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The heart of galaxy M77 shines brightly in this May 7, 2026, image from NASA's James Webb Space Telescope. The intense glow is due to gas being pulled by the strong gravity of the central black hole into a tight and rapid orbit around it. The motion of the gas causes it to heat up, releasing tremendous amounts of radiation.

The bright lines radiating out of the center are diffraction spikes. The spikes are not a physical feature of the galaxy, but an optical effect caused by the telescope itself.

Link: <https://www.nasa.gov/image-article/beacon-of-light/>

Bulletin of The Indian Association of Physics Teachers

<http://www.indapt.org.in>

The Bulletin is the official organ of the IAPT. It is a monthly journal devoted to upgrading physics education at all levels through dissemination of didactical information of physics and related areas. Further, the Bulletin also highlights information about the activities of IAPT. All communications should be addressed to:

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In an article published in *Nature* **472**, 261 (2011), the author Mark C. Taylor wrote “*There are too many doctoral programmes, producing too many PhDs for the job market. Shut some and change the rest*”. His focus was mainly on the PhD education system in the United States. Today revisiting his observations and suggestions made fifteen years ago, in context of the Indian education system, we need to think loud and introspect. According to the All India Survey on Higher Education (AISHE), more than 200,000 students enrol in the PhD program every year, out of which 25–30 thousand graduate every year. These graduates join the program with great aspiration and dreams of securing their future with decent employment as faculty in a University or some institution of eminence. Once out with a degree in hand, they face the harsh reality of the crumbling academic job market. The reality is that there are very few jobs, that too with different tags attached!

Many of these graduates are NET qualified JRFs and receive handsome monthly fellowship with annual contingent grant. The teaching jobs offered, other than the central government jobs, are often with a starting fixed salary far less than the fellowship! It is demoralising and demeaning. But the institutions or universities, both private and public claim financial challenges. And indeed it is a “demand and supply” game. A glut of graduates in a barren terrain of the academic landscape is a part of this game.

The other points to ponder over must begin with the quality scrutiny of our PhD holders. As written by Mark Taylor, “most doctoral programs, education is a process of cloning that trains the students to do what their mentors do. And the clones outnumber their mentors”! This leads to replication, very narrow approach and a construed academic vision which often does not add either to the advancement in the field of study or of any relevance to fields other than academia. Such graduates when enter into academic jobs are burdened with heavy teaching loads. As a result, they are compelled to disseminate the limited knowledge gained during the PhD work, advancing it as a mere extension with no real innovation. Often the PhD holders go for jobs which have no connection with what they did during the course of the degree.

India produces almost 2000 Physics PhDs every year. Many of them are very well trained, though in very

specialised fields and sub-fields. Specialisations that lead to narrow areas of research remain relevant only within the miniature world of specialists. How many of these graduates can actually carry forward the legacy and pursue the research specialisation, is a pertinent question. The predictable current job situation leaves no room for a positive outcome in many cases. The training thus gained becomes a futile exercise leading to individual's frustration. Being a physicist, is a great asset. With a PhD degree in hand, the graduate desires to remain a physicist provided there are options or opportunities to do so. Thus there is a dire need to link the PhD programs to not only academia, but other domains of research relevant for solving day-to-day practical problems. But this mandates the freedom to the student for working on problem(s) not dictated by the mentors but assisted. Physics graduates in particular are relatively better equipped in terms of technology. They can be good in technology jobs, provided these are within their reach! Out of the physics graduates, less than 4 % are the fortunate ones to get a permanent faculty or research scientist job. What happens to the rest? A constant struggle for a stable job in a school, coaching institute, banks! Vast majority of physics graduates are now turning to data science, finance, artificial intelligence etc. However in the Indian context, it is extremely hard for them to compete against engineering and technology students. Many of them, in search of greener pastures, look for postdoc positions abroad. The offers are extremely rare and unfortunately many of these graduates are found to be unemployable for multiple reasons!

Currently we see a downward trend in the number of students joining physics streams. One reason is the lack of job avenues. This will eventually lead to a decline in PhD holders. There is a need to balance out. The higher education system should formulate a mechanism by way of which a PhD holder can be guaranteed a stable job and the opportunity to continue and contribute to the advances in the respective field. This would definitely mean both a quality and quantity checks at the entry point. Of course NET exam is a good yardstick of selecting genuinely competent students to join the PhD program. The solution to this problem is by no means trivial, but not impossible!

Manjit Kaur

Physics News

Unexplored interactions between electrons and atomic nuclei shed light on dark matter

Dark matter particles could be mediators of the interaction between electrons and atomic nuclei. Using results from precision measurements on barium monofluoride (BaF) molecules, the team constrained these interactions mediated by Z' bosons for the first time. Z' bosons are hypothetical mediators of the weak interaction and possible dark matter particles in several SM extensions. To determine the contribution of Z' bosons to the interaction between electrons and nuclei, which gives rise to the so-called hyperfine structure of atoms, the authors used the supercomputer MOGON 2 at JGU to reinterpret existing results of precision measurements in BaF molecules. In the search for "new physics," such an approach might be able to shed light on long-standing questions. The study also found similar bounds by analyzing the experiment with the atom cesium 133, which is a more traditional method of studying the interactions between electrons and atomic nuclei. The findings demonstrate that future experiments with heavy diatomic species like BaF will push deeper into unexplored territory to hunt for the hidden forces of the universe

Read more at: <https://phys.org/news/2026-05-unexplored-interactions-electrons-atomic-nuclei.html>

Original Paper: Physical Review Letters (2026). DOI: 10.1103/d19m-s856

'Elegant triangle' experiment suggests quantum internet may be closer than we think

For more than 60 years, Bell's theorem has been the gold standard for demonstrating that quantum mechanics defies the rules of classical physics. The study, published in *Physical Review Letters*, opens a new frontier in our understanding of how quantum correlations behave in realistic network settings, one that could help usher in the age of a quantum internet. Whereas Bell tests typically feature a single source of entangled particles distributed to two observers who randomly choose which measurements to perform, the latest experiment from Dr. Gisin and colleagues pushed the limits of nonlocality to new levels of complexity. The findings suggest that quantum nonlocality is not limited to idealized lab settings, but extends to the kind of complex, realistic network structures that could underpin incoming quantum technologies. Just as Bell's theorem revealed that quantum particles are correlated in ways classical physics can't explain, we now see quantum networks produce forms of correlation that go beyond even those scenarios.

Read more at: <https://phys.org/news/2026-05-elegant-triangle-quantum-internet-closer.html>

Original Paper: Physical Review Letters (2026). DOI: 10.1103/5hhc-rw3t

Testing quantum collapse theory with the XENONnT dark matter detector

Theories of quantum mechanics predict that some particles can exist in superpositions, which essentially means that they can be in more than one state at once. When a particle's state is measured, however, this superposition appears to "collapse". In recent years, various theoretical physicists have tried to explain why and how this collapse happens. This led to the introduction of various models, such as the Continuous Spontaneous Localization and Diósi–Penrose models. One promising experiment for testing these theories is XENONnT, a highly sensitive underground dark matter detector located at the INFN Gran Sasso National Laboratory (LNGS), in Italy. This kind of approach represents a promising path toward testing one of the biggest open challenges in physics: a unified theory of quantum gravity.. The theorists are now working on a new phenomenological framework that will allow them to test this hypothesis experimentally.

Read more at: <https://phys.org/news/2026-05-quantum-collapse-theory-xenonnt-dark.html>

Original Paper: Physical Review Letters (2026). DOI: 10.1103/2jm3-4976

Soumya Sarkar
Duke University, US

June: This Month in the History of Physics

June arrives softly with monsoon winds in India. It feels gentle and familiar. Yet, hidden within this calm, the month of June carries a remarkable legacy in the history of physics. Across different years, on scattered June days, humanity has pushed its understanding from the infinitesimal quantum world to the vast reaches of the interstellar space.

