampeth Science College, Nagpur

(v) SFS College, Nagpur

(vi) Mohota Science College, Nagpur

(vii) Kamla Nehru College, Nagpur

(viii) Shivaji Science College, Amravati

(ix) Vidya Bharti College, Amravati

(x) Shivaji Science College, Akola

Over 70 students and 15 teachers attended the session in person.

The session was chaired by Prof. O. P. Chimankar, Head, PGTD Physics, RTMNU. The program began with introductory remarks by Prof. S. W. Anwane, President SRC-08E. Dr. G. V. Lakhotia, Vice-President IAPT SRC-08E and Event Coordinator, conducted the session.

Prof. Ahluwalia delivered an engaging talk that connected foundational quantum concepts to real-world applications, particularly focusing on the impact of de Broglie's Matter Wave Hypothesis in the invention of the electron microscope. He highlighted the relevance of quantum physics in daily life and paid tribute to great pioneers like Einstein and de Broglie.

An interactive Q&A session, moderated by Dr. Umesh Palikundwar, followed the lecture. The program concluded with closing remarks by Dr. O. P. Chimankar, and a vote of thanks by Dr. Lakhotia, followed by the National Anthem.

The event was a grand success in spreading awareness and enthusiasm for quantum physics among students and educators alike.

S. W. Anwane

Report (Ammani Anveshika)

Activities

Venue: HAL Public School

Event: The Eureka Experience!

Participants: 102 **No. of teachers**: 9

Date: 24 Mar 2025 **Time** 11.00 am to 1:00 pm

Topic: Develop skills and uncover hidden treasures.

After the end-of-term examination, coming to school for bag-less classes is a great idea! The students were in their natural self, with **no** stress, time management, fear of examination, or fear of failing! The participation of the students in the activities, interrogation, discussion, and search for creative answers was highly appreciated.

Unfolding the concepts from activities, correlating them with what they know and have experienced, and creating new complex knowledge that they proudly own was an achievement well ordained.

Going from simpler concepts to gradually tougher topics, seeing the relation with the two and finally using similarity and defining a relation is *not an easy task*! Anuraj shouted out the planar angle formula, Sharan saw through the relation between the angle of the plain mirrors and the number of spaces it created in the plane. Jatin could imagine the image space created about a point and gave the relation for the solid angle and the image spaces. Trishit could imagine the overall situation in which a toddler was using a lens for magnification! The climax was when Shazia analysed the 4 activities, saw the innate pattern in the outcomes, and generalized a relation to put forth a valid formula. The class discovered a scientific equation, a creditable achievement.

The team activity led to sharing of knowledge and skills among the students of IX and XI, a special bonding was established. Applying the concept to real-life situations was interesting. Nikhil suggested a simple method of determining the angle at the inner corner of a temple shikhara, and Simone's feedback was remarkable -It does not matter if we get the correct answer or not; the experience of the hands-on activity outweighed everything else.

Such interactive activities and inquiry-based questioning in the classroom broaden students' perspectives, fostering a robust scientific temperament and encouraging critical thinking, curiosity, and creativity.

Fig1. The Eureka Experience! 9th and 11th class students of HAL Public School

Fig.2- Principal Mr Om Singh Chundavad, Dr Shubha Sunil, and the Secretary graced the occasion and to facilitate the Experience!

Sarmistha Sahu
Coordinator

Report (NPECP-2025)

Valedictory Ceremony of the

National Photo Essay Competition in Physics 2025

Organized by IAPT

The Valedictory and Prize Announcement Ceremony of the **National Photo Essay Competition in Physics 2025** was held virtually on **April 21, 2025**, via Zoom. The event was jointly organized by SRC-08E Vidarbha and Dharampeth M.P. Deo Memorial Science College, Nagpur, and witnessed enthusiastic participation from over 115 students and faculty members from across the country.

