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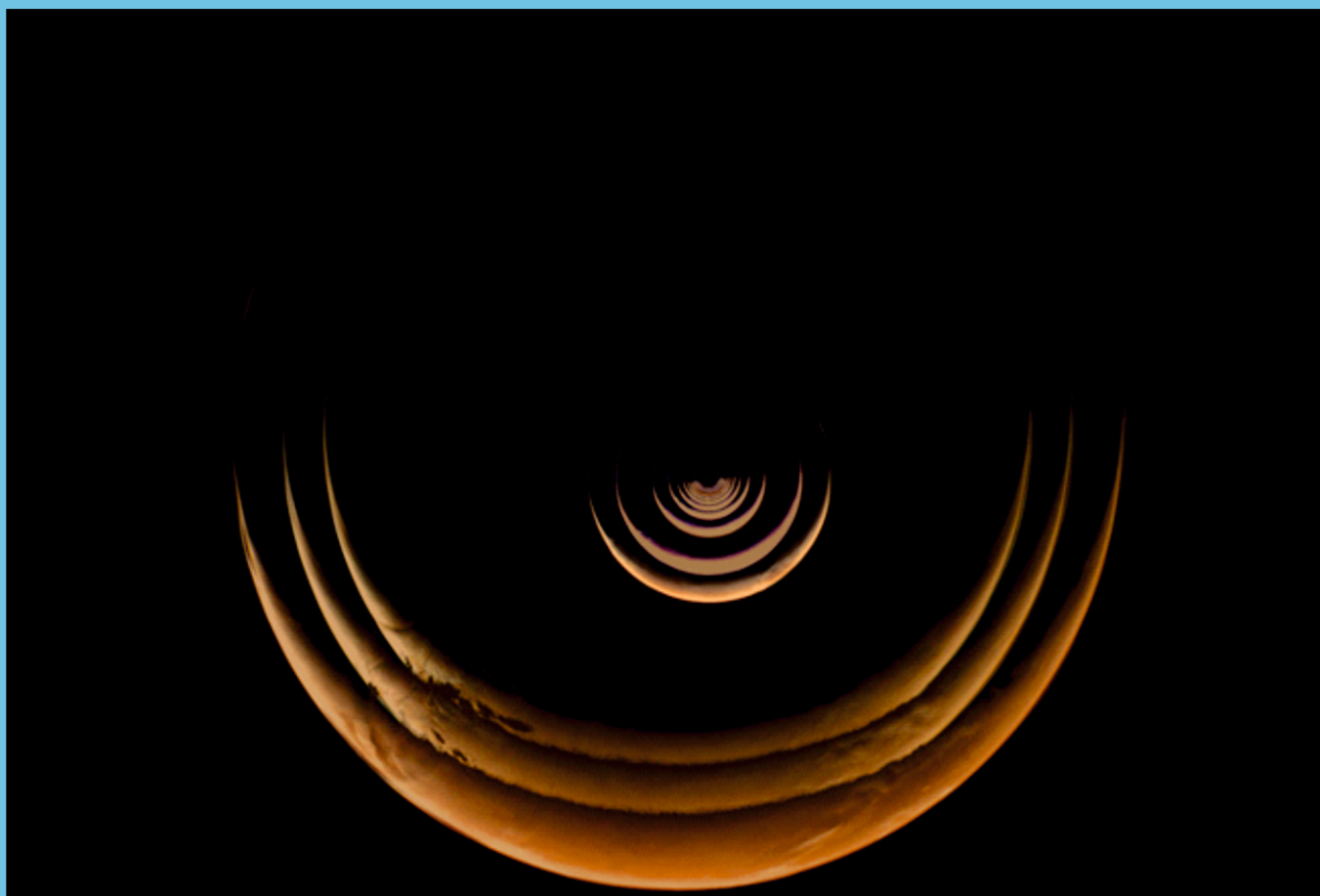
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This composite of images taken by NASA's Psyche mission shows the crescent of Mars grow as the spacecraft approached the planet for a gravity assist from May 2 to May 15, 2026. Because Psyche approached Mars from a high phase angle, the planet appeared as a thin crescent in the days running up to the close approach, lit by sunlight reflecting off its surface.

This composite photo released on July 17, 2026, shows the crescent of Mars grow as NASA's Psyche spacecraft approached the planet for a gravity assist.

Psyche flew by Mars on May 15, 2026, using the planet's gravity to gain speed and slightly tilt its trajectory. The flyby also gave the team an opportunity to prep for the science they will be conducting when they reach the metal-rich asteroid Psyche in 2029.

Link: <https://www.nasa.gov/image-article/psyche-approaches-mars/>

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

Chief Editor

- **Manjit Kaur**, Chandigarh
Email: iapt@pu.ac.in

Editor

- **C N Kumar**, Chandigarh
Email: cnkumarphys@gmail.com

Associate Editors

- **Arvind K. Taneja**, Panchkula
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Coordinators:

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Mob. 9412954316 ♦ Email: iapt.nse@gmail.com
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- NCIEP : Geetha R. S., Bengaluru
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- NPECP : Govinda Lakhotiya
Mob. 9579194076 ♦ Email: lakhotiya.govinda@gmail.com
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Email: jtghushhe21@gmail.com
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- IAPT IT CELL: Shyamkant W. Anwane, Nagpur
Email: swanwane2000@yahoo.com
- INPT : Syed Minhaz Hossain, Howrah
Email: shminhaz@gmail.com

Registered Office

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

E-Mail : iaptknp@rediffmail.com

Secretary :
Sanjay Kr. Sharma

sksharma777@gmail.com
Mob. 9415404969

Treasurer :
D. C. Gupta

guptadeepchandra117@gmail.com
Mob. 9839035685

Office Assistant :
Vinod Kr. Prajapati

iaptknp@rediffmail.com
Mob. 9935432990

Editorial

Reimagining Physics Education in India

On 12 July 2026, the online launch of the e-book *Vision for Science Education* became more than a book event. It opened a frank discussion on the state of science education in India, especially the declining appeal of physics among students. The e-book is a collection of essays by eminent physicists and scientists. It is edited by Professor Satya Prakash, former President of the Indian Association of Physics Teachers and former Vice-Chancellor of Jiwaji University, Gwalior. The Presence of Prof. Arun Grover, former Vice-Chancellor of Panjab University and the member of C14 Group of IUPAP on Physics Education was the Guest of honour. The main concern raised during the launch was clear: fewer students are choosing physics as an undergraduate major. This trend is visible across the country. It has become sharper after the National Education Policy 2020, which replaced the older medical and non-medical divide with a wider multidisciplinary choice of subjects.

Up to Class 12, physics remains almost unavoidable. It is seen as the gateway to engineering and medicine. The difficulty begins after Class 12, when students who do not enter engineering or medical colleges must decide whether to continue with the basic sciences. At this stage, physics often loses out. Two doubts shape the choice: physics is difficult, and physics does not seem to lead clearly to jobs. As a result, many students move toward biology, chemistry, mathematics, or computer science. This is where reimagining physics education becomes urgent. A subject body such as IAPT must take this challenge seriously and respond to the changing situation.

A Discipline Losing Its Students

The numbers are hard to ignore. In many state universities, 40 to 60 percent of undergraduate physics seats have remained vacant since 2020. Delhi University had about 18,000 applicants for physics in 2014. By 2023, the number had fallen to around

12,000 for a comparable number of seats. The contrast with professional courses is striking. In 2024, 12.2 lakh students appeared for JEE and 24 lakhs for NEET, while physics admissions through CUET stood at only about 1.1 lakh. The imbalance is clear.

The problem continues beyond admissions. A 2023 NASSCOM survey found that 85 percent of core science graduates consider themselves unemployable without extra skills. Only about 8 percent of physics graduates get core research and development jobs. The rest move into banking, competitive examinations, EdTech, or other fields. UGC data also show that physics intake has fallen by 22 percent in five years. Nearly 60 percent of physics PhDs from institutions outside the centrally funded technical elite do not publish in an indexed journal. The broader pattern is similar. Science enrolment has risen overall, but physics-only majors have declined by 11 percent in five years. Only 23 percent of B.Sc. graduates are judged employable in core roles, compared with 51 percent of engineering graduates.

The Two Objections

Students often express their reluctance in two simple ways. First, physics feels too hard. One reason is that it is still taught in an old style and examined in an equally outdated way, even though today's students live in a very different world. Second, students believe physics has no clear jobs. The deeper issue is that they are rarely shown the range of work that physics can lead to. They mostly see only two familiar routes: school teaching or the long path through eligibility tests toward an assistant professor's position. For many students who consider a Ph.D., even that path looks uncertain because fellowships are few and academic openings are shrinking. Engineering and medicine have not killed physics. The real failure lies in not showing students the physics inside engineering, technology, industry, and emerging national missions. This also explains why students and teachers struggle to make the four-year undergraduate

research degree attractive. That difficulty needs serious investigation.

A Blueprint for Renewal

The National Education Policy 2020 should be seen not as a burden but as an opening. This needs to be explained to prospective physics students at the time of admission. The NEP's multidisciplinary structure allows physics to be paired with useful minor courses. Physics with data science can lead to quantitative careers. Physics with public policy can support advisory roles. Physics with economics can open pathways to the financial sector. The policy's emphasis on skills also fits naturally with simulation, electronics, and instrumentation. Its shift from rote learning to conceptual understanding suits physics, which was never meant to be reduced to a formula factory.

By 2023, about 120 universities had adopted a four-year degree. Yet fewer than 15 percent of physics departments were using it fully. Many departments still prefer to offer an exit after the three-year B.Sc. degree. This raises an important question: how can the four-year physics degree become more attractive? Some leading institutions offer useful examples. IISER Pune's BS-MS pathway in physics and data science, for instance, placed its entire 2023 batch at an average salary of 14 lakh a year.

Reform must work at three levels. The first is school education. Many children choose biology because they can imagine becoming a doctor, but they cannot imagine becoming a physicist. A yearly chapter on the Physics of India can change this. It can connect physics to visible examples such as the Chenab Bridge, mobile GPS, and chip-fabrication technology. Labs should also begin with instruments before equations. When students first handle the apparatus and then learn the theory, physics becomes less abstract and more alive.

At the undergraduate stage, *Physics Plus* degrees can make the subject more relevant. These degrees can combine physics with data science, AI, finance, or

instrumentation. They should also include six-month industry projects and internships. Such programmes can help close the salary gap that makes many physics graduates appear less employable than their engineering peers. IIT Kanpur's comparable programme reached 90 percent placement, showing that this approach can work.

At the postgraduate level, physics needs stronger links with national missions. Master's projects can be tied to areas such as quantum technology, semiconductors, Gagan Yaan, and green hydrogen. A *Teach to Learn doctoral track* can also help. Under this model, research scholars would spend one day a week in schools. This would give physics greater public presence and help students see it as a meaningful and attractive choice.

IAPT can launch three low-cost initiatives that need more resolve than money. These initiatives can build on IAPT's existing networks: the *National Anveshika Network*, the *National Astronomy Network*, the *National Quantum Engineering, Science and Technology Network*, and the *National Artificial Intelligence in Physics Network*. First, every member can share an annual video showing physics at work in India. Second, IAPT can create a shared bank of NEP-ready Physics Plus curricula. Third, it can support district partnerships that link one school, one college, and one industry partner.