The Ghost Particle Turns Real

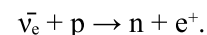
One such moment came in **June 1956**. Frederick Reines and Clyde Cowan sent a short but historic telegram to Wolfgang Pauli. It confirmed that the neutrino, once thought almost imaginary, had finally been detected. Pauli had proposed this particle in 1930. He did so to explain how energy is conserved in beta decay. Even he himself doubted its existence. The neutrino was called a 'ghost particle' or even a 'Poltergeist', because it barely interacts with matter. Yet, this ghost is 'roaming' everywhere.



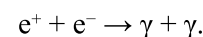
Reines and Cowan conducting the neutrino experiment in 1956. [Wikipedia]

Neutrinos are born in the Big Bang. They are produced in stars, in violent **s u p e r n o v a** explosions, and in nuclear reactions on the Earth. Even inside our bodies, tiny amounts are created through radioactive decay. Billions of these particles pass through us every second, silently and without effect.

And in the process their detections seemed almost impossible. The breakthrough came from the nuclear reactors. These reactors produced strong streams of neutrinos. The famous Cowan–Reines experiment provided the first clear detection of the neutrino. It used antineutrinos produced in large numbers inside a nuclear reactor during beta decay. The key reaction in the experiment is:



Here, an electron antineutrino ($\bar{\nu}_e$) interacts with a proton (p). This produces a neutron (n) and a positron (e^+). The positron does not live long. It quickly meets an electron and annihilates each other with the production of the two gamma rays:

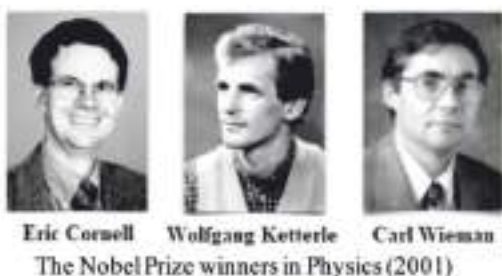


These gamma rays can be detected immediately. The neutron behaves differently. It moves more slowly and is captured later by a nucleus. This capture releases another gamma ray. Thus, the experiment looks for two signals. First, a prompt signal from positron annihilation. Second, a delayed signal from neutron capture. The coincidence of these two events gives a clear and unique signature. It confirms that an antineutrino interaction has taken place. In this simple yet brilliant way, an almost invisible particle was finally detected.

Their success changed physics forever. It opened a new way to study the universe. Later, scientists found that the neutrinos can change their identities. They can switch between electron, muon, and tau types as they travel. This solved the famous solar neutrino problem. It also showed that neutrinos have mass, previously not expected. From a set of doubtful idea, the neutrino became central to modern physics.

The Fifth State of Matter

Another June brought a very different kind of discovery. On **June 5, 1995**, scientists created a new state of matter in the laboratory. Eric Cornell and Carl Wieman produced the first Bose–Einstein Condensate, or BEC. This achievement came almost 70 years after its prediction by Albert Einstein based on the ideas of Satyendra Nath Bose. Soon after, Wolfgang Ketterle also created BEC in his laboratory, confirming the result. The idea behind BEC is simple, yet deep. In normal conditions, atoms behave like separate particles. But at extremely low temperatures, something strange happens. Particles called bosons begin to occupy the same quantum state. They lose their individuality. Instead, they behave like a single wave. Bose first described how such particles should be counted. Einstein extended this idea to atoms.



To create BEC, the above scientists had to cool atoms to almost absolute zero. At such low temperatures, the atoms spread out like waves. When the density is high enough, these waves overlap. The atoms merge into a single coherent state. It is often called a “super atom.” The work of the three physicists was acknowledged through the award of Physics Nobel Prize of 2001. The creation of BEC was not just a confirmation of a theory. It opened new areas of research.

The Birth of Modern Electronics

June also marks an important moment in the history of physics-based technology. In **June 1948**, William Shockley filed the patent for the bipolar junction transistor, or BJT. This device changed the world of electronics. It grew out of earlier work by John Bardeen and Walter Brattain, who built the first point-contact transistor in 1947. The story began even earlier. Julius Lilienfeld had suggested that



J. Bardeen (left), W. Shockley (centre) and W. Brattain (right) at Bell Labs, 1948 [Wikipedia]

electric fields could control current in a material. This idea inspired the later work. At Bell Labs, Shockley and his team wanted to replace vacuum tubes. These tubes were large, fragile, and inefficient. The transistor offered a better solution.

The BJT works by controlling current through junctions of different semiconductor materials. It is small, reliable, and efficient. Soon, it replaced vacuum tubes in many devices. Radios became portable. Computers became smaller. Systems for communication improved. For more than two decades, the BJT was the main building block of electronics. Shockley, Bardeen, and Brattain

received the Nobel Prize in Physics (1956) for this invention. Later, new devices like the MOSFET became more common. Yet, the BJT laid the foundation. It started the semiconductor age. It made the modern electronics possible.

Beyond the Edge of the Solar System

Then comes a story from the vastness of space. On **June 13, 1983**, Pioneer 10 came close to the Neptune. At that time, Neptune was the furthest planet from the Sun. As a result, Pioneer 10 became the first human-made object to go beyond the known edge of the Solar System.



Pioneer 10 under construction (Dec.1971)[left] and during encapsulation into payload fairing [right]

Launched by NASA in 1972, Pioneer 10 was built to explore the outer planets. It achieved many firsts. It was the first spacecraft to pass through the asteroid belt. It was the first to fly past the Jupiter. It was also the first placed on a path to leave the Solar System. Powered by nuclear energy, it travelled at a remarkable speed. Its journey was not easy. The asteroid belt was once thought to be very dangerous. Yet, Pioneer 10 passed through it with only minor impacts. On reaching the Jupiter, it faced intense radiation. Despite this, it sent back valuable data that revealed the size and strength of the Jupiter's magnetic field. It also detected plasma structures stretching far into space. The spacecraft continued its journey outward of the Saturn in 1976 and also the Neptune's orbit in June 1983. Though Pioneer 10 was designed for a mission of about two years, it sent data for more than 30 years. Its final signal came in January 2003. By then, it was over 12 billion kilometers away. The signal took more than 11 hours to reach the Earth. It was a faint whisper from deep space.

Pradipta Panchadhyayee

Facets of the Heisenberg's Uncertainty Principle

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Abstract:

Importance of Heisenberg's uncertainty principle in physics has been brought out by discussing its various applications.

1. Introduction:

The Heisenberg's uncertainty principle, expressed by $\Delta x \Delta p_x \geq \hbar/2$ can be regarded as आत्मा (soul) of Quantum Mechanics because this plays a crucial role in many of its applications. The situation is equivalent to a stanza from Shrimad Baghavad Gita:

ईश्वरः सर्वभूतानां हृद्देशेऽर्जुन तिष्ठति |
भ्रामयन्सर्वभूतानि यन्त्रारूढानि मायया |

[O Arjuna, god resides in the heart of all beings directing their wanderings by the magical power of maya, on which they are seated as if it were a madrine.]

Similarly, the uncertainty principle is quite important in the description of many phenomena associated with our existence and the existence of everything in the universe. There have been many proposals to demonstrate the invalidity of the uncertainty principle, including several by the great theoretician Einstein himself. However, every time, the uncertainty principle triumphed and the refutation attempt of the proposal enlightened the Physics principles.

In fact, due to Einstein's last attack (EPR-paradox) on the uncertainty principle, a new subject of Quantum Entanglement was discovered. It then blossomed into various branches like Quantum Computing and Quantum Communication.

Remarks by Feynman, in his lectures on Physics are very appropriate; "The uncertainty principle "protects" quantum mechanics. Heisenberg recognized that if it were possible to measure the momentum and the position, simultaneously with a greater accuracy, the quantum mechanics would collapse. So, he proposed that it must be impossible. Then people sat down and tried to figure out ways of doing it, and nobody could figure out a way to measure the position and the momentum of anything - a screen, an electron, a billiard ball, anything - with any greater accuracy.