The ceremony was compered by **Dr. G. V. Lakhotiya**, National Coordinator of the event, who underscored the importance of integrating creativity and visual storytelling in physics education. This was followed by an overview of the competition presented by **Prof. Shyamkant Anwane**, President of SRC-08E.

The event featured a distinguished panel of eight expert evaluators, including:

- **Prof. C.K. Ghosh** (Kolkata)
- **Dr. Y.C. Kamla** (Bangalore)
- **Prof. Ranjita Deka** (Guwahati)
- **Dr. Leena Joshi** (Mumbai)
- **Dr. Neetu Verma**
- **Prof. Pallavi Dixit** (Pune)
- **Dr. Jasmir Randhawa** (Nagpur)

Winners – Category 1: UG/PG Students

Rank 1: Romanchita Choudhury B.Sc. Semester VI Essay Title**:** Quantum Entanglement: Einstein's Spooky Action at a Distance

Institution: Pandu College, Guwahati

Rank 2: Chaitali Vinod Manwar B.Sc. Semester VI Essay Title**:** Through the Quantum Veil: Unlocking the Secrets of Dark Matter

Institution**:** Dr. Ambedkar College, Deekshabhoomi, Nagpur (DACN)

□ Consolation Prizes

- Samruddhi Kishor Jibhekar

  Essay Title: The Universe of Quanta, I Am Experiencing!

  Institution: Shri Shivaji Science College, Nagpur
- Yugansh Nandu Kanoje

  Essay Title: Quantum Threads: Unraveling Reality

  Institution: Shri Shivaji Science College, Nagpur
- Mahakpreet Kaur Rai

  Essay Title: Quantum Mechanics Behind Formation and Existence of Stars and Black Holes

  Institution: Dr. Ambedkar College, Deekshabhoomi, Nagpur

Winners – Category 2: Faculty / Teachers / Research Scholars

Rank 1: Dr. Mahendra Madhukar Khandpekar Professor

Essay Title**:** Quantum Technologies Revolutionizing the 20th & 21st Centuries

Institution: B.K. Birla College (Empowered Autonomous Status), Kalyan

Rank 2 : Divyanshu Mishra Research Scholar Essay

Title**:** A Quantum Journey from Schrödinger to Density Functional Theory (DFT) for Real-World Applications in Material & Bioscience with Calculations in Quantum Supercomputers

Institution**:** HBTU, Kanpur University

Consolation Prizes

- Mr. Samir Khule School Teacher

  Essay Title**:** Quantum Mechanics and Technologies of the 20th and 21st Centuries Institution: Bhavan's B.P. Vidya Mandir, Ashti (Khurd), Nagpur

- Md Nurulla Mollick School Teacher Essay Title: From Atoms to Algorithms: A Century of Quantum Mechanics and Technological Evolution