We need to remember that the flint defined the Stone Age. In the same way, the physicist is indispensable to the quantum age. The Chenab Bridge stands because someone understood the strength of materials. The next chip, the next moonshot, and the next monsoon model will also depend on students who choose physics today. IAPT's task is to help them make that choice through a reimagined physics curriculum. As a subject society, we have a duty to rise to the occasion and shape a new vision for the future. The challenge is large because institutions are diverse and affiliating systems are complex. But that is exactly why the response must be urgent, practical, and collective.

PK Ahluwalia

Physics News

Oxygen collisions at the LHC show new indications of extreme state of matter

All four main LHC experiments have found new signs that oxygen and neon collisions may create the extreme state of matter that existed during the first microseconds after the Big Bang. One year after the first-ever collisions of oxygen at the Large Hadron Collider (LHC), the main LHC collaborations - ALICE, ATLAS, CMS and LHCb, have each reported signs of the state of matter known as quark - gluon plasma (QGP) produced in these collisions. It was previously thought that colliding heavy ions such as lead - which is more than 200 times heavier than the protons typically collided at the LHC—was the only way to create the conditions necessary to form QGP. But this premise has recently been thoroughly challenged, including earlier this year, when the ALICE Collaboration, which specializes in the study of this extreme state of matter, reported a new sign of QGP from proton–proton and proton–lead collisions. The leading explanation is the presence of QGP, which causes particles produced in a collision and moving at intermediate momenta to exhibit anisotropic flow. Studies of possible QGP formation in light-ion collisions continue as researchers comb through the LHC data.

Provided By: CERN (<https://phys.org/partners/cern/>)

Plasma design rules show how to preserve attosecond flashes for observing electrons

Researchers have determined how to select the thickness and density of a plasma target so that a pulse passing through it retains its attosecond duration and high intensity. An attosecond is 10^{-18} of a second. Pulses of this duration can be compared to an ultrafast camera flash: They make it possible to effectively "freeze" the motion of electrons and investigate processes that cannot be resolved using longer pulses. However, the same plasma involved in generating the pulse can also "blur" it. Different frequency components of the radiation travel through the medium at different speeds. To determine this limit, the researchers performed one- and two-dimensional particle-in-cell simulations on Skoltech's Zhores supercomputer. The paper also presents a map that can be used to determine the maximum target thickness permissible in attosecond experiments for a given plasma density. In the future, such systems could be used to investigate electron motion, chemical reactions and material properties on extremely short timescales.

Read more at: <https://phys.org/news/2026-07-plasma-attosecond-electrons.html>

Original Paper: Applied Physics Letters (2026). DOI: 10.1063/5.0324448

Quantum neural networks get their first hardware test

Neural networks have transformed how machines find patterns in data, from recognizing faces in photos to predicting the shapes of proteins. So far, all of this progress has been made on ordinary classical computers, but with quantum computers now edging into practical use, there is a real possibility that neural networks could tap into distinctly quantum effects and operate in ways that classical machines never could. A neural network is built from layers of simple units, each taking in signals and passing on an output depending on what it receives. To train a network, the connections between these units are adjusted until the network reliably produces the right answer for a given task. The team tested the network on the classic task of recognizing handwritten digits. By introducing a moderate amount of quantum uncertainty, they found that its accuracy actually improved compared with the fully classical mode. As quantum computers grow larger and better controlled, this kind of benchmarking will matter for determining which architectures are worth developing further and whether quantum neural networks might one day tackle problems beyond the reach of classical computers altogether.

Read more at: <https://phys.org/news/2026-07-quantum-neural-networks-hardware.html>

Original Paper: Physical Review Letters (2026). DOI: 10.1103/9bp2-42v3

Soumya Sarkar
Duke University, US

August: This Month in the History of Physics

1675: The Foundation stone of RGO is laid

King Charles III of England laid the foundation stone of RGO i.e. the Royal Greenwich Observatory possibly the most famous observatory of modern time on August 10, 1675. It was, in fact, not the first observatory in Europe but the first in Britain. King Charles III appointed John Flamsteed in charge of the observatory in 1676 when it became functional. The position came to be known as Director but more popularly as Astronomer Royal. What was this observatory supposed to do or supposed to deliver? Well, there were quite a few important problems on hand that astronomy was expected to provide solution for. Among these a very important task that the observatory was to address the longitude problem.



RGO at London

At that time the seafarers and sailors going for the voyages had a great difficulty in finding their exact location in the open sea. The latitude of a point on the sea they could find out from the observations of the pole star and hence they could know how far north or south they have moved from their point of departure. But longitude was a big problem and the sailors could not know the east and west positions. The determination of longitude demanded accurate time keeping i.e. the sailors must know the local time accurately through astronomical observation, and that would enable them compare that with the time at the place they left. At any moment the difference between the local time of two places is connected to the differences in the longitude of the two places as we

very well know now.

We must keep in mind when the Observatory began its journey Newton was in his thirties and was at the peak of his scientific career. Later when this longitude problem was resolved thanks to the manufacture of excellent chronometer by Harrison the prime meridian with a longitude of zero degree was taken as the longitude passing through Greenwich, of course after some bitter debate with France where the people wanted to have the zero-longitude line as the one passing through the observatory in Paris.

1789: A new moon of Saturn is discovered

William Herschel the German-British astronomer could make his telescope talk. By using the telescope in 1780s he went on critically looking at the corners of the sky in search of newer celestial objects. The success began to come with a telescope that in today's standard are essentially archaic. On August 28, 1789 he could discover one satellite of the planet Saturn. However, this planet now known as Enceladus got its name in 1847 when John Hershell the son of William Hershell took this name from the Greek mythology where Enceladus has been described as a giant.

Enceladus so to speak is not a giant and is only the sixth largest satellite of the Saturn. Its diameter is about 500 km. We had to wait for nearly two centuries to know more about Enceladus until the two space probes Voyager 1 and Voyager 2 had a "close" flyby of Saturn in 1980 and 1981. In 2005 more could be known about Enceladus when the space probe Cassini specially designed to probe the Saturn and its satellites could collect more information about Enceladus to make it a reasonably familiar celestial object.

1894: Discovery of the first inert gas

The British Association for Science produced an unusually brief report of its 1894 meeting for a pathbreaking discovery that actually took both the fields of physics and chemistry by storm. It referred to a report published on Monday, August 13 and mentioned "A joint meeting with Section A was held, at which Lord Rayleigh, Sec. R.S., and Professor W. Ramsay, F.R.S., gave a preliminary account of a New

Gaseous Constituent of Air." And it was indeed a hitherto unknown gas and an elementary one. So that was the discovery of a new element as well and the element was Argon. Interestingly it was a constituent of atmospheric air yet it remained elusive and now we know that Argon is present by 0.93% by volume in air. This is definitely not an insignificant amount, but the fact it was an inert gas the detection was difficult. Lord Rayleigh carried out some very careful and long experiments where he compared the density of pure nitrogen obtained through chemical reactions with that of the nitrogen obtained after elimination other known gases of air. There remained a discrepancy of 0.5% between the two values obtained by two methods. This problem was resolved by William Ramsey, the professor of chemistry through the discovery and identification of the first inert gas argon.



Lord Rayleigh



William Ramsey

In 1904 Lord Rayleigh won the Nobel Prize in physics and the citation read "for his investigations of the densities of the most important gases and for his discovery of argon in connection with these studies". In the same year Ramsey went on to win the Chemistry Nobel Prize. The citation of Chemistry Prize to William Ramsey mentioned his award was "in recognition of his services in the discovery of the inert gaseous elements in air, and his determination of their place in the periodic system". This goes to show the immense significance of the discovery.

1981: IBM Personal Computer

The name personal computer was in vogue in our country about three decades back underlining that computers have broken their specially embedded connection with the laboratories or research institutes

but are moving into common man's study. The thought was inspired by the arrival of a special type of computer from the International Business Machine (IBM) those were introduced as personal computers. On August 12, 1981 the first such personal computer arrived at the market and the rest is history. Today one may smile at the various features of that computer as it (Model 5150) had an Intel 8088 processor (4.77 MHz), 16 kB–256 kB RAM, and a motherboard of 64 kB. It was a disc operated system or DOS. This implied that it had a storage facility through a 5.25" Floppy drives (160 kB) or cassette tape. Moreover, the personal computer had a monochrome or black and white display possibly beyond the imagination of anybody familiar with today's computers. Of course, it had the option to use a standard TV screen as a monitor and the other option was the IBM monitor.



The price of the first personal computer in USA at the time of launch in 1981 was \$ 1565. This amount if translated to today's market is about \$ 5950 to \$ 6000 as one dollar in 1981 had the same buying power as of about 3.7 to 4.0 dollar of today. If converted to Indian currency this price is more than INR 5.5 lakh today. There were many other features that today's computer users will find difficult to imagine. Yet these were expensive large in size and had extremely low storage capacity marked the journey of PC and so many other types of personal digital devices. Literally this large PC was a small but significant step for the technology on that day. It had allowed humankind to take some giant strides in the next four decades.

Bhupati Chakrabarti

A Blueprint for Quantum Education: From Early Childhood to Advanced Research

Bindiya Arora* and Vipul Badhan †

Department of Physics, Guru Nanak Dev University, Amritsar

*bindiya.phy@gndu.ac.in †vipulbadhan269@gmail.com

We are living in an era where quantum mechanics is no longer just a daunting chapter in a physics textbook-it is a technology, an industry, and a new scientific language. It is one of the most rapidly growing fields globally, requiring responsible development not only because of its dual-use potential but also to combat the public skepticism often attached to the word quantum.

To reduce the gap between the producers and users of this technology, informed public literacy is essential. After all, it is the public that supports and funds these advancements. Furthermore, as quantum technology advances, we desperately need trained personnel to fill emerging industry gaps. Achieving this requires a fundamental shift in how we teach the subject.

Traditionally, quantum mechanics is introduced by jumping straight into abstract concepts like Hilbert spaces, spin, and wavefunction collapse without any conceptual grounding. When I first encountered quantum mechanics, it felt like being handed a set of weird rules and complex equations. It generated fear rather than curiosity. Instead of a sudden jump, we need to build a staircase.

Here is a proposed blueprint for a structured, five-level quantum education framework designed to train the next generation of quantum scientists. This framework develops quantum ideas much like learning a language: starting with stories in childhood, learning the alphabet in school, formalizing grammar at the undergraduate level, writing literature as a graduate student, and eventually inventing new linguistics as a researcher.