Quantum mechanics maintains its perilous but still correct existence."

Wave-particle duality is the main concept for the validity of the uncertainty principle. This is similar to the duality between Atma and Paramatma in Hindu philosophy.

Let us begin with the expressions for Δx and Δp_x . $\Delta x = \sqrt{\langle x^2 \rangle - \langle x \rangle^2}$; {Angular bracket $\langle - \rangle$ indicates the expectation value}. We can choose $\langle x \rangle = 0$ by relocating the origin. $\Delta p_x = \sqrt{\langle p_x^2 \rangle - \langle p_x \rangle^2}$; here $\langle p_x \rangle = 0$ for every bound system. Therefore $\Delta p_x = \sqrt{\langle p_x^2 \rangle} = \sqrt{2mE(\text{kinetic})}$. There are also other well-known forms of the uncertainty principle. For example, between time and energy $\Delta E \Delta t \geq \hbar/2$. Also, there exists uncertainty relation for an object's angular position (ϕ) and its angular momentum L_ϕ [1,2]. The uncertainty relation exists for each pair of conjugate variables. Since the uncertainty principle is an inequality, exact and precise predictions are not possible; probability automatically enters in the analysis of the experimental results. The uncertainty principle, however allows us to understand numerous things as discussed in the sequel.

2. Some Consequences of the Uncertainty Principle

Non-existence of electron in the nucleus: In the early history of modern physics, until the neutron was discovered, protons and electrons were considered as the constituents of the nucleus of an atom. The uncertainty principle however demonstrates, using order of magnitude calculation, that the electrons do not exist in the nucleus. If an electron is a resident of nucleus, then its position uncertainty Δx is of the order of nuclear radius $R \approx 10^{-13}$ cm. Then $\Delta p \approx \frac{\hbar}{R} = \frac{1.05 \times 10^{-27}}{10^{-13}} \text{ erg} \cdot \text{s} \cdot \text{cm}^{-1}$. Hence, $p \approx 1.05 \times 10^{-14} \text{ g cm/s}$. Since, $p/m_e > c$, using relativistic relation $E \approx cp \approx 3.15 \times 10^{-4} \text{ erg} \approx 200 \text{ Mev}$. Thus, the kinetic energy of such an electron in the nucleus would be of this magnitude. Potential energy $\propto -1/r$ and the

kinetic energy $\propto 1/r^2$. Hence, decreasing r causes an increase in KE much faster than the decrease in potential energy of the order of $\frac{e^2}{R} \approx 1.36 \text{ MeV}$. Even if one considers the nucleus of Uranium with $Z=92$, the potential energy is of the order of $\frac{Ze^2}{R} \approx 125 \text{ MeV}$. If such an electron comes out of the nucleus, its outside kinetic energy would be $200 - 125 \approx 75 \text{ MeV}$. So far no β -decay with such large energy release has been observed. This, however, does not restrict protons and neutrons to remain in the nucleus as their mass is ≈ 2000 times that of the electron. Due to large mass of neutron/proton, non-relativistic treatment suffices for the analysis; hence $\text{K.E.} = p^2/(2m) \approx 20 \text{ MeV}$. The nuclear potential represented by the Woods-Saxon potential is much deeper than the kinetic energy associated with the protons and neutrons, and hence they may exist within the nucleus.

Stability of Hydrogen atom: The stability of hydrogen atom or of any other bound system, requires following characteristics. For the interaction between the constituent parts, it must have attractive nature for long range and repulsive nature for short-range giving rise to a minimum in energy as a function of separation between its parts (see figure 1). For hydrogen atom, the attractive force is due to the Coulomb interaction between proton and electron; potential energy $\propto -1/r$. If we try to confine the electron in a region very close to the nucleus (proton), its position becomes more certain so that uncertainty in its momentum is large in accord with the uncertainty principle. Assuming momentum to be of the same order of magnitude as uncertainty in it, its mean square momentum will be large. This produces a sort of outward repulsive force that opposes the Coulombic attraction between the proton and the electron. This leads to stability of the hydrogen atom. Same thing explains the ionic bond. For example, in NaCl, Na^+ and Cl^- ions attract one another due to the coulomb interaction. As they approach closer, the electronic clouds of the ions start overlapping. This reduces the space for their distributions and reduces the position uncertainty Δx . Automatically, Δp starts to increase, which is equivalent to increasing the kinetic energy. This increase in KE is not matched by the decrease in potential energy and hence it limits the closer approach of the two ions. Generalizing this, it can be said that the stability of entire matter (including ourselves) is due to the repulsive force provided by the operation of the uncertainty principle.

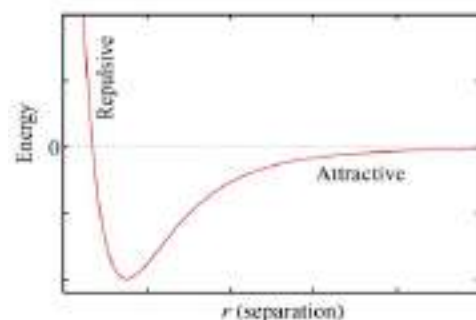
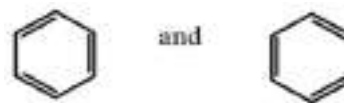


Figure 1

Electron orbits: The Bohr model of the hydrogen atom deals with orbits of electron around proton. For example, the allowed circular orbits are defined by the quantization rule $pr = n\hbar$, where r is the radius of circular orbit and $p = mv$ is the momentum of electron and n is an integer. The electron orbits will be well defined (as demanded by Bohr's model) if the uncertainties Δr and Δp in r and p , respectively, are extremely small as compared to their values, i.e., $\Delta r \ll r$ and $\Delta p \ll p$ so that $\Delta r \Delta p \ll pr$ or $\Delta r \Delta p \ll n\hbar$. This together with the uncertainty principle $\Delta r \Delta p \geq \hbar/2$ implies that $n \gg 1$. Thus, the uncertainty principle dictates that for the concept of orbit to be valid n should be very large [3]. Only for large n , we are back to the classical regime, then it is alright to talk about electron orbits. The Bohr model is, of course, very important and revolutionary in old quantum theory.

Resonance energy: The cyclic ring structure of the benzene molecule C_6H_6 , originally given by Kekule, has three double bonds and three single bonds alternately. This can be represented by two possible arrangements;



The actual structure, according to quantum mechanics is a superposition of these two structures. The π -electrons associated with these bonds are not restricted to the positions indicated by double bonds but are smeared out over the entire ring. This delocalization gives rise to increased uncertainty in position, which consequently reduces the momentum uncertainty, and hence reducing the kinetic energy of the electrons in the system. This reduces the binding energy of benzene, making it stabler than the two structures above. This reduction in binding energy is called

resonance energy. For benzene molecule, it is $\approx 1.63\text{eV}$ per molecule. For naphthalene with two rings structure, the resonance energy is $\approx 3.25\text{eV}$ per molecule.

This resonance energy plays very important role in protein structure involving peptide bonds. The peptide bond structure resonates between following two representations:



Here electrons are delocalized over multiple atoms. The delocalization increases the position uncertainty for electrons involved. This decreases the momentum uncertainty which gives rise to the extra binding for peptide bond, making the structure more stable. Due to the resonance between above two structures, peptide bond has double bond character in part [4]. This prevents rotation around about this bond. Hence, the peptide bond has a rigid planar structure, which is important for the three-dimensional structure of protein molecules.