  Institution: Shishu Sadan High School, Kolkata

- Dr. Pranita C. Deshpande College Faculty

  Essay Title**:**"LIGO" – Resurrection of Albert Einstein

  Institution: Dharampeth Science College, Nagpur

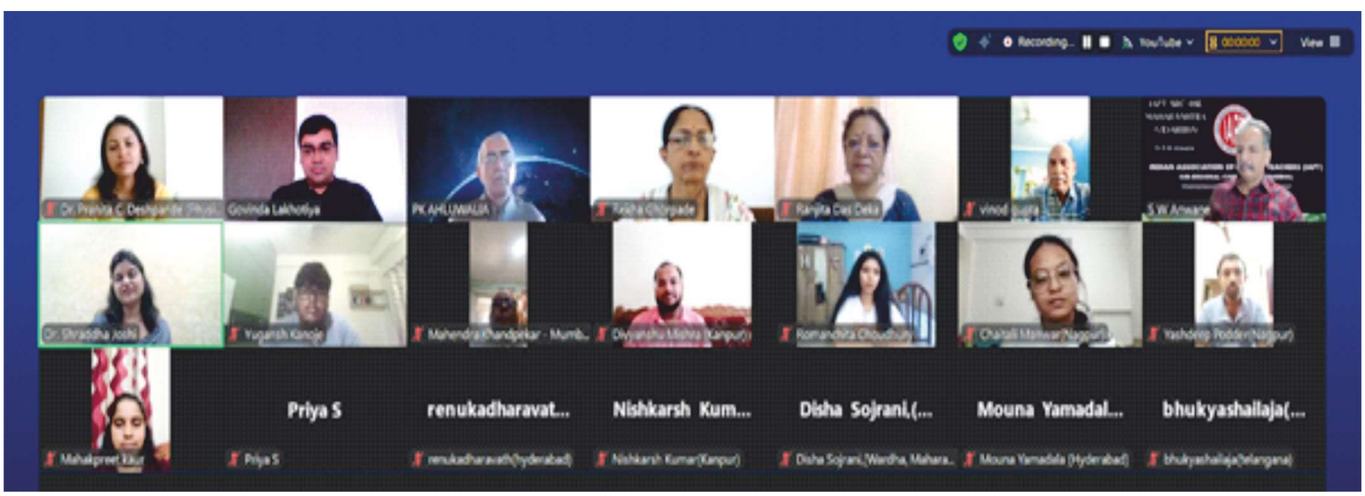
The event concluded with reflections from participants, who shared how the competition sparked their interest and deepened their appreciation for quantum science.

Prof. P.K. Ahluwalia, President of IAPT, and **Dr. Rekha Ghorpade**, General Secretary of IAPT, applauded the participants and organizers for their enthusiasm and commitment. They emphasized the role of such initiatives in nurturing scientific curiosity and a culture of innovation among budding and practicing physicists alike.

The event was convened by Dr. Prashant Ambekar, with Dr. Shraddha Joshi, Mrs. Payasvini Dhok, and Dr. Pranita Deshpande serving as coordinators.

The Top 10 Photo Essays of the Year can be revisited on the official IAPT Central YouTube channel.

https://www.youtube.com/live/25PkACOauKY?si=ZsJ9JuMVUzgFC_yz



Shyamkant W. Anwane

Report (RC-09)

Prof. Babulal Saraf Memorial National Workshop

Innovative Experiments of Physics for College Teachers and Students

Department of Physics, ISR, IPS Academy conducted an experimental workshop on innovative experiments of Physics in the memory of Late Prof. Babulal Saraf entitled "**Prof. Babulal Saraf Memorial National Workshop on Innovative Experiments of Physics for College Teachers and Students"** from 3rd-8th March 2025. Aim to organize this workshop is to encourage and improve experimental Physics education in the college and to bridge the gap between theory and experiments. Thirty one participants joined this workshop.

Chief Guest of the workshop was Dr. Vasant G. Sathe, Centre-Director, UGC-DAE-CSR, Indore. He addressed the participants and informed about the importance of "Make in India" as Indian government has refused to import machine from abroad. So, this is the best time for young generation to initiate their start up to design their experiments with the innovative ideas. If some students need funds for that, then UGC-DAE-CSR can even provide the same.

Ms. Neha Jain, Director of IPSA encouraged all the participants.

Dr. Premlata Gupta, Principal IPS Academy motivated all the participants and informed about the specialties of IPS Academy.

This workshop was sponsored by Indian Association of Physics Teachers (IAPT), RC-9. Dr. Pradeep Kumar Dubey, Ex- IAPT EC member informed about the activities of IAPT at national level.

Prof. M.L.Sharma, Ex- Director of ISR discussed about the life journey of Late Prof. Babulal Saraf.

Dr. Jitendra Tripathi, President IAPT, RC-9 and HOD Physics as well as Convener of the workshop informed about the details of the department and workshop.

In this workshop, IPS felicitated Dr. Kamal Kushwah, Prof. and Head of Physics, Engineering college, Jabalpur as he was awarded Babulal Saraf Medal 2024 by IAPT.