Level 1: Early Childhood - Cultivating Curiosity

At the childhood level, the goal is not mathematical accuracy, but building curiosity and intuition. Children respond best to stories, comics, visuals, and playful hands-on activities. Instead of abstract math, we can build a feel for quantum behavior:

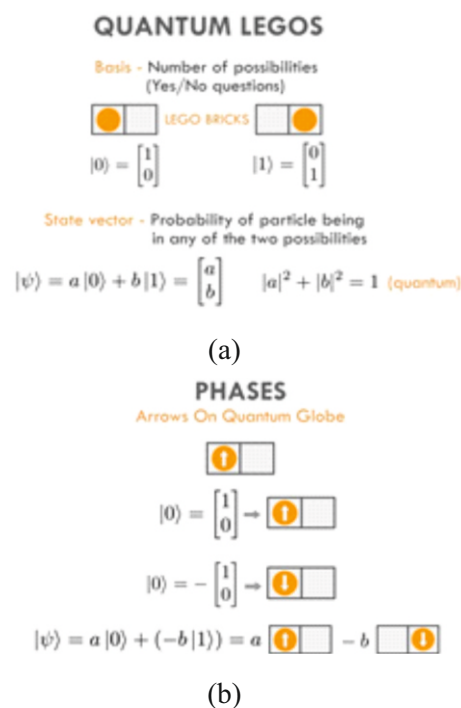
- **Superposition:** Introduced using primary colors as a basis. Children learn that they can build any

color of their choice by mixing these basis colors in appropriate proportions

- **The uncertainty principle:** Taught through a playful game of "Quantum Jitters." One child acts as a freely moving electron, and another acts as a scientist trying to tag them. Once the electron is tagged (measured), it immediately starts to vibrate and jump around.
- **Correlation:** Introduced as a group activity with a pair of socks. Two friends share a pair of differently colored socks. If one child looks at their sock, they instantly know what color their friend holds. Measurement can be defined by keeping the socks in sealed envelopes and the state of the socks remains undecided until the envelope is opened.

With the help of modern AI tools, generating engaging comic strips and visuals to support these stories is easier than ever.

Level 2: School Age - The Analogist



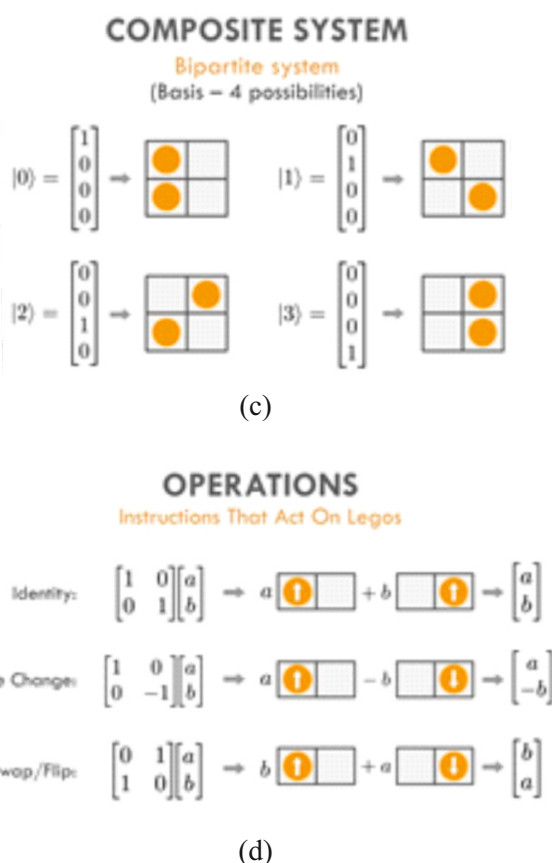


Fig. 1 Using dotted Lego to introduce core concepts to high school students. (a) Basis states: a dot can be in the left or right box. (b) Phases: represented as spinning arrows on the dot. (c) Scaling up: two Legos yield four possible states. (d) Operations: instructions that flip, swap, or rotate the dots.

At the school level, students are familiar with binary logic (yes/no questions), basic probability, and perhaps simple matrices. Here, we build mathematical foundations using familiar analogies.

School-aged children love to build and break rules. We can give them **Dotted Legos**, where the bricks represent the possible answers to a binary question (e.g., Is the dot on the left side or the right side?).

- **States and superposition:** The possibilities are introduced as a column matrix. A quantum state is simply the superposition of the particle existing in these basic possibilities, attached to probability coefficients.
- **Phases:** Introduced as spinning arrows on a dot. An

“up” arrow might represent a state, while a “down” arrow gives that state a negative phase.

- **Scaling up:** By handing students a pair of Legos, they quickly realize that the number of possibilities for a composite system increases to four, introducing multipartite states.
- **Operations:** Become instructions that act on these dots to flip, swap, or rotate them.

The current technology-driven generation easily grasps graphical drag-and-drop programming. By introducing tools like the IBM Quantum Composer at this age, excitement kicks in. It is incredibly empowering for young students to build functional quantum circuits.

Level 3: Undergraduate - Formalizing the Math

Now is the time for rigorous math: complex numbers, differential analysis, the Schrödinger equation, and wavefunction formalism. But because the foundation was laid in school, students feel a sense of familiarity rather than fear. This is the ideal level to build a feel for counter-intuitive quantum ideas and quantum thinking.

Bell's Inequality [1] is a beautiful way to show how quantum predictions fundamentally differ from classical expectations. Instead of dense math, we can use game-based learning.

The correlation game

Two volunteers (Alice and Bob) build a strategy to win a card game. They separate to opposite corners of the room so they cannot communicate. At their corners, they flip a coin (Heads or Tails) and flash a card (Red or Yellow).

The Winning Condition:

- If they both flip Heads, or one flips Heads and the other Tails, they must show the **same** color card to win.
- If they both flip Tails, they must show **opposite** color cards to win.

Students quickly realize that the best classical strategy, no matter how clever, cannot win this game more than 75% of the time. However, if Alice and Bob share particles with correlations, they can exceed this 75%

win rate without cheating.

Level 4: Graduate - Interpretation and Debate

Currently, graduate quantum mechanics is often taught as if the equations contain absolute, unquestionable information. The Copenhagen interpretation is frequently presented as a hardcore fact rather than an interpretive choice, with students told to “just calculate” and accept wave function collapse without context. To prepare students for research, quantum mechanics must be presented as a dynamic, debatable field. Postulates should not be magical rules; they should be constructed operationally through experiments.

While many textbooks use the Stern-Gerlach experiment, spin is a complex concept layered with misconceptions. My 15 years of teaching experience suggest that the **Mach-Zehnder interferometer** [2] offers a smoother introduction:

- a) A photon hitting a 50-50 beam splitter naturally creates a superposition of paths.
- b) Recombining the paths shows interference, demonstrating the **Born rule** directly (detector clicks correspond to squared amplitudes).
- c) Adding devices to track “which-way” [3] information destroys the interference, capturing the **measurement postulate**.
- d) Erasing that information restores the interference, introducing advanced concepts like the **quantum eraser** [4].

By introducing multiple interpretations (Many-Worlds, Hidden Variables, Relational QM), students learn to view a problem from various perspectives. Schrödinger's cat becomes a multi-interpretation playground. Teaching students to distinguish between a $\textit{mathematical fact}$ and an interpretive choice builds profound intellectual maturity.

Level 5: Researcher - Questioning the Limits

At the final level, the objective is to question the boundaries of quantum mechanics and reconstruct the theory where it breaks down. The core question becomes: If we could start over, how else might we build the laws of the universe?

Researchers explore theoretical approaches to open questions across multiple frontiers:

- Foundational reconstructions [5]: Deriving quantum mechanics from operational axioms and minimal physical principles.
- Relational quantum mechanics [6]: Formulating the theory based purely on observer information acquisition, where the “reality” of a system is defined strictly by its interactions.
- Relativistic quantum information (RQI) [7]: Exploring the intersection of quantum mechanics and relativity, including entanglement harvesting in non-inertial frames, the Unruh effect, and how quantum information behaves in curved spacetime.
- The black hole information paradox [8]: Investigating the fate of quantum information, the holographic principle (AdS/CFT correspondence), firewall paradoxes, and the idea that spacetime itself emerges from quantum entanglement (ER=EPR).
- Quantum reference frames [9] Moving beyond classical coordinate systems by treating reference frames themselves as physical quantum systems that can exist in superpositions.
- The quantum-classical boundary & gravity [10,11,12]: Reconstructing discrete, Lorentz-invariant spacetime structures using causal set theory and investigating systems with indefinite causal orders.

Ultimately, students at this level can choose their own trajectory-whether diving into the deep philosophical foundations of reality, devising experimental setups to test the superposition of macroscopic particles, or tackling the application-based challenges of the burgeoning quantum technology sector. By providing them with the intellectual freedom to challenge established paradigms, we empower the next generation of researchers to stop merely reading the rules of the universe and start writing them.

The Path Forward

This five-stage framework is just the beginning. The next steps involve developing level-specific

curricula, designing hands-on lab modules, and creating assessment tools. By transitioning from static textbooks to a dynamic, scalable learning language, we can successfully demystify the quantum world and thoroughly prepare the next generation of quantum scientists and engineers for the challenges ahead.

NOTE:

The content was presented as an invited talk at the ICPE conference held at IIT Ropar, Dec 2025. AI tools were used to help rephrase parts of this text for better readability.

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Great Minds: Tales from the World of Physics

Chinmoy Kumar Ghosh* & Pradipta Panchadhyayee†

*Dept. of Physics, Ramakrishna Mission Residential College (Autonomous) Narendrapur, WB

†Dept. of Physics (UG & PG), Prabhat Kumar College, Contai, WB

The Third Pauli Effect

The Austrian physicist Wolfgang Pauli is best known for two seminal contributions - the Exclusion Principle and the neutrino hypothesis. In this context, George Gamow, in his well-known book, 'Thirty Years That Shook Physics' [1], recounts a humorous 'third effect' attributed to Pauli. The book itself offers an engaging introduction to modern physics, blending scientific insight with lively anecdotes about great physicists. Gamow noted that Pauli, an out-and-out theoretical physicist, maintained a marked distance from experimental work—so much so that it was jokingly said his mere presence near an apparatus could cause it to malfunction. Times without number, it has so happened that whenever Pauli merely crossed the threshold of a laboratory, some or the other glassware had broken. This is what is referred to as the Third Pauli Effect, which by taking cue from his famous exclusion principle (No two electrons can occupy the same quantum state), gets stated as “*A functioning device and Wolfgang Pauli may not occupy the same room.*”



L to R: George Gamow, Wolfgang Pauli, and Otto Stern

As a matter of fact, this Effect is supported by several evidences.

Pauli's car developed a trouble without any obvious external cause when he had gone for honeymoon tour

with his second wife. Otto Stern once asked Pauli to keep away from the site of his experimental set-up as he felt that the devices may not function properly if Pauli were present.

The British physicist Rudolf Peierls mentions about a case which took place at a reception where this effect was to be parodied by making a chandelier crash deliberately upon Pauli's entrance. The chandelier was suspended from a rope which was to be released, but it got stuck instead, thus becoming a real example of the Pauli effect.



L to R: Rudolf Peierls, James Franck and Gustav Hertz

However, no illustration can perhaps match the one mentioned below, which happened at the University of Göttingen. Quite an expensive device used in the Franck and Hertz Experiment suddenly stopped working without any apparent reason. But Pauli was not at Göttingen at the time of the incident. So, Franck at least this time Pauli was not responsible as he was not present in Göttingen. But it turned out that Pauli had been on a railway journey to Zürich and had switched trains at the Göttingen Railroad Station at about the same time of the onset of failure.