Energy and band formation: A positively charged hydrogen molecular ion is composed of two protons and an electron moving around them. If the two protons are far apart, the electron will stay close to one of the protons forming a hydrogen atom in ground state and the other proton being bare. The two possible base states are:

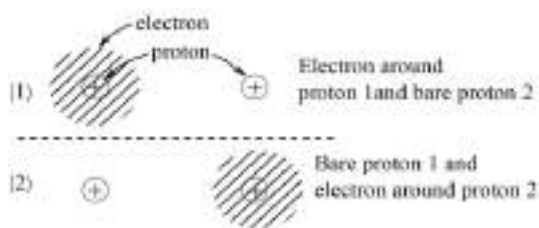


Figure 2

For qualitative analysis we restrict ourselves to the lowest state and spin up for the electron. For closer distance between the two protons, electron may jump from one proton to the other proton; the base states however remain the same. The actual state of the hydrogen molecular ion is superposition of these two states as given below:

$$|A\rangle = \frac{1}{\sqrt{2}}(|1\rangle - |2\rangle) \text{ and } |B\rangle = \frac{1}{\sqrt{2}}(|1\rangle + |2\rangle).$$

In state $|A\rangle$, the probability of electron to be at centre is zero (due to symmetry), while in state $|B\rangle$, the probability of electron to be at the centre is nonzero. Hence, compared to state $|A\rangle$, the state $|B\rangle$ has more spread out electron wave function. The position uncertainty is larger for state $|B\rangle$ and therefore the momentum uncertainty is lower giving rise to lower energy for state $|B\rangle$ compared to state $|A\rangle$. The energy levels of these two states, using detailed analysis, including proton-proton repulsion, are shown by Figure 3.

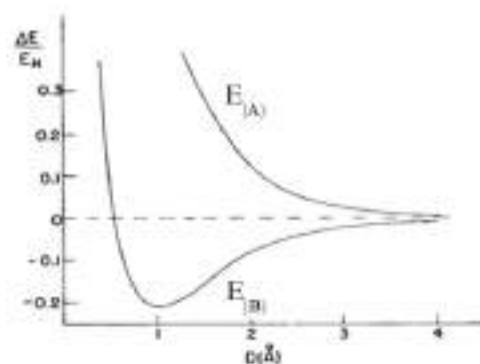


Figure 3

The uncertainty principle qualitatively explains why state $|B\rangle$ is lower in energy compared to state $|A\rangle$ for the positively charged hydrogen molecular ion.

The same consideration also explains, strong binding of the covalent bond to form the H_2 molecule [5]. The wave function of the two electrons with opposite spins, spreads considerably between the two protons, hence lower in energy forming strong bond due to the uncertainty principle.

Natural line width of spectral lines: The natural line width (apart from the Doppler broadening and the collisional broadening) of spectral lines in atomic or molecular transitions is the width of distribution in frequency units of the transition between excited state and lower energy state. If the lower energy state is the ground state of the system, then the ground state has essentially infinite lifetime, the transition linewidth is then governed by lifetime of the excited state; (Otherwise lifetimes of both the states are involved). Energy-time uncertainty principle ($\Delta E \Delta t \geq \hbar/2$) relates the lifetime of an excited state with the

uncertainty in energy-generating photons with different frequencies. A short lifetime will have large energy uncertainty and hence a broad spectral line. While large lifetime will produce sharper spectral line. Note that the lifetimes of the metastable states in gas lasers are generally $\sim 10^{-6}$ s to 10^{-3} s, and of the excited states in ordinary atoms are $\sim 10^{-8}$ s. Thus, lifetime for lasing state will be about 10^3 times higher than the excited state involved in the emission of usual light so that for the same frequency the laser light will have a linewidth 3 orders of magnitude less than that for ordinary light. This accounts for very sharp monochromaticity of the laser light.

In the same way, the experimental energy width of short-lived resonance particles in particle physics is directly related to their lifetime through the uncertainty principle. Here, more accurately the energy of particle is measured, one can know less precisely - how long it existed. The uncertainty principle also plays a role in the existence of virtual particles, which can briefly come into existence due to inherent uncertainty in energy. According to the quantum field theory, the electromagnetic interaction between charged particles is due to exchange of such virtual photons between them. The range of electromagnetic interaction is infinity as the rest mass of photon is zero.

Furthermore, the strong nuclear force between nucleons in the nuclei is however short ranged. Its range is of the order of the nuclear radius, $r_0 \approx 1.5 \times 10^{-1}$ cm. Correspondingly $\Delta p = \frac{\hbar}{r_0} = mc$, for relativistic particle.

$\therefore m \approx \hbar/r_0 c \approx 0.233 \times 10^{-24}$ g. In terms of electronic mass $m \approx 250m_e$. The mass of the mediating exchange particle for strong nuclear force is about the mass of the pion. On basis of this Yukawa predicted the approximate mass of pion; correspondingly the particle mediating β -decay must be extremely heavy, since the β -decay is considered to be due to almost zero-range interaction. The corresponding exchange particles are: W-boson, 81 ± 2 GeV for β -decay and Z-boson, 93 ± 2 GeV for muon decay.

Estimation of Ground state energy: One can use the uncertainty principle to estimate the ground state energy of hydrogen atom and ground state energy of simple harmonic oscillator. For hydrogen atom, potential energy $\approx -e^2/r_0$, where r_0 is the extent of

the sphericity of the electron distribution. Hence $\Delta x \approx r_0$. The kinetic energy $= \frac{\langle p^2 \rangle}{2m} = (\Delta p)^2/2m \approx \frac{1}{2m} (\hbar/r_0)^2$. Total energy estimate $E \approx \frac{\hbar^2}{2mr_0^2} - \frac{e^2}{r_0}$. Minimizing this with respect to r_0 gives an estimate of ground state energy,

$$\frac{\partial E}{\partial r_0} = 0 = -\frac{2\hbar^2}{2mr_0^3} + \frac{e^2}{r_0^2} \Rightarrow r_0 = \frac{\hbar^2}{me^2},$$

and $E_g = -\frac{me^4}{2\hbar^2}$. These two estimates give correctly the Bohr atom radius and the ground state energy of the hydrogen atom. The perfect agreement is accidental as we know that the uncertainty principle is not used for detailed exact calculations. This is order of magnitude estimate. Here the uncertainty principle is used without factor of 2 in the denominator. Similarly, for harmonic oscillator, $x_0 =$ estimated uncertainty for its position, then the total energy estimate $E = \frac{1}{2}m\omega^2 x_0^2 + \frac{\hbar^2}{2mx_0^2}$ using the uncertainty principle. Minimizing this with respect to x_0 gives the

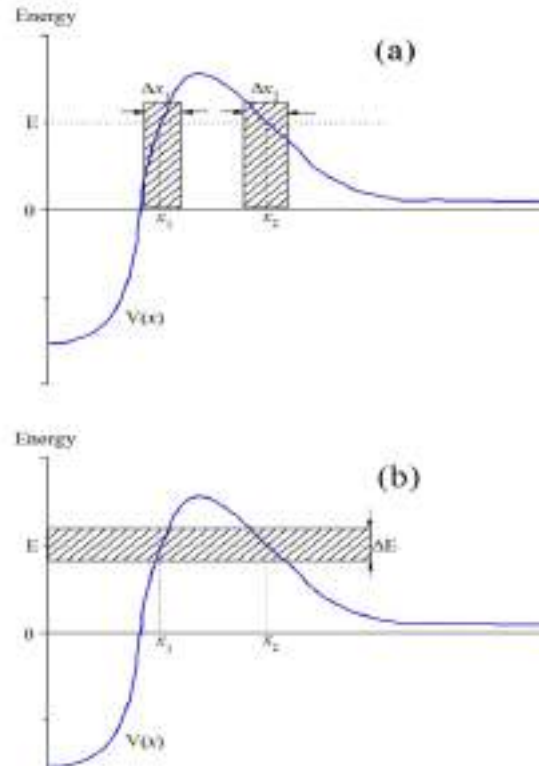


Figure 4

estimate of its ground state energy $E_{gs} = \frac{\hbar\omega}{2}$.