The program was conducted by Dr. Anjali Jain Deotale and vote of thanks was proposed by Dr. Jaiveer Singh.

In total, there were 20 practical. All the participants performed the experiments very sincerely. On 7th March 2025, Dr. P.K.Dubey demonstrated experiments of Physics to enhance the basic concepts of Physics.

Jitendra Tripathi

Report (RC-08E)

International Faculty Development Programme on

Advanced Materials and Characterization Techniques (AMCT-2025)

The **Department of Applied Physics**, Yeshwantrao Chavan College of Engineering (YCCE), Nagpur, in collaboration with the **IAPT**, successfully organized a **one-week International Faculty Development Programme (FDP)** on **"Advanced Materials and Characterization Techniques (AMCT-2025)"** from **6th to 12th February 2025**. The event brought together an impressive assembly of experts, researchers, and academicians from across India and around the world, making it a vibrant and global learning platform.

The FDP saw enthusiastic participation from **over 270 attendees** representing **19 states of India** along with contributions from **international experts**, truly reflecting its international stature.

The inaugural ceremony was graced by:

Dr. U.P. Waghe, Principal, YCCE

Prof. P.K. Ahluwalia, President, IAPT

Dr. S.W. Anwane, President, SRC-08E

Dr. G. Lakhotia, Vice-President, IAPT SRC-08E

Principal Dr. U.P. Waghe, in his welcome address, emphasized YCCE's unwavering commitment to academic excellence, research innovation, and interdisciplinary collaboration in science and technology. He also highlighted the institution's **Ruby Jubilee celebrations**, commemorating its **40-year journey of excellence**.

Prof. P.K. Ahluwalia, the Chief Guest underlined the critical role of physics and interdisciplinary research in the advancement of **materials science**. **Dr. Anwane**, shared insights into the various impactful activities carried out by the council in the Vidarbha region.

Dr. Vikrant Ganvir, Convener and Head of the Department of Applied Physics, offered a comprehensive overview of the FDP, emphasizing its objective of promoting cutting-edge research and knowledge sharing in the field of **advanced materials and their characterization**.

The FDP featured **renowned speakers** from premier institutions and industries, including:

Dr. Ashish Kumar – Central University of Jammu

Dr. P. C. Deshmukh – IIT Tirupati & IISER Tirupati

Mr. V. P. Katekar – IIT Bombay

Prof. P. Ramasamy – Director, SSN Research Centre and National President, Indian Association for Crystal Growth

Dr. N. Ugemuge – ANC Warora International experts included:

Dr. Atul D. Sontakke – Director, Product Engineering, Seaborough, Amsterdam

Mr. Shadab Hussain – Senior Associate, MLOps, The Math Company, Frisco, Texas, USA

Dr. Arsala Z. Khan, Co-Convener, conducted the proceedings and proposed the **vote of thanks**, expressing gratitude to all dignitaries, speakers, participants, and organizers.

The program's success was the result of the dedicated efforts of the organizing team: **Dr. H.V. Ganvir, Dr. B. N. Patil, Dr. S.A. Fartode, Dr. M.A. Upasani, Prof. O.D. Verma, Dr. G.K. Sukhadeve**, and **Prof. A.D. Lokhande**.

The FDP not only served as an excellent academic enrichment opportunity but also fostered meaningful dialogue and collaboration among educators and researchers in the field of advanced materials.

S W Anwane

Indian Association Of Physics Teachers
(Registered under Section XXI of Societies Act 1860, Reg. No. K-1448)
Regd. Office : Flat No. 206, IInd Floor, Adarsh Complex,
OPR-4, Awas Vikas-1 Keshavpuram, Kalyanpur, Kanpur-208017
Email: iaptknp@rediffmail.com Ph.: 9415404969, 9839035685, 9935432990

NATIONAL COMPETITION FOR INNOVATIVE EXPERIMENTS IN PHYSICS (NCIEP) – 4th-7th October 2025, Goa University, Goa

FIRST CIRCULAR

The National competition for innovative experiments in Physics (NCIEP) has been held since 2003, to encourage Physics Teachers, students and Physics educators to conceive and set up innovative experiments in Physics. The Competition is held every year at the venue of the Annual Convention of IAPT. Innovation rather than sophistication is the main theme and therefore the use of computers for data acquisition and display is not allowed.