Another time [2], Wolfgang Pauli visited Princeton to conduct research at the Institute for Advanced Study. Nearby, at Princeton University, the Physics Department in Palmer Physical Laboratory housed a

powerful particle accelerator in its basement - the Princeton cyclotron, equipped with a massive 50-ton magnet. During Pauli's stay, the cyclotron suddenly caught fire, burning for more than six hours and leaving the walls of the building blackened.

Bose-Dirac Interaction

Shyamadas Chatterjee, a doctoral student of Satyendra Nath Bose, once shared a memorable story with Dwaraka Nath Bose [3], the son of Dr. Sunil Chandra Bose, Netaji's elder brother. It dates back to the early 1950s, when Paul Dirac visited Kolkata to deliver a lecture at the Institute of Nuclear Physics. The hall was filled with anticipation, and in the front row sat Bose himself - calm, silent, and, to many observers, seemingly half-asleep.



L to R: P. A. M. Dirac and S. N. Bose

As Dirac developed his argument on the blackboard, he paused at a crucial step, hesitating for a moment. Almost instinctively, his gaze shifted toward the white-haired Bose. Slowly, Bose rose, walked up to the board, and with a few swift strokes completed the

equation. Without a word, he returned to his seat and slipped back into his earlier quiet, drowsy posture, as though nothing unusual had occurred.

After the lecture, Dirac and his wife were escorted to a car. They were guided toward the rear seats, while Bose, Chatterjee, and another companion were about to take the front. Dirac, however, politely objected and requested that Bose join him in the back. Instantly came Bose's reply, sharp and playful: "We follow Bose-Einstein statistics in front - you should follow Fermi-Dirac at the back!"

The remark, though humorous, carried a neat scientific analogy. In Bose-Einstein statistics, many identical particles can occupy the same state—just as several people could comfortably share the front seat. In contrast, Fermi-Dirac statistics follows the exclusion principle, where no two identical particles can occupy the same state - much like the more restricted seating at the back. With this witty comparison, Bose turned a simple seating arrangement into a delightful lesson in quantum physics.

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Discussion on a Problem from the book by Halliday and Resnick – Fundamentals of Physics-Volume 2

Article

Arun Kumar Banerjee
Email: arunkbanerjee@gmail.com

Problem 5 of Chapter 26

The Problem

Earth's lower atmosphere contains negative and positive ions that are produced by radioactive elements in the soil and cosmic rays from space. In a certain region, the atmospheric electric field strength is 120 V/m and the field is directed vertically down. This field causes singly charged positive ions, at a density of 640 cm^{-3} , to drift downward and singly charged negative ions, at a density of 550 cm^{-3} to drift upward. The measured conductivity of the air in that region is $2.7 \times 10^{-14} (\Omega \text{ m})^{-1}$. Calculate

- The magnitude of current density and
- The ions drift speed, assumed to be the same of positive and negative ions.

Solution:

Let us try to solve this from the first principles. From Ohm's law (assuming that it holds) we have:

$$V = IR$$

$$I = \frac{V}{R}$$

Equation 1

We also know that with ρ = resistivity and σ = conductivity:

$$R = \rho \frac{L}{A}$$

$$\sigma = \frac{1}{\rho} = \frac{L}{AR}$$

$$R = \left(\frac{1}{\sigma}\right) \times \left(\frac{L}{A}\right)$$

Substituting for R in equation 1 we have

$$I = \frac{V}{\left\{\left(\frac{1}{\sigma}\right) \times \left(\frac{L}{A}\right)\right\}}$$

$$\Rightarrow \frac{I}{A} = J = \sigma \left(\frac{V}{L}\right) = \sigma E$$

Equation 2

Given

$$E = 120 \text{ V/m}$$

$$\sigma = 2.7 \times 10^{-14} (\Omega \text{ m})^{-1}$$

Substituting the values in equation 2 we have

$$J = (2.7 \times 10^{-14}) \times 120 \frac{\text{V}}{\Omega \text{ m}^2}$$

$$\underline{\underline{= 3.24 \times 10^{-12} \text{ Am}^{-2}}}$$

b. Given

$$n_+ = 640 \text{ cm}^{-3}$$

$$n_- = 550 \text{ cm}^{-3}$$

Assuming same drift speed for positive and negative ions we have as

$$v_d = \frac{J}{ne} = \frac{J}{(n_+ + n_-)e}$$

Substituting

$$v_d = \frac{3.24 \times 10^{-12}}{\{(640 + 550) \times 10^6\} (1.6 \times 10^{-19})} \text{ ms}^{-1}$$

$$\underline{\underline{= 1.7 \text{ cm s}^{-1}}}$$

Beyond the numbers:

The joy of physics lies not in obtaining an answer, but in discovering the world concealed behind the answer. As Richard Feynman said

Religion is the culture of faith:

Science is the culture of doubt.

The problem in Halliday and Resnick asks us to calculate the current density and drift speed of ions in the lower atmosphere which we found as above. The given electric field is 120V/m directed downward, and the measured conductivity of air is $2.7 \times 10^{-14} (\Omega \text{ m})^{-1}$.

Using Ohm's law for a conducting medium

$$J = \sigma E$$

We find a current density of only a few Pico amperes per square meter.

But should the story end here?

Tiny current with a Cosmic Role

The atmosphere is never completely neutral. Cosmic rays and radioactive elements in the Earth's crust continuously ionize the air, producing positive and negative ions.

Under the Earth's fair weather electric field, positive ions drift downward and negative ions drift upward. Together they constitute a minute but continuous current.

The current is so small that it appears insignificant. Yet this current is part of one of nature's grandest electrical systems.

The Earth and the Ionosphere: A planetary Capacitor.

The Earth behaves as one conducting sphere while the ionosphere, about 60-1000 kms above us forms another conducting shell. Between them lies the atmosphere, which is mostly an insulator, acts as a dielectric. The nature has fashioned a gigantic spherical capacitor with a potential difference of roughly 250,000 volts. However, the atmosphere is not a perfect insulator. The current calculated in the Halliday and Resnick problem continuously leaks charge away from this capacitor. This raises a profound question:

What keeps the Earth-Ionosphere capacitor charged?

Thunderstorms: Nature's Batteries.

The answer lies in the thunderclouds.

Inside a thunderstorm the moist air rises. The water droplets freeze – the ice crystals, hail particles (graupel) and super-cooled droplets collide. During this collision the electrons are preferentially transferred. Experiments show that under typical conditions the small ice crystals acquire positive charge and are carried upwards while the heavier graupel particles become negatively charged and fall lower (why such preferential charging happens is a matter of research). Therefore we can say:

- Positive charge is driven upward toward the ionosphere.
- Negative charge is driven downward toward the Earth.

In this sense, thunderstorm performs the same function as batteries in ordinary circuits. They continuously replenish the charge that is slowly lost through fair-weather atmospheric conduction.

The Global Electric Current

The upward current inside the storm regions and the downward current in fair-weather regions together form a closed circuit surrounding the entire Earth.

Our planet is therefore not merely a mechanical system or a thermodynamic system.

It is also an electrical machine.

Every second, thousands of thunderstorms, distributed around the globe, maintain this immense circuit.

Lightning: A sudden change of conductivity

The same air whose conductivity is only $2.7 \times 10^{-14} (\Omega m)^{-1}$ can during a lightning discharge, become a highly conducting plasma carrying current of tens of thousands of amperes. Thus the peaceful current calculated in the H&R problem and the terrifying brilliance of lightning are manifestations of the same underlying physics.

The difference is one of scale, not of principle.

The problem has taken us hiking the unusual path

- Atmospheric electricity
- The Earth Ionosphere capacitor,
- Thunderstorms
- Lightning
- Plasma physics
- And the global electric circuit.

Richard Feynman once remarked that there is pleasure in recognizing a fact and then discovering that it is connected to many other facts. Perhaps the greatest reward of studying physics is not obtaining

$$J = 3.2 \times 10^{-12} \frac{A}{m^2}$$

But realizing that this almost unimaginably small current is one thread in the electrical life of our planet.

I would like to conclude by the thought:

Perhaps the greatest reward of studying physics is not merely obtaining an answer, but realising that even an unimaginably small current is one thread in the electrical life of our planet.

The problem begins with a few ions drifting through the atmosphere and ended with thunderstorms and lightning and the electrical life of Earth itself. Such is the power of Physics.

First Sunday Club: A Memorable Gathering with Three Generations of Science Educators

The First Sunday Club (FSC) is a monthly program that has been conducted continuously since 2013, without missing a single month. It is the flagship activity of SGM-IAPT Anveshika and is currently organized at Sopan Ashram in collaboration with Shiksha Sopan.

One of the defining features of the First Sunday Club is the regular presence of Dr. H. C. Verma. Teachers eagerly look forward to interacting with him every month, and whenever he is unable to attend, they genuinely feel the absence of his insightful discussions. The club provides an open platform where teachers freely raise questions related to science and education. Every participant is encouraged to share their thoughts, while Dr. Verma patiently guides the discussion toward a meaningful conclusion. Around 30–35 teachers and science enthusiasts regularly participate in each session. As always, the meeting began with a round of introductions, allowing everyone to become acquainted with one another.

During this month's session, Mr. Pradeep Yadav initiated a thought-provoking discussion by raising a question related to Gauss's theorem. The participants examined the problem from different perspectives,

leading to an engaging and enriching scientific discussion. A practical demonstration was also presented to illustrate a simple method for determining the contact angle, and it was decided that this topic would be explored further in future sessions.

Another interesting discussion was initiated by Mr. Abhay from Deendayal School, Kanpur, who raised a conceptual question related to Optics. The question led to an in-depth scientific discussion, with teachers actively sharing their viewpoints and experiences. Dr. H. C. Verma guided the discussion, helping participants analyze the concept from fundamental principles and arrive at a clear understanding. Such discussions are a hallmark of the First Sunday Club, where curiosity and collaborative learning are given equal importance.

The most remarkable highlight of this month's First Sunday Club was the presence of three legendary science educators. Dr. R. N. Kapoor, who laid the foundation of the Anveshika movement and established the very first SGM - IAPT Anveshika, attended the meeting in person. He was joined by senior IAPT member Dr. B. N. Das, who also interacted warmly with the participating teachers.



Dr. Kapoor shared inspiring memories from his life, describing the challenges he faced on his journey to Kanpur and narrating how the idea of Anveshika was born. His experiences deeply inspired everyone present.

The gathering became truly unforgettable as three generations of eminent science educators came together—95-year-old Dr. R. N. Kapoor, 85-year-old Dr. B. N. Das, and 75-year-old Dr. H. C. Verma. Participants felt privileged to interact with these distinguished personalities, seek their blessings, and learn from their lifelong dedication to science education. This unique occasion made the First Sunday Club an especially memorable and inspiring event for all who attended.

The session concluded with a vote of thanks by Mr. Amit Kumar Bajpai, Coordinator of SGM-IAPT Anveshika, who expressed his heartfelt gratitude to all the participants, guests, and senior members for making the event a grand success. He then invited everyone for tea and samosas. As is the tradition of the First Sunday Club, the tea break became another enriching session in itself, where teachers continued their discussions in an informal and friendly atmosphere. These casual interactions provided an excellent opportunity for participants to exchange ideas, seek guidance, and strengthen their bonds, adding yet another memorable dimension to the day's gathering.