Solidification of liquid ^4He : Another interesting phenomenon which can be understood qualitatively using the uncertainty principle is the fact that liquid ^4He cannot be solidified under normal pressure. The van-der-Walls interaction between two ^4He atoms is described by potential energy $V(r)$ as shown in Figure 1. The minimum in potential energy curve (Energy expressed as kT) is about $9K$ deep. Now for well-defined solid the positions of atoms involved must be well-defined within the range of about 0.05nm , which is of the order of the distance between atoms in a solid matter; $\Delta x \leq 0.05\text{nm}$. This corresponds to uncertainty in momentum of about $\hbar/\Delta x$ and hence its kinetic energy is $\geq \frac{\langle p^2 \rangle}{2m} = \frac{\hbar^2}{2m(\Delta x)^2}$

$$= \frac{(1.054 \times 10^{-34})^2}{2 \times 4.0026 \times 1.67 \times 10^{-27} (0.05 \times 10^{-9})^2}$$

$$\approx 33.23 \times 10^{-23} \text{ J.}$$

Taking average kinetic energy of Helium atom as $\frac{3}{2}kT$, the above energy corresponds to $16K$. This is more than the depth of the potential well and hence no localization of the atom. The system remains in the liquid form. (The ^4He however solidifies at very low temperature under extreme pressure of 25Atm). Other inert gases however solidify because their masses are higher than that of ^4He . The hydrogen molecules however solidify in spite of their small mass because the interaction between hydrogen molecules is different from the Van-der-walls interaction, with much larger well-depth.

Barrier penetration or quantum tunnelling: One can also visualize the phenomenon of barrier penetration or quantum tunnelling with the help of uncertainty principle. Accompanying diagram (Figure 4a) shows classical turning points x_1 and x_2 , for a particle with energy E associated with the potential energy curve $V(x)$. Classically allowed regions for particle with energy E are $0 < x < x_1$ and $x > x_2$. At the classical turning points the particle would come to rest momentarily. But according to uncertainty principle it cannot have both precise position and precise momentum or a precise trajectory. So, the point at which particle turns around is not well-defined. It is spread over a region Δx centred around classical turning points. If the uncertainties Δx_1 , and Δx_2 , are sufficiently large then these would overlap; then there

is a possibility that the particle would tunnel through from inside to outside (decay) or from outside to inside (absorption of particle). This process can also be visualized using energy time uncertainty. If the turning occurs at time t with uncertainty Δt , then it would have energy uncertainty ΔE (Figure 4b). If $E + \Delta E$ is larger than the height of the potential barrier then the tunnelling possibility exists.

Zero-point fluctuations: Consider an assembly of systems, each with two states m and n , and corresponding energies E_m and E_n , such that $E_m > E_n$. The energy difference $E_m - E_n = \hbar\omega$, here ω is the angular frequency of light emitted/absorbed when the system makes a transition from (m to n)/(n to m). The Planck's law for the black-body radiation then states that in equilibrium, the energy density of radiation $I(\omega)$ is given by,

$$I(\omega) = \frac{\hbar\omega^3}{\pi^2 c^2} \frac{1}{(e^{\hbar\omega/kT}) - 1}. \quad (3)$$

At equilibrium, the number of systems in states m and n are N_m and N_n , respectively. The emission rate is R_{mn} and the the corresponding absorption rate is R_{nm} . The emission consists of two components: (a) stimulated emission rate proportional to the product of N_m and $I(\omega)$ and can be written as $B_{mn} N_m I(\omega)$, and (b) spontaneous emission rate proportional to N_m , written as $A_{mn} N_m$. The corresponding absorption rate is $B_{nm} N_n I(\omega)$.

$$R_{mn} = A_{mn} N_m + B_{mn} N_m I(\omega),$$

$$R_{nm} = B_{nm} N_n I(\omega). \quad (4)$$

These A and B coefficients are called Einstein coefficients. It is clear that the absorption rate does not include the spontaneous absorption as it would violate the conservation of energy. At equilibrium, both these rates are equal and the ratio N_m / N_n equals $e^{-\hbar\omega/kT}$ according to the Boltzmann distribution law in thermodynamics. Hence solving for $I(\omega)$,

$$I(\omega) = \frac{A_{nm}}{(B_{nm} e^{\hbar\omega/kT}) - B_{mn}}. \quad (5)$$

Comparing this with the Planck's black-body radiation law, Einstein concluded that $B_{nm} = B_{mn}$. One can see that the ratio of the Spontaneous emission to the stimulated emission rate is,

$$\frac{A_{mn} N_m}{B_{mn} N_m I(\omega)} = \frac{A}{BI(\omega)} = (e^{\hbar\omega/kT} - 1). \quad (6)$$

For the light coming from the Sun, (surface temperature 6000K) this ratio for $\lambda = 400$ nm is around 400 and for $\lambda = 700$ nm, it is 30. This indicates that dominant part of the radiation we normally receive is dominated by the spontaneous emission. Putting all this in the expression for R_{mn} gives,

$$R_{mn} = N_m \frac{\hbar\omega^3}{\pi^2 c^2} B \left\{ 1 + \frac{1}{e^{\hbar\omega/kT} - 1} \right\}. \quad (7)$$

The second term in the bracket is the average number of photons \bar{n}_ω present in the radiation mode with angular frequency ω . Hence,

$$R_{mn} = N_m \frac{\hbar\omega^3}{\pi^2 c^2} B \{ 1 + \bar{n}_\omega \}. \quad (8)$$

Here now comes the entry of the uncertainty principle. The number of photons present (\bar{n}_ω), as indicated by the second term in the equation above, provide the necessary perturbation for the stimulated or the induced emission. Even in the absence of the photons, the first term gives rise to the Spontaneous emission. Its presence can be inferred from the uncertainty principle, which gives rise to zero-point energy $\frac{1}{2} \hbar\omega$, which is responsible for what is called zero-point fluctuations. Thus, the spontaneous emission is due to virtual photons created temporarily by the zero-point fluctuations, existing because of the uncertainty principle. Thus, in reality, the spontaneous emission is in fact a stimulated emission due to the uncertainty principle.

The zero-point fluctuations also explain the presence of Hawking radiation. The quantum fluctuations, constantly produce virtual particle-antiparticle pairs. In the vicinity of the black-hole's event horizon (figure 5), one of the two particles crosses the event horizon, while the other particle escapes as Hawking radiation.

Second law of thermodynamics: In thermodynamics, the second law can be said to be protected by the uncertainty principle. Maxwell's demon was introduced to circumvent the second law of thermodynamics. As shown in figure 6, the demon opens the door between two parts of a container holding gas particles, such that the fast-moving gas molecules are collected in one part while the slow-moving particles are to be gathered in the other part of the container. This makes one part of the system hotter and the other part cooler. This is against the second

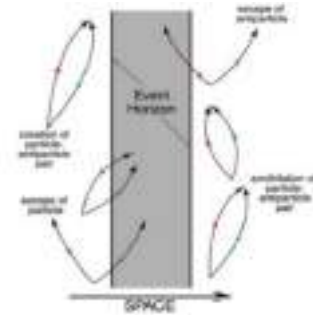


Figure 5

law of the thermodynamics as the process takes, heat from cooler part to the hotter part. It is precisely here, the uncertainty principle steps in. The demon has to gather the information about position and velocity of the molecules in order to separate them. The demon has to know the velocity of the particle and its position but while doing so, he disturbs the particle and hence cannot decide due to the operation of uncertainty principle. The process naturally disturbs the molecules, and the demon is defeated in its attempt to gather this information by the uncertainty principle.

By the way in statistical thermodynamics the volume of elementary phase space cell is h^3 involving Planck's Constant. The fact that particle trajectory in phase space cannot be defined precisely due to uncertainty principle is used in defining the size of the elementary cell in the phase space and this idea is used in statistical mechanics [6].