1. The following categories are included:

   (A) The participant can be a teacher at any level or M. Phil. / Ph. D. awarded /Ph.D. pursuing student or a Scientist from national laboratories or a science communicator working in science centers, etc. He/she need not be an IAPT member.

   (B) The participant can be a student pursuing UG/PG course

   (C) The participant can be a High School student Studying in 9-12 standard.

   For all categories participants themselves have to demonstrate the experiment.

2. The experiment should be an original one, designed by the participant himself/ herself. It can be even a demonstration type experiment. As 2025 had been declared as the year of Quantum Science and technology participants are most welcome to design experiments in that topic.

   For category B and C, students can work under the guidance of a mentor .

3. Top 3 experiments from each category A, B and C are awarded cash prizes.

Selected entries from each category will be invited for a demonstration at the 39th IAPT convention to be held from 4thto 7th October 2025 at Goa. The invited participants will be paid railway fare from the workplace to the convention place as per IAPT rules. In case of joint authors, only one of the participants is eligible to receive TA (as per IAPT rules). Top ten student participant entries (for category B and C) may be given an amount of Rs 1000/- each towards expenditure incurred in setting up the experiment. Please submit the write-up of experiment as an email attachment (both word & PDF file is a must) to the coordinator at the email id: **nciepiapt03@gmail.com** The selected participant must come with his/her own setup for final demonstration.. Decision of the judges will be final. Detailed announcement will be shared shortly.

Closing date to receive the entries is 31st August , 2025. Please feel free for any query at e- mail: nciepiapt03@gmail.com or WhatsApp number 8088812890

Dr Geetha R S, Coordinator, NCIEP 2025

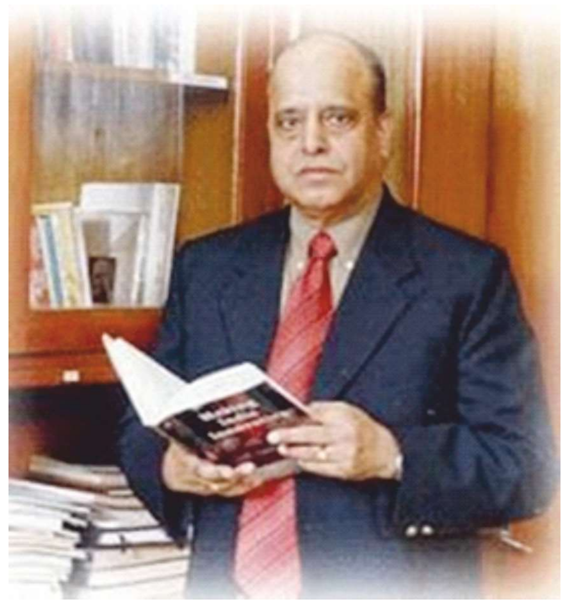
Homage to Prof. Krishnaswamy Kasturirangan

A leader of Indian Space Programme, Prof. Kasturirangan nurtured Indian Space Research Organisation (ISRO) to be a symbol of self-reliance and excellence. As Chairperson of ISRO for nine years he led the formulation of both the Mars and Moon missions. In the last five years he steered New Education Policy (NEP 2020), in the country and in its structure one can see his signatures in the form of a huge team effort, a hall mark of space programme culture. Curricular frame work for school education and for higher education are two documents which he guided, if implemented in letter and spirit can raise the quality of education in the country to new heights. He indeed was the architect of NEP.

His academic achievements laid the foundation for his illustrious career as a space scientist and educator, leading India's space program and contributing significantly to the field of astronomy and space science. He has been a role model for young aspiring students beyond IIT's.