Amit Kumar Bajpai
Coordinator
SGM-IAPT ANVESHKA

Report

IAPT-APhO Workshop - Performance-based Olympiad Level Experiments (POLLEX)

The Indian Association of Physics Teachers – Asian Physics Olympiad (IAPT-APhO) Cell successfully organized the **Performance-Based Olympiad Level Experiments (POLLEX-XXI)** workshop on 20–21 July 2026 at Khaitan Public School, Sahibabad, Ghaziabad, Uttar Pradesh. The workshop commenced with an inspiring address by Dr. Rekha Ghorpade, General Secretary of the Indian Association of Physics Teachers (IAPT). In her motivational speech, she encouraged students to cultivate scientific curiosity, develop strong experimental skills, and aspire to represent India in prestigious international Physics Olympiads. Her inspiring words and heartfelt blessings greatly motivated the participants and set an enthusiastic tone for the two-day programme. The workshop brought together enthusiastic students from several schools, providing them with hands-on exposure to experimental physics at the level of the Asian Physics Olympiad (APhO). Through carefully designed laboratory activities, the participants developed scientific reasoning, experimental precision, data analysis skills, and a deeper understanding of fundamental physics concepts

essential for success in National and International Physics Olympiad competitions.

The workshop was conducted by an expert team of resource persons comprising of the Chief-Coordinator(Examinations), IAPT; Prof. B.P. Tyagi, Prof. (Dr.) Vijay Kumar, Coordinator, IAPT-APhO Cell and Principal, Dhanauri P.G. College, Haridwar; Dr. Avijit Chamoli, and Mr. Vishesh Sharma from Graphic Era Hill University, Dehradun. Prof. B. P. Tyagi also delivered an insightful lecture on the pathway to the International Physics Olympiads, motivating students to pursue excellence in physics and scientific research. The programme was graced by Mr. Anand Kumar, Principal of Khaitan Public School, Ghaziabad, who warmly welcomed the IAPT-APhO team. He expressed his commitment to supporting all future IAPT activities on the school campus. The workshop received wholehearted support from the dedicated faculty members of the school. Ms. Laxmi, Ms. Nidhi Narayan, Mr. Sandeep, Mr. Titiksha Vats, Mr. Shivam Soni, Mr. Arjun Madhra, Ms. Rumpa, Kritika Sharma, Ms. Ruchi Arora along with many other senior teachers, played a significant role in

the successful planning and execution of the workshop. Their dedicated efforts ensured the smooth conduct of all technical and academic sessions.

A special highlight of the programme was the visit of Dr. Surender Goel, Retired Professor and Life Member of the Indian Association of Physics Teachers (IAPT). He interacted with the participants, appreciated their enthusiasm for experimental physics, and blessed the students for their future academic and scientific pursuits. Teachers from several schools actively participated in the workshop, including Ms. Archana Bajpei (IPS Indirapuram, Ghaziabad), Mr. Rahul Kumar (East Delhi Public School, Ghaziabad), Ms. Suruchi Agarwal (Amity International School, Vasundhara, Ghaziabad), Mr. Roop Kumar (S.K. Girls School, Ghaziabad), and Mr. Sandeep (Khaitan Public School, Sahibabad, Ghaziabad). They interacted with

the resource persons and highly appreciated the initiative. Students from these schools also actively participated in the workshop. The participating teachers unanimously endorsed POLLEX-XXI as an outstanding platform for nurturing scientific temperament, strengthening experimental competence, and preparing students for national and international Physics Olympiads. The successful organization of POLLEX-XXI reflects the continued commitment of the IAPT-APhO Cell to promoting excellence in experimental physics education. The workshop not only enhanced the practical skills, scientific aptitude, and experimental competence of the participating students but also strengthened collaboration among schools, teachers, and the IAPT community in nurturing the next generation of young physicists and future Olympians.



Vijay Kumar
Coordinator, IAPT-APhO

Report (SRC-08D)

Anveshika Bharat Jyot Yatra

The Maharashtra chapter of the **Anveshika Bharat Jyot Yatra** was successfully organized from 7th to 11th July, 2026 under the inspiring leadership of **Padma Shri Prof. H. C. Verma**, Founder of the National Anveshika Network of India (NANI) and former Professor, IIT Kanpur. The educational tour covered institutions in **Kolhapur, Gadhinglaj, and Sangli**, with the objective of promoting **concept-based**

Physics education, scientific temperament, experimental learning, and career awareness among students and teachers. A total of 15 educational programs were successfully organized at universities, colleges, schools, and Anveshika Centers.

The journey commenced in **Kolhapur District**, where programs were organized at prestigious educational institutions, including **SHARDHA GROUP OF**

INSTITUTIONS, Shivaji University, Kolhapur, Rajaram College, Kolhapur and the GCG-IAPT Anveshika Centre at Dr. Ghali College, Gadhinglaj. Hundreds of students actively participated in hands-on demonstrations covering mechanics, optics, electricity, magnetism, thermodynamics, waves, and modern physics.

Across all 12 programs, live physics demonstrations became the central attraction. Students enthusiastically performed experiments, discussed scientific principles, and interacted directly with experts. Teachers were introduced to innovative classroom methodologies that emphasize conceptual understanding, inquiry-based learning, and the use of affordable experimental apparatus.

The Bharat Jyot Yatra also strengthened collaboration among NANI, IAPT, universities, colleges, schools, and Anveshika Centers in Western Maharashtra. It created a strong network of educators committed to promoting scientific temper in accordance with the vision of the National Education Policy (NEP 2020).

Objectives of the Yatra

- * Promote scientific temper among students and society.
- * Learning Physics through experiments rather than rote memorization.
- * Strengthen collaboration among Anveshika Centres.
- * Inspire teachers to adopt activity-based teaching methodologies.
- * Popularize low-cost and locally developed science experiments.
- * Spread the vision of Prof. H. C. Verma for joyful and meaningful science education.

Programme-wise Summary

1. Shraddha Junior College, Kolhapur – *Quantum Physics and Physics as a Career*

An inspiring session on **Quantum Physics and Physics as a Career** was conducted for approximately **700 science students** at Shraddha Junior College. Students were introduced to the fascinating concepts of quantum physics through simple explanations and learned about opportunities at IISc, IITs, IISERs,

TIFR, and other research institutions. The session also highlighted the International Physics Olympiad, emerging technologies such as quantum computing, and career prospects in scientific research.

2. Shraddha Olympiad School – *Interactive Session with Olympiad Students*

An interactive session was organized for approximately **200 Olympiad students** at Shraddha Olympiad School to strengthen their scientific aptitude and problem-solving skills. The programme included scientific puzzles, conceptual discussions, and strategies for Olympiad examinations. Students actively participated in the question-answer session and were motivated to develop logical reasoning and pursue scientific excellence.

3. Physics Teachers' Workshop – *Innovative Physics Teaching*

A workshop on **Innovative Physics Teaching** was conducted for around **100 teachers** to promote effective classroom practices. The programme focused on concept-based teaching, demonstration-oriented learning, and the use of low-cost experimental models. Teachers also explored innovative assessment methods to make physics learning more engaging and meaningful.

4. Shraddha CBSE School – *Developing Scientific Curiosity*

An engaging session on **Developing Scientific Curiosity** was organized for approximately **200 students** at Shraddha CBSE School. Students were encouraged to explore physics beyond textbooks through observation, interactive demonstrations, and discussions on quantum science and emerging technologies. The programme inspired curiosity and scientific thinking among young learners.

5. Felicitation Ceremony of JEE Main & Advanced Students

A felicitation programme was held for nearly **50 successful JEE Main and Advanced students** to recognize their academic achievements. The students interacted with **Prof. H. C. Verma**, who shared valuable guidance on higher education, research opportunities, and career planning.

6. Shivaji University, Kolhapur – *Quantum Physics and Research Opportunities*

A special lecture on **Quantum Physics and Research Opportunities** was delivered for approximately **200 students, research scholars, and faculty members** at Shivaji University. The programme focused on modern developments in quantum physics, higher education opportunities, scientific careers, and the International Physics Olympiad. An extensive interaction with research scholars enriched the learning experience.

7. Rajaram College, Kolhapur – *Conceptual Physics and Problem Solving*

An interactive programme on **Conceptual Physics and Problem Solving** was conducted for around **400 students** at Rajaram College. The session emphasized conceptual understanding, logical reasoning, and systematic problem-solving techniques supported by numerical applications. Students actively participated in discussions and clarified their scientific concepts.

8. Inauguration of GCG-IAPT Anveshika Centre

The GCG-IAPT Anveshika Centre was inaugurated by Padma Shri Prof. H. C. Verma, marking an important step towards promoting activity-based physics education. The event included the inauguration of a demonstration laboratory, an exhibition of physics experiments, and interactive sessions with students and teachers. The centre will serve as a hub for experiential science learning.



Demonstration of experiments by Students

9. Understanding Physics through Experiments

A highly interactive programme on **Understanding Physics through Experiments** was conducted for approximately **300 students**. Through live demonstrations and observation-based learning, students explored important physics concepts in an engaging manner. Active participation and experimental verification helped strengthen their conceptual understanding.

10. Bhilawadi Students' Programme – *Understanding Concepts through Experiments*

An engaging session was organized for approximately **200 students** at Bhilawadi to demonstrate physics concepts through hands-on experiments. The programme connected everyday phenomena with scientific principles and encouraged students to ask questions and participate actively. The demonstrations made learning physics enjoyable and meaningful.

11. Teachers' Programme at Bhilawadi

Transforming Physics Education in India A teachers' development programme was conducted for around **100 teachers** at Bhilawadi on **Transforming Physics Education in India**. The session focused on the future of physics education, the National Education Policy (NEP 2020), joyful learning, classroom innovation, and activity-based teaching. Teachers were encouraged to adopt student-centered and concept-based instructional practices.



Lecture of Prof. H.C. Verma

Ashwini Bhagwanrao Salunkhe
Secretary

Regional Competition of Innovative Experimental Physics (RCIEP 2026)

Date: July 19, 2026

Participants registered: 8

Venue: Department of Physics, MLA College for Women (Autonomous), Malleswaram, Bengaluru

A total of five participants took part in the competition. Three participants were teaching professionals. One participant from college, a second-year B.Sc. student, while one participant was a Class IX student. The participation reflected a healthy mix of school, college, and teaching communities.

A wide variety of innovative experiments were demonstrated.

These included: Levitation of light objects using ultrasonic waves.

A comprehensive study on transformers, including an investigation into whether two independent coils can function as a transformer.

The effect of a falling magnet under gravity due to the influence of eddy currents.

Absorptivity of Potassium Permanganate using a Spectrophotometer.

Diffraction intensity measured using Arduino.

All the experiments were conducted successfully within the stipulated time. The event commenced at 2:00 p.m. as scheduled, and every participant was able

to demonstrate their experiment without any technical failure or interruption. The participants displayed good preparation and confidence while explaining the scientific principles behind their work.