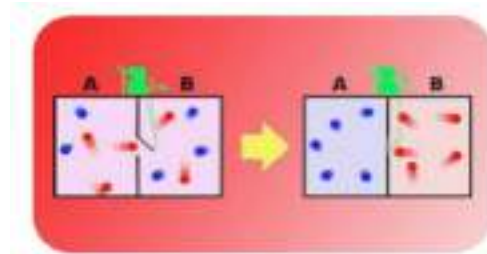


Figure 6

Biology, superconductivity and quantum computation: In biology, the transfer of information is executed through the storage, replication, and transfer of large molecules like DNA and RNA, which store and transmit the genetic code and proteins which carry out essential functions and act as the products of genetic information. Here, the transfer of information through large molecules is necessary to avoid the errors in transmission. Small molecules would have been affected more by the uncertainty principle and hence there would have been too many mutations and the biological fidelity would have been disturbed.

The BCS theory of superconductivity explains the formation of Cooper pairs and the characteristic coherence length (ξ) of the superconducting state. The coherence length, which describes the distance over which the superconducting order parameter varies and the spatial extent of the Cooper pair electrons, is associated with the uncertainty principle. In the superconducting state, a finite energy gap (Δ) for superconductor exists, which represents the binding energy of the Cooper pairs. The uncertainty principle links this energy gap to the lifetime or stability of these pairs. The wave function for the paired electrons corresponds to the electron with energies within Δ of E_F (Fermi energy)

$$\Delta = \delta E = \delta \left(\frac{\hbar^2 k^2}{2m} \right) \approx \left(\frac{\hbar k_F}{m} \right) \hbar \delta k, \quad (9)$$

If we assume that the spread of the wave function is determined by the uncertainty relation, $\xi \delta(\hbar k) \approx \hbar$, $\therefore \xi \delta k \approx 1$,

$$\xi = \frac{1}{\delta k} = \frac{\hbar k_F}{\Delta m} \approx \frac{\hbar^2 k_F^2}{k_F m \Delta} \approx \frac{E_F}{\Delta k_F}. \quad (10)$$

Above equation indicates that Cooper pair electrons in a superconductor are not localized particles, but rather form extended, overlapping pairs due to the energetic advantage gained when their position uncertainty is related to their momentum range.

The Heisenberg's uncertainty principle fundamentally limits simultaneous knowledge of conjugate variables like a quantum particle's position and momentum. This principle impacts quantum computing by introducing the measurement problems where observing a qubit's state inherently disturbs it, leading to potential state collapse and influencing the outcome of quantum algorithms. The inherent uncertainty and probabilistic nature of quantum mechanics are critical for designing as well as for understanding how quantum computers operate, enabling complex analysis and providing multiple outcomes to problems which the classical computers cannot. Furthermore, the locality is also gone due to the understanding of Quantum entanglement, the entire subject arose due to Einstein's strong objection to the uncertainty principle.

3. Epilogue

Laplace is associated with the deterministic philosophy. A super intelligent being with infinite

computational ability, with complete instantaneous knowledge of every particle (position & velocity) and with perfect understanding of physical laws (such as Newtonian physics/Classical physics) would be able to predict with certainty the state of the universe at any other later time. It could predict the future with perfect accuracy. This Laplacian dream of determinacy, of course, collapsed due to the validity of uncertainty principle, as it states that complete knowledge of position as well as of velocity of any particle cannot be acquired.

Concluding Remark

To conclude, we mention that the uncertainty principle is associated with many aspects of physics, chemistry and biology. There must be many more facets of the principle still unexplored. This reminds again of another stanza from Bhagavad Gita,

यच्चापि सर्वभूतानां बीजं तदहमर्जुन ।
न तदस्ति विना यत्स्यान्मया भूतं चराचरम् ।

[O Arjuna, I am the seed of all existence. There is nothing moving or unmoving that can exist without me.]

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Minutes of the EC Meeting: October 04, 2025

A meeting of IAPT Executive Committee members was held on October 04, 2025, at Goa University, venue of 39th Annual Convention of IAPT. Following members attended the meeting:

1. Prof. P. K. Ahluwalia, President
2. Prof. Rekha Ghorpade, General Secretary
3. Prof. Rajnita Deka, Vice President East Zone
4. Prof. Y. K. Vijay, Vice President West Zone
5. Prof. V. Rajeshwar Rao, Vice President South Zone
6. Prof. P.C. Deshmukh, Vice President Central Zone
7. Prof. Manish K. Kashyap, RC – 01 Delhi & Haryana
8. Dr. Sheojee Singh, Member RC – 03 Chandigarh
9. Prof. Sunder Singh, Member RC – 04 Uttar Pradesh
10. Prof. Y. C. Sharma, Member RC – 06 Rajasthan
11. Prof. Chetan Limbachia, Member RC – 07 Gujarat, Daman & Diu
12. Dr. Shivanand A Masti, Member RC – 08 Maharashtra
13. Prof. H. Dayama, Member RC – 12 Karnataka
14. Prof. V. Madhurima, Member RC – 13 Tamil Nadu
15. Prof. K. M. Udayanandan, Member RC – 14 Kerala
16. Prof. Yeswant M. Gaunkar, Member RC – 21 Goa
17. Dr. Ch. Ramakrishna, Member RC – 22 Telangana
18. Prof. B. P. Tyagi, Chief Coordinator Examination
19. Dr. Sanjay Kr. Sharma, Secretary
20. Dr. D. C. Gupta, Treasurer
21. Prof. S. W. Anwane, Co-opted Member
22. Prof. Vandna Luthra, Co-opted Member
23. Prof. H. C. Verma, NANI Coordinator
24. Prof. P. K. Dubey, Coordinator, NGPE
25. Dr. S. K. Joshi, Coordinator, NCEWP
26. Dr. Geetha R. S. Coordinator, NCIEP
27. Dr. G. V. Lakhotiya, Coordinator, NPECP
28. Devesh Kumar Tyagi, President RC – 04
29. Krishna Swaroop Sharma, President RC – 06
30. Mahesh N. Shetti, President RC – 08

31. Rajesh K Nimat, Secretary RC – 08
32. J. A. Bagande, Treasurer RC – 08
33. Dr. M. S. Jogad, President RC – 12
34. Dr. Ch Madhusudan, President RC – 22
35. Dr. Sapna Sharma, Secretary RC – 23
36. Vinod Kr. Prajapati, Office Assistant Kanpur

Several other members of IAPT also were present.

Following business was transacted:

1. To read and confirm the minutes of the previous EC Meeting.

Minutes of the last EC meeting held on June 22, 2025 was read and approved.

2. Report on activities of Central IAPT by GS:

Prof. Rekha Ghorpade informed the following:

- IAPT Election process for the term 2025-27 was completed in December 2024. Sincere gratitude to prof. P. D. Lele, the Returning Officer, IAPT for completing the task well in time. We also thank IAPT members from Mumbai SRC for helping in counting process. Thanks to IAPT Registered Office, Kanpur and Prof. Sanjay Sharma, Secretary for their help in the process.
- IAPT Expresses Sincere gratitude to all the outgoing Executive Members for their valuable inputs and helping us to take IAPT activities to greater heights. Welcome to the new EC members for the term 2025-27. Looking forward to moving ahead and achieve the IAPT objectives in an effective manner.
- **IAPT-JSO Cell:**
IAPT has signed a MoU with Vidya Vardhaka Sangh, Bengaluru and TDC-IISc to carry out the JSO activities in their premises. 21st IJSO-2024 was held at Bucharest, Romania during December (01-10), 2024. Indian team won all **6 Gold Medals, 4 subject Medals and the Country Winner Trophy.**
- **IAPT-APhO Cell:**
Indian Team participated in APhO-25 at Saudi Arabia and won **2 Silver Medals, 4 bronze medals and 1 honorable mention.**
- IAPT was the co-host for the conference

epiSTEME-10 (January 03-06, 2025) organized by HBCSE TIFR, 7 members (3-outstation & 4 local) represented IAPT. GS presented about IAPT activities along with its mission and objectives.