We at Indian Association of Physics Teachers deeply mourn the sad demise of Prof. Kasturirangan. It is a huge loss to the country.
Our heartfelt condolences to the bereaved family members and his bigger family at ISRO. May his soul rest in peace.

President
Prof. PK Ahluwalia
Indian Association of Physics Teachers.
25.04.2025



Prof. K. Kasturirangan

Bachelor of Science with Honours: He graduated in science from Ramnarain Ruia College, Mumbai, and later completed his Bachelor of Science with Honours from the University of Mumbai.

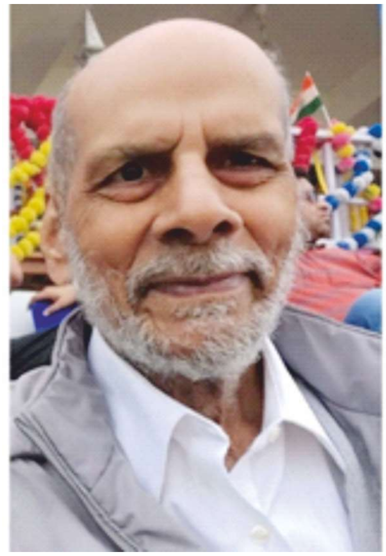
Master of Science in Physics: He obtained his Master's degree in physics from the University of Mumbai.

Doctorate Degree in Experimental High Energy Astronomy: He received his Doctorate degree in 1971 from the Physical Research Laboratory, Ahmedabad.

Donation received in account of IAPT@40 Corpus Fund

Sr. No.	Date	Name	Place	Amount Rs.
			Previous Balance	**6,10,200.00**
1.	04-04-2025	Dr. M. J. Ponnambalam	Tirunelveli	1,00,000.00
2.	09-04-2025	Dr. C. Salma	Nellore	500.00
3.	15-04-2025	Dr. H. S. Virk	Mohali	1,00,000.00
			Total Rs.	**8,10,700.00**

Homage to Dr Iqbal Singh Minhas



October 10, 1940 - April 26, 2025

Bachelor of Science (Honours School):

Master of Science (Honours School):

He completed his B.Sc.(H.S) and M.Sc.(H.S) in Physics, from the Department of Physics, Panjab University, Chandigarh

Doctorate Degree: He received his Doctorate degree from Indian Institute of Technology, Kanpur.

After returning from my study leave in France, I was looking for a dwelling unit in sector 37. Dr Minhas suggested us a three bed room unit just adjacent to his dwelling unit in house No 414 on the first floor. It was of our choice for the family of four and we settled for the same. Thus we became close neighbour in July 1978. They had a small baby girl and his mother was also often visiting them. Thus the two families of five adults and three kids had wonderful time. Later they were blessed with a son and we celebrated this occasion with all happiness of life together. They were extremely nice and open hearted people with grandeur of rural Punjab.

It so happened that we were given the same office No F7 in the department. Dr. Minhas suggested that you occupy the window seat and I shall be happy near the door. Thus we remain roommate in the department nearly for a decade till he was given another office space.

This decade long partnership was the partnership of human relationship, emotional bonding and sharing of academic values. He was an intellectual with deepest understanding of basics of physics. He consistently contributed to philosophy of physics; the challenging subject for anyone. He was a teacher par excellence, true to his students to get them convinced with the concepts of physics with best of his ability. He was disciplined and compassionate human being. We were too close to each other sharing academics, family problems and administration responsibilities of the department. He was fond of smoking but my consistent advise brought a day that he left it forever; a happy moment for us.

Later on we shifted to our own houses but the family intimacy continued till we were together in the department. We had the most difficult time when his son lost to life in United States.

It was too difficult to console them. They managed to come out of that but that pain was there till we met together in Feb. 2025 to exchange our life experiences nearly for two hours. Our last communication was on March 16, 2025; he was not well. After a brief illness, he breathed his last on April 26, 2025.