The judges, Dr. R. S. Geetha, Dr. Somasekhara S, and Dr. S. K. Nataraju, observed each experiment with great interest and enthusiasm. They patiently interacted with every participant, asking thought-provoking questions about the underlying scientific principles, the methodology adopted, and the relevance of the experiments to present-day science and everyday life. Their constructive feedback encouraged participants to think critically and scientifically.

One important area that requires attention is participant outreach. Greater efforts should be made to create awareness about RCIEP and encourage wider participation from schools, colleges, and teachers. Improved publicity and communication strategies would help attract more participants and further enhance the reach and impact of the programme.

Richa Kaul
Coordinator



Anveshika- Experimental Demonstration Workshop Inspires Young Minds at Cuttack

Report (RC-16)

The Indian Association of Physics Teachers (IAPT), Regional Council, RC-16, successfully organised an Experimental Demonstration Workshop on July 17,

2026 at Saraswati Shishu Vidya Mandira (SSVM), Tulasipur, Cuttack, reaffirming its enduring commitment to nurturing scientific temper through experiential learning.

The workshop was inaugurated by Er. P. C. Sethi, Hon'ble MLA, Cuttack Sadar, who eloquently emphasised that the journey towards a *Viksit Odisha* must be illuminated by the wisdom of science and the spirit of innovation. Describing experimentation as the very foundation of technology and applied science, he called upon students to cultivate curiosity, creativity, and a questioning mind.

The workshop was conducted under the enlightened chairmanship of Prof. Shree Mishra, President, IAPT RC-16, whose steadfast leadership reflected the Association's enduring commitment to the advancement of science education. Prof. Rita Paikray, Secretary, IAPT RC-16, served as the Workshop Co-Chair, lending scholarly guidance and organisational vision to the proceedings. The occasion was further ennobled by the gracious presence of Prof. L. P. Singh, Prof. Harihar Mishra, Sh. Sarat Kumar Dash, Dr. Hrushikesh Acharya, and Sh. Chitta Ranjan Bhukta, whose involvement in demonstration of experiments illuminated the 485 participants from class 9th, 10th, 11th and 12t, assembled in the workshop. The workshop was convened by Dr. Gourishankar Sahoo, Secretary-elect, IAPT RC-16, whose dedicated efforts harmonised the academic and organisational dimensions of the programme, while Sh. Sanjay Kumar Patnaik, Secretary, School Management Committee, SSVM, served as the Organising Secretary, ensuring the seamless execution of the event. Together, their collective stewardship transformed the workshop into a vibrant confluence of knowledge, experimentation, and educational excellence, bearing testimony to the timeless truth that *"wisdom is the principal thing; therefore, get wisdom"* and that science, when guided by enlightened minds, becomes a beacon for societal progress. The scientific heart of the programme was the captivating demonstration of nearly 50 innovative physics experiments by Dr. Rajashree Mohapatra, State Coordinator, Anveshika. Through lucid, hands-on demonstrations on reflection, refraction, diffraction, wave motion, force, energy, and mechanics, she transformed abstract principles into living experiences, awakening scientific curiosity among students and teachers alike.



The valedictory session was adorned by the gracious presence of Er. Devadatta Pradhan, Administrative Service Officer, who observed that the awakening of a scientific temper in young minds is the living seed from which the tree of innovation and national progress flourishes. Prof. L.P. Singh eloquently advocated the harmonious union of theoretical understanding with hands-on experimentation, affirming that such a synergy forms the cornerstone of meaningful science education and must remain integral to the school curriculum. Reflecting on the evolving landscape of learning, Prof. Harihar Mishra offered a profound perspective on the complementary roles of Artificial Intelligence (AI) and the timeless wisdom of Grandmother's stories (*Aima Kahani*), illustrating how the fusion of technological intelligence with cultural heritage nurtures imagination, ethical reasoning, and scientific creativity. Prof. Rita Paikray presented a panoramic overview of the initiatives of the Indian Association of Physics Teachers (IAPT), highlighting its enduring mission to carry the light of science from the laboratory to the land, transforming experimental knowledge into a vibrant instrument of education, innovation, and societal progress. The workshop stood as a luminous testimony to IAPT's mission of making physics joyful, experimental, and transformative, inspiring the next generation to seek truth through observation, inquiry, and discovery.

Rita Paikary
Secretary

Workshop on Designing Case study-based problems in Physics

A one-day workshop on "Designing Case Study-Based Problems in Physics" was organized by Goa RC-21 in association with the Goa State Council of Educational Research and Training (GSCERT) on 4 July 2026 at St. Xavier's Higher Secondary School, Mapusa, Goa. The workshop was conducted for Higher Secondary School (HSS) Physics teachers with the objective of equipping them with the skills required to design meaningful case study-based assessment questions in alignment with the National Education Policy (NEP) 2020. The workshop was attended by 60 participants.

The workshop commenced with the inaugural session, where the organizers welcomed the participants and highlighted the growing importance of case study-based learning in enhancing conceptual understanding, critical thinking, problem-solving, and the application of Physics principles to real-life situations.

The resource persons for the workshop were Prof. Mahesh Shetti from Wilson college Mumbai and Prof. Atul Mody, an eminent Physics educator with decades of experience in Physics teaching, curriculum development, and teacher education. They explained the fundamental principles involved in designing effective case study-based questions and emphasized the need to integrate real world contexts into Physics teaching and assessment. Various examples from movies clips were presented to demonstrate and understand the concepts in mechanics, optics, thermal Physics, and modern Physics as to how conceptual

understanding can be assessed through authentic scenarios rather than routine numerical problems.

The sessions included hands-on activities in which participants worked collaboratively in groups to develop their own case study-based questions. Participants also engaged in discussions on common challenges encountered while preparing competency-based assessment items and explored strategies to overcome them.

The workshop provided practical insights into designing assessments that promote analytical thinking, interpretation of scientific information, and application of physical concepts in everyday life.

The workshop concluded with a feedback session in which participants appreciated the well-structured program, interactive activities, and practical orientation of the sessions. The organizers expressed their gratitude to the resource persons, host institution, and all participating teachers for making the workshop a success.

Overall, the workshop proved to be highly beneficial in enhancing the pedagogical and assessment skills of Higher Secondary School Physics teachers. It reinforced the importance of competency-based education and provided teachers with valuable tools to develop innovative, engaging, and meaningful case study-based problems that foster deeper conceptual understanding and scientific reasoning among students.



Shri Abhimanyu Bhelave, Centre Head Goa Science
Centre watering plant



Reshma Raut Dessai
Secretary



The poster is a vibrant blue and white design celebrating the 40th IAPT Annual Convention. At the top left is the IAPT logo, a circular emblem with 'IAPT' in the center and 'INDIAN ASSOCIATION OF PHYSICS TEACHERS' around the perimeter, with Hindi text below. The main title '40th IAPT Annual Convention 2026' is in large, bold, dark red font, followed by '(Ruby Jubilee Celebration)' in green. Below this, it says 'Organized by Indian Association of Physics Teachers (IAPT) Delhi & Haryana - Regional Council 01 (RC01)' in red, and 'In Collaboration with Amity Children Science Foundation, New Delhi' in red. The dates 'October 04-06, 2026' are in blue. A line of text mentions 'Along with Preconvention Workshops (October 03, 2026)'. The central graphic features a blue banner with 'Our Mission' and 'Reaching the unreachable' in stylized fonts, surrounded by icons of a target, a globe, a mountain, and people. The bottom section shows an aerial view of Amity University, Noida, with a yellow banner stating 'Venue: Amity University, Noida (Delhi NCR)'. The Amity University logo is in the bottom right corner. Various scientific icons like a microscope, lightbulb, gears, books, satellite, DNA helix, and a compass are scattered around the text.

40th IAPT Annual Convention 2026
(Ruby Jubilee Celebration)

Organized by
Indian Association of Physics Teachers (IAPT)
Delhi & Haryana - Regional Council 01 (RC01)

In Collaboration with
Amity Children Science Foundation, New Delhi

October 04-06, 2026

Along with Preconvention Workshops (October 03, 2026)

Our Mission
Reaching the unreachable

Venue: Amity University, Noida (Delhi NCR)

AMITY UNIVERSITY

About IAPT

The Indian Association of Physics Teachers (IAPT) was established in the year 1984 by the great visionary, (Late) Dr. D. P. Khandelwal, with active support from leading Physics teachers from the country, with the aim of enhancing the quality of Physics teaching and Physics teachers at all levels (www.indapt.org.in). It has now grown into a biggest subject with 10000+ life members spread all over India, including about 100 members from abroad. The members include school, college, university teachers, research workers, science administrators and science savvy enthusiasts. For its grass root working, the country is divided into 24 regions, each with 8 sub-regional councils. The apex executive council coordinates and directs the effort at the national level. IAPT has collaboration with leading institutions of the country such as TIFR, HBCSE, IITs, IISERs and IISC.

About Convention:

National Convention of Indian Association Physics Teachers is an annual event which brings together passionate teachers, students, educators, researchers, and innovators from across the country to explore new trends, challenges and opportunities in Physics teaching, Learning and research.

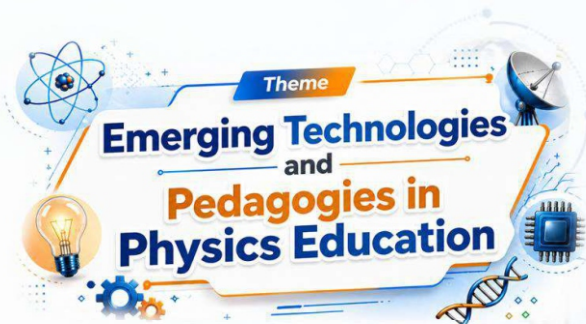
About Amity University, Noida:

Amity University is India's leading research and innovation driven private university, passionate about grooming future leaders who are not only skilled professionals, but responsible individuals with strong values. It has been established by an Act of the State Legislature and is recognized by the University Grants Commission (UGC). With 4,500+ academicians, scientists, and researchers, Amity brings together a diverse faculty from well-regarded institutions globally. The university offers world-class infrastructure, advanced campus technology, strong industry interaction, top placements through its Corporate Resource Centre, a rigorous admission process, and a focus on personality development to prepare students for professional success.

Convention Highlights:

- ❖ Invited Talks
- ❖ Panel Discussions
- ❖ Oral Presentations
- ❖ Poster Presentations
- ❖ Physics Stage shows
- ❖ Award Ceremony for Competition Winners
- ❖ Launching of IAPT Publications
- ❖ IAPT DSM Award
- ❖ Felicitation of NSEP & NGPE Gold Medalists
- ❖ Prof. B N Chandrika Memorial award for best poster
- ❖ Journey to Patent
- ❖ National Competition for Innovative Experiments in Physics (NCIEP)

- ❖ National Competition in Computational Physics (NCICP)
- ❖ National Essay Writing Competition
- ❖ National photo Essay Competition



Sub Themes:

- ❖ Robotics & STEM for Beginners
- ❖ Everyday Physics (Real-life Applications)
- ❖ Collaborative Group Learning Activities
- ❖ Quantum Technology and Physics Education
- ❖ Women in Physics
- ❖ Designing Experiments for Physics Teaching
- ❖ Technological Interventions in Physics Teaching
- ❖ Pedagogical Inventions in Physics Education
- ❖ Low Cost Activity Based Teaching-Learning of Physics
- ❖ Emerging Research Areas in Physics
- ❖ New Trends in Physics Assessment & Evaluation
- ❖ Innovations and Entrepreneurial Opportunities in Physics
- ❖ Reimaging Physics Education in View of NEP-2020
- ❖ 21st Century Emerging Technologies (AR,VR and AI) in Physics

Pre-convention workshops:

- ❖ Workshop for setting up Laser experiments (Ved Rattana Memorial Workshop)
- ❖ AI Applications for Physics Teachers
- ❖ Designing Physics Experiment for activity-based learning and competency building
- ❖ ExpEYES Workshop for computer-interfaced experiments
- ❖ Creating Table Top Accelerator

Publication:

Presented papers in convention will be published in a reputed international journal after peer review. The information in this regard will be sent to registered participants.