- **Celebration of IYQ 2025:** IAPT carried out a yearlong campaign to celebrate International Year of Quantum Science and Technology throughout the country via its regional councils. These seminars brought many leading scientists and experts to deliver lectures marking the timeline of the development of various aspects of Quantum Science in the last 100 years. The series generated a good resource of video lectures and provided an opportunity to network with leading scientists of the country. Professor PK Ahluwalia lauded this great collective effort of different regional councils across the length and breadth of the country. Following regional councils participated and hosted the webinars:
 - Quantum Zoom School of Bharat (INDIA)_ A Unified Educational Journey Across Schools in India, Celebration of IYQST-2025, Initiative by RC12A (January 22-23, 2025).

Webinar Series by Central IAPT and Regional Councils:

- January 2025 : Curtain Raiser by RC 07 (Gujarat)
- February 2025 : RC 14 (Kerala)
- March 2025 : RC 22 (Telangana)
- April 2025 : RC 06 (Rajasthan)
- May-June 2025 : RC 15 (WB)
- July 2025 : SRC 04A (Kanpur)
- August 2025 : RC 23 (Himachal Pradesh): Mega Quantum Quiz by RC 23 (HP): Monthly 22 episodes, 22 booklets given to the participants. 25 MCQs in each Quiz (550 questions)

- **Meeting with zonal vice presidents /EC members:** To seek the proactive indulgence of our respective zonal wise presidents and EC members, a meeting was held to seek their suggestions and action plans. It is heartening to note that this has resulted in more coordination between the zonal vice presidents and respective regional councils under their care. A special

mention must be made of initiative taken by Prof. Meenakshi Sayal, zonal VP(North) to conduct a workshop on designing question items as a result of this meeting. Members were urged to be in touch with each other to create an impact in the field.

- **IAPT Competitions:** Announcements have been made through the bulletin and also uploaded on the IAPT website: www.indapt.org.in NPECP and INYPT are already completed.
- **IAPT Examinations:** NSE-24 and NGPE-25 were successfully completed as per the schedule. Detailed report by Prof. B. P. Tyagi, CCE Registration process for NSE-2025 is complete and the Exams will be on November 22 & 23, 2025. Announcement for NGPE-26 is published. Our sincere thanks to Prof. B. P. Tyagi, CCE and the Exam teams and Prof. P. K. Dubey, Coordinator, NGPE
- **IAPT Anveshika Bharat Yatra** with the guidance from Prof. H. C. Verma, Coordinator, NANI is on its way.....! Yatra started in Jammu & Kashmir, next in Himachal Pradesh, Punjab and now in Rajasthan.
- **NASNI (National Astronomy Network of India)** A new Initiative started by RC 23 (H.P.) under the coordinatorship of Prof. Hemant Kumar and the team of dedicated IAPT members. Along with many Astronomical activities, NASNI organizes a guest lecture on the first and third Wednesday of every month. It organizes workshops, lectures and sky watching sessions for beginners and enthusiast through its members. The first meeting of NASNI was organised on Wednesday 1st January 2025 and till 1st October 2025 total 19 sessions have been organised. Prof. Hemant Kumar could not attend the meeting but the details of NASNI activities are uploaded on our website.
- **IAPT-NDLI Agreement – IAPT Bulletin Hosting:** Members were informed that the complete repository of Indian Association of Physics teachers digital bulletins have been posted on national digital library maintained at IIT Kharagpur. This is a great work which has been performed and a path generated to host future bulletins also on the website. Members

expressed and satisfaction on this development. Professor PK Ahluwalia thank Professor Sumit Ray, President Regional Council 15, Professor Bhupati Chakrabarti and Prof. CK Ghosh for their hard work for this to happen. It was also suggested that regular updating of the bulletin on NDL portal should be continued.

- **GIREP-EPEC-2025 Conference:** Prof. P. K. Ahluwalia, President IAPT and Prof. Rekha Ghorpade, GS attended the conference in an online mode which took place at Leiden, The Netherlands from June 30 to July 04, 2025. An agreement between IAPT and GIREP [an International Research Group] was signed on July 1, 2025 in an online mode.
- **ICPE-2025:** The conference will be organized at IIT Roper with IAPT & IISER Mohali as the cohosts, in December (16-20), 2025.
- **Prof. R. M. Dharkar Memorial Workshop on 'Designing and Analyzing Cognitively Aligned Question Items for Quality Driven Assessment in Physics'** was successfully organized from June 23 to July 07, 2025, every day from 5:00 pm to 7:00 pm in an online mode.
Concept Design & Chief Patron: Prof. P. K. Ahluwalia.
Coordinator: Prof. Meenakshi Sayal, VP-North Zone.
Convenor: Prof. Neetu Verma, EC member, RC02.
- **Proposals:**
 1. **IAPT IT Cell:** Members were informed that a dedicated IT cell has been constituted and Prof. S. W. Anwane will be the coordinator of this cell. Later Prof. Anwane presented a vision of IAPT IT cell. To effectively update the official website of IAPT, it was decided to provide a research assistant on a monthly honorarium basis.
 2. **A proposal to have an IAPT Bhavan at Kanpur:** Prof. Ghorpade informed the members that since IAPT activities are increasing, we need to have our own multistorey dedicated premises in Kanpur.
 3. **A proposal to have an MOU with Vidya Vardhaka Sangh for a JSO facility in Bengaluru.**

All the three proposals were approved by the EC members.

3. Reports presentation by RC- office bearers/representatives:

1. **RC 01 Delhi Haryana:** Prof. Munish Kashyap, JNU Delhi and EC member RC01 presented the report as given below:

As part of Anveshika Bharat Yatra lamp was carried with a curated program in different colleges schools and Universities in the region resulting in great enthusiasm about Anveshika activities. Stage shows and creative presentations through dance and music were presented. It helped spread the message about IAPT activities. Prof. Ved Ratna Memorial Lecture, an Annual event of RC 01 was held in collaboration with SCERT Haryana. Another programme was organised in Delhi Technological University in collaboration with Physics Department. Prof. Munish put before the members a proposal on behalf of RC01 to conduct 40th Annual Convention of IAPT in Delhi. After good discussion, proposal was accepted. It was decided to convey this approval to President RC 01, Prof. Hari Sahjwani.\

2. **RC 02 Punjab:** No report was presented. It was decided to convey to the President that such a report is most desirable and at least a representative should come to present the report of the activities.
3. **RC 03 Chandigarh:** Report was presented by Prof. Sheojee Singh. During February March 2025, Demonstrations were conducted by Prof. MS Marwaha and Prof. Sanjay Sharma for B.Ed. and M. Ed. Students as part of Anveshika Bharat Physics Yatra. Programs were conducted in different schools and colleges of Chandigarh. It was coordinated by Professor. Sheojee Singh. A very successful National Student Symposium was organized in Physics Department Panjab University Chandigarh with a number of expert lectures, poster presentations and oral presentations by the participants. A commendable program which revisits Chandigarh on alternate years.
4. **RC 04 Uttar Pradesh:** Report was presented by Prof. Sundar Singh. Following are the brief

details of activities: Science Olympiad workshop, Webinar lecture series was conducted by Sub RC 04 A Kanpur as part of IYQ 2025, a workshop on fun with physics was conducted, a workshop on IOT was conducted, Webinar lecture series targeted to UG students course was conducted, Anveshika Bharat Physics Yatra passed through Uttar Pradesh and under this National program many events were arranged in various schools and colleges. Regular activities under Samadhan Anveshika were held during the year from time to time.