He always accomplished the IAPT- responsibilities assigned to him with commitment and dedication. We are grateful for his constructive contribution to IAPT.

We have lost an affectionate neighbour, a decade long roommate and an intimate colleague forever on April 26, 2025. We pay our emotional homage to the noble soul and condolences to the family members.

Prof. Satya Prakash
Former President IAPT

Unpacking the Complexities of Teaching Science - A Perspective from Cognitive Linguistics

This article continues our discussion on the role of cognitive science in science/physics education research, focusing on a paper that investigates how teachers help students construct mental models of imperceptible scientific mechanisms (atmospheric pressure, photosynthesis etc.). As we know these imperceptible mechanisms are codified or stacked into technical terms and embedded in academic language structures which we find in our textbooks, which majority of students find difficult to comprehend on their own.

Salve, J., Upadhyay, P., Mashood, K. K., & Chandrasekharan, S. (2024). Performative Bundles: How Teaching Narratives and Academic Language Build Mental Models of Mechanisms. *Science & Education*, 1-39. **https://link.springer.com/content/pdf/10.1007/s11191-023-00488-7.pdf**

Models of scientific mechanisms are structurally complex and dynamic. Let's take photosynthesis as an illustrative example. Building such mental models in our minds requires mentally simulating novel structures, their state changes, and higher-order transformations (such as transpiration and liquid levels). These mental simulations are then intertwined with a series of external representations (ERs), including formal terms (like stomata and guard cells) and schematic structures (such as figures and graphs). All these complexities are stacked or packed into a technical term like photosynthesis, which in turn is embedded in the academic language found in our textbooks. When students encounter this term later, they essentially have to unpack or unfreeze these complexities to achieve what we call understanding. The role of the teacher is to help students mediate the processing of constructs like photosynthesis, which students find difficult due to its abstract nature. Drawing on insights from cognitive linguistics, the above paper provides a process account of how teacher narratives enable this challenging task by connecting and building on students' everyday experiences.

Though the example illustrated in detail in the above paper is that of photosynthesis, one can easily connect the arguments to abstract physics concepts as well. More details on this and extensions to physics can be found in the PhD thesis of the first author: **https://www.hbcse.tifr.res.in/academic/graduate-school/ph-d-s-awarded/jps002_thesis_finalver.pdf**

In the thesis, the discussion developed in the context of analyzing mechanism models in biology is extended to mathematical model building in physics. Derivations, a core component of physics education, are conceived as an activity in mathematical model building – a process of loading the real world into mathematics. Equations emerging from derivations are considered akin to terms like photosynthesis, in the sense that models of real-world phenomena are loaded into equations, whereas mechanism models are packed into terms like photosynthesis. The physics study discussed in the thesis is based on an interactive learning system developed for the derivation of wave equation (see Wave Equation, **https://mcc.hbcse.tifr.res.in/interactive-derivations/**). The derivation system embodies the pedagogical narrative of derivations as loading of reality into equations and makes explicit a conceptual structure (sequence of 5 steps) underlying many derivations in physics. The design of the learning system incorporates the concreteness fading view, highlighting the transition from concrete to abstract in the whole process. The study discussed indicates that the learning system and the associated teacher narrative can positively impact student understanding of conceptual and epistemological dimensions of derivations.

In summary, the thesis and the paper bring to the fore the enormous complexity underlying the process of making students understand abstract concepts in science in general, undertaken by teachers on a day to day basis in their classrooms (which unfortunately does not often get the appreciation it deserves). Arguments are made by drawing on the intricate relationship between language, cognition/mental simulation, and their role in the construction of scientific knowledge.

K K Mashood
HBCSE - TIFR, Mumbai

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Dr. Sanjay Kr. Sharma

Managing Editor

Flat No. 206, Adarsh Complex,
Awas Vikas-1, Keshavpuram, Kalyanpur, Kanpur-208017

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