IAPT Meetings:

- ❖ Executive Council Meeting
- ❖ General Body Meeting

Patron

Prof. P. K. Ahluwalia, National President, IAPT
Dr. Amita Chauhan, Chairperson, Amity Group of Schools

National Advisory Committee

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Prof. Vijay Arora, Vice-Chancellor, CDLU, Sirsa
Prof. B. L. Ahuja, Vice-Chancellor, Bodoland Univ., Kokrajhar
Prof. Balvinder Shukla, Vice-Chancellor, Amity University, Noida
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Prof. Ajoy Ghatak, Professor (Retd.) IIT Delhi
Prof. B. P. Tyagi, Chief Coordinator Exams, IAPT

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Prof. P.C. Deshmukh, Vice President, IAPT
Prof. Meenakshi Sayal, Vice president, North Zone
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Prof. Prafulla K. Jha, MS University, Vadodara
Prof. S.K. Tyagi, IIT, Delhi

Local Organizing Committee

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Sh. Surjan Singh, Vice President, IAPT-RC1
Dr. Satendra Kumar Singhal, Secretary, IAPT-RC1
Prof. Oum P. Sharma, Former President, IAPT-RC1
Prof. Seema Vats, Former President, IAPT-RC1
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Dr. Manoj Kaushik, Treasurer, IAPT-RC1
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Dr. Vandana Bagga, EC Member, IAPT-RC1
Dr. Ankur Taya, EC Member, IAPT-RC1
Dr. Prajwalit Shikha, EC Member, IAPT-RC1
Sh. Vikram Verma, EC Member, IAPT-RC1
Ms. Swati Chawla, EC Member, IAPT-RC1
Dr. Lalit Mittal, Amity Children Science Foundation, New Delhi

Prof. Manoj Kumar Pandey, FOT, Amity Univ., Noida
Mrs. Pragya Nopany, Founder-coordinator. BVN-IAPT Anveshika

Prof. Vandana Luthra, Gargi College, Univ. of Delhi
Sh. V.V.V. Satyanarayana, Sr. Engineer, IUAC, New Delhi

Registration Details

Last date for Abstract Submission for paper presentation: **Sept. 05, 2026**

Information for acceptance of paper: **Sept. 07, 2026**

Last date of Registration: **Sept. 15, 2026**

IAPT Members and participants

- ❖ A - Participation without Accommodation: **Rs. 2,500/-**
(includes Convention Kit, Convention lunch and dinner)
- ❖ B - Participation with Accommodation: **Rs. 7,500/-**
(includes Convention Kit, Convention lunch, dinner and 4 night sharing accommodation)
- ❖ C - Accompanying family person: **Rs. 5,000/-**
(includes breakfast, lunch, dinner and 4 night sharing accommodation)

Industry Sponsorships

- ❖ Platinum Sponsor: Rs. 1,00,000/-
- ❖ Golden Sponsor: Rs. 75,000/-
- ❖ Silver Sponsor: Rs. 50,000/-

Registration Link:

<https://forms.gle/yjyNEVWQB3H8Lx4z7>

Note:

1. Participants who wish to present their papers are advised to register after the acceptance of paper.
2. Registration without paper submission can be done in advance anytime before the last date.

Bank Details:

Name: Indian Association of Physics Teachers RC-1
A/C Number: 154201000004506
IFSC Code: IOBA0001542
Bank Name: Indian Overseas Bank



Prof. H. K. Sahjwani
President, IAPT RC-1
9871679878

Dr. Manoj Kaushik
Coordinator (NC-IAPT)
9868180395

Sh. Surjan Singh
Convener (NC-IAPT)
9810485647

Prof. Manish K. Kashyap
Coordinator (NC-IAPT)
9467210306

Dr. S. K. Singhal
Convener (NC-IAPT)
9868516554

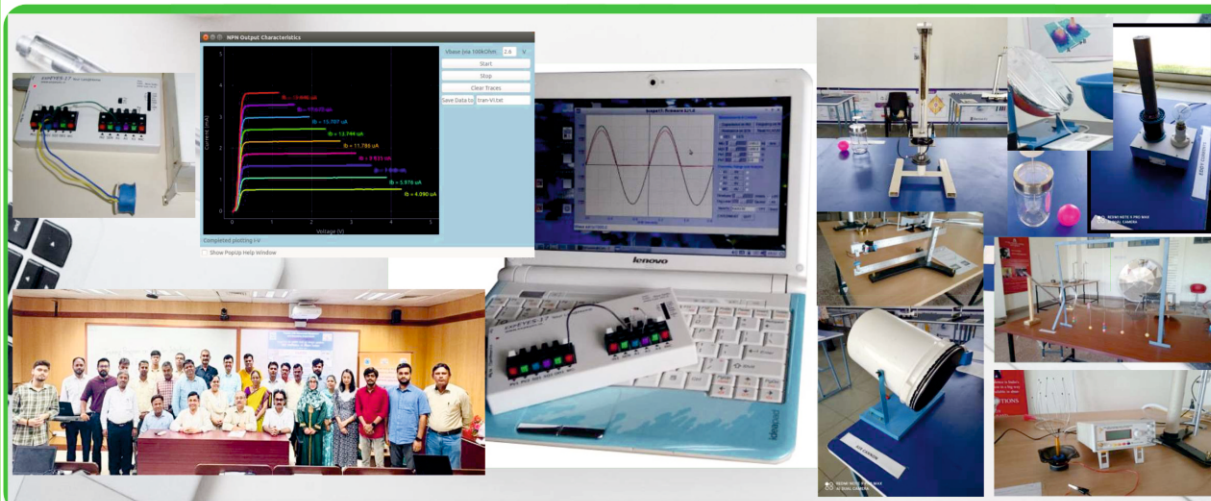
Dr. Lalit Mittal
Local Coordinator (NC-IAPT)
9899590592

Century of IAPT Innovation Hubs in India

Faculty Development Programme on Science Experiments and ExpEYES

(31 August – 5 September, 2026)

Inter-University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi – 110067



IAPT Innovation Hubs are interactive science centers set up by the Indian Association of Physics Teachers (IAPT). They feature over 20 portable, hands-on scientific models designed to make STEM (Science, Technology, Engineering, and Math) fun and easy to understand for students. Over 100 of these hubs are now installed in schools and colleges across India. They bring complex physics concepts to life using simple, everyday objects. This project was started by the IAPT and the Centre for Innovation in Science Teaching (CIST) at IIS University, Jaipur. The goal is to build "scientific temper" in youth. This means helping kids learn by touching and testing things themselves. It brings the "learn by doing" rules of the National Education Policy 2020 to real classrooms.

The Teaching lab at IUAC, New Delhi, was started in 2005 with the objective of developing cost-effective equipment for teaching science. The basic technique followed is to provide analog and digital input/output capabilities to a computer through the input/output connectors on the interfacing equipment. Experiments are designed utilizing these I/O capabilities and suitable sensor elements to convert physical parameters into voltage signals. As part of its outreach program, the Inter-University Accelerator Centre conducts one-week teacher training programs twice a year.

Resource Persons

Prof. Y.K.Vijay, Director, CIST, IIS University, Jaipur
Prof. OSKS Sastri, CUHP, Dharamshala
Prof. Vandna Luthra, Gargi College, New Delhi

Shri. V V V Satyanarayana, IUAC, New Delhi
Prof. Vijay Kumar, Dhanauri PG College, Haridwar
Prof. Vireshkumar Thakkar, Sir P T Sarvajani College of Science, Surat

Link for Registration

<https://docs.google.com/forms/d/e/1FAIpQLSef6HsMeo32NWEAMPFPxOOgmL8QBsrE2orJz0c-yfIRAdvvTA/viewform?usp=publish-editor>

Participants will be provided with the travel support, local hospitality, and accommodation at IUAC.

Contact Persons

Prof. Y.K.Vijay, CIST, IIS University, Jaipur
Shri. V V V Satyanarayana, IUAC, New Delhi
Email: iuacteachinglab@gmail.com



Indian Association of Physics Teachers
206, Adarsh Complex, Awas Vikas, I,
Keshavpuram, Kalyanpur, Kanpur, Uttar Pradesh



अंतर विश्वविद्यालय त्वरक केंद्र
Inter-University Accelerator Centre - (IUAC)



First Announcement

13th IAPT National Student Symposium on Physics (NSSP) - 2026



The IAPT National Student Symposium on Physics (NSSP) is an annual national-level event organized by the Indian Association of Physics Teachers (IAPT) to provide undergraduate, postgraduate and research students a platform to present research, exchange ideas, and engage with experts. Since its inception (2013), this prestigious symposium has been successfully hosted by several leading universities and institutes across the country.

We are glad to announce the 13th IAPT National Student Symposium on Physics (NSSP) -2026 will be held during October 29-31, 2026, at Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore (M.P.)

SALIENT FEATURES OF THE SYMPOSIUM:

1. Invited talks by Subject Experts.
2. Oral / Poster presentations by the UG / PG /Research Students
3. Interactive session for students with scientists.
4. Visit to Research Laboratories.
5. Local hospitality and accommodation for outstation participants.

NSSP-2026 Registration Details:

- **Registration** **Start Date:** 10 August 2026 **End Date:** 20 September 2026
- **Registration fee:** Rs. 1000/- for outstation participants (With Accommodation)
Rs. 700/- for regional participants (without Accommodation)
- **Registration Link:** <https://forms.gle/k7cqCgMG1MT9jqki6>



Abstracts & Manuscripts Submission Details:

- **Submission Window:** 10 August 2026 – 30 September 2026
- **Template Link:**
<https://drive.google.com/drive/folders/1QwXELxsKjqm7jj6tzBww9-Nn4oL3byzS?usp=sharing>
- **Submission Email:** nssp2026@svvv.edu.in
- **Acceptance Notification:** Status of abstracts/manuscripts will be communicated via email to the corresponding author.
- **Publication Opportunity:** Selected articles will be published in *Student Journal of Physics* (International Edition).



Contact Information:

Dr. Uttam Sharma, Convener, NSSP-2026 HOD (Physics) & Coordinator, SVIS, SVVV, Indore

Mobile: 9826212353

Email: nssp2026@svvv.edu.in

for detail visit: www.svvv.edu.in

NATIONAL GRADUATE PHYSICS EXAMINATION (NGPE-2027)



Conducted by

INDIAN ASSOCIATION OF PHYSICS TEACHERS

Registered Office : 206, Adarsh Complex, OPR 4, Awas Vikas-1, Keshavpuram, Kalyanpur, Kanpur - 208017

Web: www.indapt.org

(Regd. No. K 1448)

Day, Date & Time of Examination **SUNDAY, January 24, 2027**

TIME : 10.00 AM to 1.00 PM

Last Date for Enrolment : 17th November 2026
Eligibility for Appearing in NGPE-2027 : Students of B.Sc. I, II and III (Pass, Hons. or Integrated) are eligible.
(Any one who has already passed B.Sc. is NOT eligible)

Exam Information :

Enrolment Fee : ₹ 300 (Rupees Three Hundred Only)

 Language for NGPE : English, Hindi, Gujarati, Tamil,
Telugu or any other language
if 100 or more Students opt
for it.

Format for NGPE :

Part A : 25 MCQs with any number of options (1,2,3 or all 4) may be correct.

Credit is given only if all the correct options are marked (6 marks each; Total 150 marks)

Part B1 : 10 Short Answer (5 to 6 Lines) Questions (5 marks each; Total 50 marks)

Part B2 : Ten Problems (10 marks each; Total 100 marks)

Unique Features of this Examination :

- ★ Fully voluntary examination in a stress free environment.
- ★ Carry away the question paper both part A and part B.
- ★ It provides Individual's own assessment at all India level.
- ★ Same paper for all BSc I, II and III Year Students with separate national merit.
- ★ Solutions in printed form are provided to Centre In-Charge for each participant.
- ★ The only national level examination testing students in both theory & experiment.
- ★ Previous Year (2026) Question Paper & Solution for every centre registered for NGPE - 2027.

CERTIFICATES AND AWARDS IN NGPE - 2027

(Cash Award will be released only if the candidate continues higher studies in Physics)

**NGPE-2027
Awards**

- | | |
|---------------------------------|---|
| TOP 10% at Each Centre | : Centre Topper Certificate |
| TOP 1% at State Level | : State Topper Merit Certificate |
| TOP 1% at National Level | : National Topper Merit Certificate + Book Prize |
| Top 5 Students in India | : Merit Certificate + GOLD MEDAL + ₹ 20,000/- Cash Award |

- ★ Top 25 will be eligible for appearing in NGPE Part-C Examination - 2027 (an examination in experimental skill) for final selection for **GOLD MEDAL** and one time Scholarship (Max. 5 in Number) worth ₹ 20,000/- for pursuing higher studies in Physics. TA is paid and free lodging arranged.
- ★ Top 25 will have eligibility for an interview for Admission in Post - B.Sc. Integrated Ph.D. Programme in Physical Sciences 2027 of **S N BOSE NATIONAL CENTRE FOR BASIC SCIENCES, KOLKATA**, (Only BSc III year students with more than 60% Marks)
For more details must see website: <http://bose.res.in/admission.htm> or write email to admission@bose.res.in
- ★ May get opportunity to attend one week **EXPERIMENTAL PHYSICS WORKSHOP** organized by IAPT AT KOLKATA (Regional Council - 15). TA is paid.
- ★ Top 5 to 10 students of B.Sc. First year (of University 3Yr System) shall be eligible to participate in prestigious **NATIONAL INITIATIVE FOR UNDERGRADUATE SCIENCE [NIUS]** program of Homi Bhabha Center for Science Education, TIFR, Mumbai. [This is A Govt. of India, DAE Program organized at Mumbai].
- ★ Top 20 students of B.Sc. I appearing in NGPE-2027 may get an opportunity for two weeks Academic Workshop on Basic Physics at **IIT Guwahati** (Preferably for those from University 3-yr B.Sc. System)
- ★ Some more programmes for toppers may be declared later.

 To obtain previous Ten Year Question Papers with complete solution deposit / transfer Rs. 150/- (One hundred fifty only) per set in IAPT account as per Bank details: Name of the account: Indian Association of Physics Teachers, Name of the bank : Indian Bank, Branch : Dalanwala, Dehradun Pin 248 001, Account Number : 50492247138, IFSC Code : IDIB000D515. Then write a mail to iaptddn@gmail.com

FOR FURTHER INFORMATION : CONTACT

Dr Pradip Kumar Dubey

Coordinator NGPE

75, Bhagat Singh Marg, Opp. Shani Mandir

Dewas - 455 001 (M.P.)

Ph: 9425059796

Email: pradipkdubey@gmail.com

Prof B P Tyagi

Chief Coordinator (Examination)

23 Adarsh Vihar, Raipur Road,

Dehradun - 248001 (Uttarakhand)

Tel : +91 135 4050260, 9837123716, 9632221945

Email: iaptddn@gmail.com

Local Contact

Tel : _____

Final Reminder

National Competition for Innovative Experiments in Physics (NCIEP) 2026

The last date for submitting entries to the **National Competition for Innovative Experiments in Physics (NCIEP) 2026 is 31 August 2026.**

We warmly invite teachers, undergraduate and postgraduate students, and students of Classes 9–12 to showcase their innovative physics experiments. The competition values originality, conceptual clarity, and simple yet effective demonstrations over expensive equipment. Selected participants will present their experiments at the **40th IAPT Convention** to be held at **Amity University, Noida, from 4–6 October 2026**. Those already selected at the regional level may submit the same experiment for the national competition. Participants who could not attend a regional competition may also submit their entries. Please ensure that your write-up follows the prescribed format and includes the required declaration of originality. Submit your entries to **nciepiapt03@gmail.com** on or before **31 August 2026**. We look forward to receiving your creative ideas and wish all participants the very best.

Geetha R S, Coordinator, NCIEP

Obituary: Prof. Vinaya Katdare

(14 December 1958 – 27 June 2026)

With profound sorrow, I record the passing of my senior friend and mentor, Prof. Vinayak Katdare. Though fourteen years older, he remained a constant companion and guide since our first meeting at a Resource Generation Camp for the Physics Orientation-cum-Selection Camp in 2006. In recent years, as the Junior Science Olympiad (JSO) shifted from Homi Bhabha Centre for Science Education (HBCSE) to the Indian Association of Physics Teachers (IAPT) in Bengaluru, my interactions with him deepened. Prof. Katdare carried the institutional memory of the programme, preserving and transmitting its philosophy and practices. His absence leaves a void difficult to imagine.

Prof. Katdare served at Ruparel College, Mumbai, from 1983 to 2016, where he became renowned for his exceptional teaching of physics. Over 33 years, he guided thousands of students, many of whom became scientists, professors, and directors of leading institutions. His contributions to the Olympiad movement were equally significant. As a long-standing member of IAPT, he designed questions and experiments of remarkable quality, particularly in optics—his favorite branch. His insistence on precision, such as drawing ray diagrams to scale, reflected his deep insight. The repository of problems and experiments he created remains a lasting testament to his brilliance.

He accompanied JSO teams to the International

Junior Science Olympiad, most recently in 2023, where students under his guidance won gold and silver medals. In Bengaluru, his role in the Indian National Junior Science Olympiad (INJSO) was pivotal. From the initial stages to the Orientation-cum-Selection Camp, he moderated and scrutinized every paper with unmatched rigor. His childlike curiosity enriched our work—whether refining NCERT textbook activities or resolving the challenge of explaining multiple shadows at OCSC.

Beyond academics, Prof. Katdare was a warm and caring presence. His room often became a gathering place where colleagues shared tea, laughter, and reflections. He was like an elder brother—supportive in crises, generous with appreciation, and always ready for enriching discussions.

Fittingly, his final moments came at HBCSE after a day's work at the Pre-Departure Camp. His passing was sudden yet dignified, echoing the ancient prayer: “अनायासेन मरणं विना दैन्येन जीवनम्”—a peaceful death without suffering, a life without helplessness. We will deeply miss his wisdom, friendship, and unwavering commitment.



M K Raghavendra
IAPT-JSO, Bengaluru

Future Oriented Science Education (FOSE) - What is it ?

The practical applications of science have given us the means of a fuller and richer life, but also the means of destruction and devastation on a vast scale. Wise men would have considered the consequences of their activities before starting on them; scientists have failed to do so, and only recently have they become conscious of their responsibilities to society. They have gained prestige as men of action, but they have lost credit as philosophers.

Max Born, The Waynflete Lectures, Oxford, 1948.

The recently concluded GIREP 2026 conference on physics education in Crete, Greece, began with a keynote address titled 'Future-Oriented Physics Education' by Prof. Olivia Levrini. The address highlighted the rapidly changing nature of our world, marked by unprecedented acceleration, uncertainty and sustainability concerns. It stressed the need to reposition and revamp physics education to address these challenges and advancements of our times. The talk underscored the importance of imagining and formulating futures that are more just, sustainable, and attentive to the well-being of all. It questioned the dominance of the philosophical underpinnings of Newtonian mechanics in school physics education, which are undergirded by values and stances such as certainty, Laplacian determinism, and linearity. The suggestion is to put more emphasis on the science of complex systems and familiarize students with probabilistic thinking and navigating uncertainties. The need to loosen the grip of the Newtonian conception of space and time on school curricula and to inculcate notions of alternative forms of temporality was stressed. Prof. Levrini acknowledged that some of these issues are intricately intertwined with cultural values, thereby explicitly political and proposed to look outside western philosophies for insights and inputs. The following chapter from their research group gives further details on their approaches and advocacies.

Miani, L., Cassina, F. D. Z., & Levrini, O. (2026). Cultivating a Critical Attitude Towards Digital Artifacts Through a Future-Oriented Science Education Approach. In *Educating to Inhabit Futures: Seeding a Critical Culture of Digital Innovation Among New Generations in the AI Era* (pp. 75-96). Nova Science Publishers.

The significance and contemporary relevance of the issues raised in the talk were insightful and widely appreciated. However, the challenge of integrating these discussions with core curriculum topics — Mechanics, Electrodynamics, Quantum Mechanics, etc. — taught in current physics classrooms remains. This is especially true in contexts like ours, where physics education is still predominantly textbook-driven and lecture-based. We presented a possible approach at GIREP to address this concern by recasting the pedagogy of physics as an activity centered on mathematical model-building:

Mashood, K. K., Pinto, R., & Chandrasekharan, S. (2026). Blending Mathematical Model-building and Futures-Oriented Science Education (FOSE). Extended abstract in GIREP-MPTL Conference, Rethymno, Crete, Greece. <https://indico.cern.ch/event/1527018/contributions/7018799/>

Placing the intertwined trajectory of — Mathematical Model Building, Experiments, Instrumentation, Technological Innovation, and Societal Intervention — at the heart of our predicaments and current human condition can provide an operational way to coherently connect what is taught in our classrooms to FOSE discussions. Physics, with its core practices of — building mathematical models followed by experiments and instrumentation — has enabled and is still enabling phenomenal feats. However, we need to deeply ponder whether all of this is coming at the cost of our biosphere and survival. As Max Born exhorts, it is high time to regain our lost standing as philosophers.

K K Mashood
HBCSE - TIFR, Mumbai

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*If undelivered please return to :***Dr. Sanjay Kr. Sharma****Managing Editor**

Flat No. 206, Adarsh Complex,

Awass Vikas-1, Keshavpuram, Kalyanpur, Kanpur-208017