5. **RC 05 Uttarakhand:** No report was presented. It was decided to convey to the President RC 05 that these reports need to be taken seriously and these provide opportunity to the RC to showcase its work in the region.
6. **RC 06 Rajasthan:** Report was presented by President Prof. K S Sharma. Following were the yearlong activities:

Rajasthan RC won first position IAPT RC Exemplary Award **Shreshtha**, an indicator of a good overall vision of the RC. As part of IYQ 2025 webinar series, RC conducted a 3-day successful program with leading quantum scientists giving the lectures. A STEM workshop was arranged to sensitize both teachers and students. A homage online meeting for paying tributes to Prof. S Lokanathan was conducted, highlighting his dedicated service to physics teaching and research. International Conference on Quantum Science and Gravitational waves for the 4th Successive year, it was initiated by Prof. Y.C. Sharma. Number of expert lectures both in offline and online modes were conducted. Separate sessions for oral and poster presentation were arranged in which students participated enthusiastically. A summer school for physics teachers and students was arranged in IIS School Jaipur. Innovation Hub is spreading its wings in the country by a dedicated effort to spread the legacy of Prof. Babulal Saraf. Prof. YK Vijay is the lead coordinator. Till date more than 80 hubs have come up in various parts of the country. A special postage cover was released on the occasion of celebrations of IYQ 2025. It was an initiative of executive member of RC 06 Dr. Yogesh Bhatnagar. Rajasthan RC carried Anveshika Bharat Physics Yatra throughout Rajasthan by the volunteers of IAPT. It was a grand success. Prof. Ahluwalia commended the

efforts of RC 06 and congratulated all the members for having the distinction of winning first Prize for the year 2025.

7. **RC07 Gujarat, Daman, Diu:** Celebrations of International year of quantum mechanics was initiated from Gujarat RC with a curtain Raiser in which professor Ajoy Ghatak, Professor PK Ahluwalia, Professor KN Joshipura and Professor PC Deshmukh delivered 4 lectures over a period of 3 days in an online seminar. Year 2025 also saw the holding of first annual convention of Gujarat RC. Invited talks were given by professor Pruthul Desai, Professor Viresh Thakkar and Professor Jinendra Jain. Number of state level competitions in tune with the national competitions of IAPT were organised successfully and selected entries were sent to the respective national coordinators. These included poster presentations, National competition on innovative experiments in Physics. State level seminar on Quantum Science and Technology for teachers was organised. Quiz entitled Quantum curiosity was also held in which about 140 students participated. As an annual feature Regional Council also organized a lecture under the aegis of IAPT – PRL lecture series. There was a proposal for organizing national convention.
8. **RC 08 Maharashtra:** Report for Maharashtra Regional Council was presented by Prof. Mahesh Shetti, President RC 08. Maharashtra Regional Council is divided in 5 Sub Regional Councils. Following Activities were carried out by various SRCs

Mumbai SRC

Summer school in theoretical physics for UG level students for the duration of 10 days (60 hours) in the month of April 2025. It was conducted at Wilson College and 24 students from various colleges participated and successfully completed. They were assessed for their learning. Mumbai SRC also helped to conduct 1 week summer school in the month of June 2025. Regional essay competition was held for UG and school level. The theme was the same as NCEWP. The best entries were sent for national competition.

- HCP memorial lecture series was started in online mode. The themes will be related to

physics education.

- Workshop for school teachers on science exhibition was conducted.
- Error analysis workshop was conducted.

Kolhapur SRC

- Activities in the form of public lectures are planned to observe the year of Quantum Science.
- Lecture on Einstein was conducted.
- FB page was created to increase visibility on social media.

Marathwada SRC

- Outreach activities were conducted for National Science Day.
- Summer school for class XII is planned.
- State level convention will be hosted.
- Year of Quantum will be celebrated by various activities.
- Question Bank will be created for students.

Vidarbha SRC

Maximum number of activities were conducted by Vidarbha SRC. They were quite balanced 25 different activities addressing various levels. There were different workshops for and webinars for school students, college students and teachers. Various outreach programmes in the form of seminars, guest talks, star gazing programmes were conducted also, innovative National Photo Essay Competition was initiated and conducted at National level.

Pune SRC

They have planned to conduct training in online mode for the NGPE examination. They have also planned lecture series on Nobel Prize in Physics. Various Sub-RCs have helped to spread activities to different regions of Maharashtra state.

9. **RC 09 Madhya Pradesh:** Report of the RC was Presented by Prof. P. K. Dube. Following were the highlights of the activities:

Prof. VK Gupta, got prize in the National Essay Writing Competition in Physics. Workshop for teachers was conducted. UG students workshop was conducted. It was informed that Annual Babulal Saraf workshop will be conducted as planned. National Science Day was celebrated. Number of programs have been conducted at Vaishnav Vidyapeeth, Indore. Number of stage shows were conducted in Jabalpur Engineering College. Anveshikas are functional in

RC-09 and some programs under Anveshika Bharat Yatra have been conducted.

10. **RC 10 Chhattisgarh:** No representative came in the meeting to present the report. Prof. Ahluwalia requested members to contact Chhattisgarh EC to be in touch with us, so that it may be activated.

11. **RC 11 Andhra Pradesh:** No representative from RC 11 was present to share the report of activities. It was decided to inform the executive secretary to do the needful.

12. **RC 12 Karnataka and Lakshadweep:** Prof. Dyma presented a brief report as follows:

IYQ was celebrated across Karnataka in schools, colleges and Universities. A workshop was organised to improve STEM results of class 10 at Kalyan Karnataka. Workshops were organised to improve the quality of Physics learning through experiments at Gadag, Kalaburagi and Raichur. It was suggested that this report in the meeting should cover in a consolidated manner the activities of Sub RCs also because they are a subset of the Regional Council.

13. **RC 13 Tamil Nadu and Puducherry:** Prof. T S Natrajan presented the report as follows:

Teacher training and student training workshops were organized during the year using low-cost equipment developed by Prof. Arvind Gupta and Prof. TS Natrajan. A series of online talks were conducted celebrating IYQ 2025. RC web page has been used on dynamic website from time to time.

14. **RC 14 Kerala:** Prof. Udaya Nandan presented the report of RC 14 and informed that RC is focusing on schools by conducting experimental workshops for both teachers and students.

15. **RC 15 West Bengal:** Report was not presented because EC representative could not come.

16. **RC 16 Orissa:** Members were informed that this RC despite the constitution of executive has become dormant. Repeated reminders but no response has been forthcoming. Prof. Ahluwalia urged the members in Orissa RC to come forward and bring this RC into active mode.

17. **RC 17. Assam, Arunachal Pradesh, Meghalaya:** Following was reported in the meeting:

In the last couple of years, activity has increased

a lot in North East, due to active role played by the members in RC 17. Following is the list of activities conducted:

Two innovation hubs have come up at 1. Southpoint school Guwahati and 2. Bodoland University. Teachers training hub was conducted from 22nd January to 23rd January. Children's Science Day and National Science Day were celebrated in many, schools and colleges. Talks were also arranged to celebrate IYQ 2025.

Prof. Ahluwalia congratulated Zonal President and President RC 15 and their teams to put up a good set of IAPT activities happening in the region.

18. **RC 18. Tripura and Manipur:** No report was presented. It was decided to request general secretary to look into the matter and also to activate the RC which is seemingly in dormancy.
19. **RC. 19. Bihar:** No report was presented because of the absence of EC representative. Prof. Ahluwalia informed that RC is not active and we are losing touch with the members in a very important region of the country. More sub-RCs must be created in Bihar to reach out to a large number students as well as teachers.
20. **RC 20. Jharkhand:** No representative was present in the meeting. This RC is not active, though its EC is in place. IAPT central has been trying to reach out. It was decided to request senior member of the region to talk to EC to activate the RC.
21. **RC 21. Goa:** Report was presented by Dr. Yashwant Gaonkar as given below:

Goa RC conducted its 26th Regional convention, which is a permanent feature of RC Annual Calendar of activities. A best practice of the RC. Goa RC also conducted a series of online talks and joined hand with NASNI (National Astronomy Network of IAPT) to host Astronomy talks. A special workshop was organised for school teachers and students with expert lectures by Prof. H C Verma. This year Goa is hosting 39th Annual IAPT convention with special feature of pre-convention workshops on virtual labs and quantum computing. Dr. Gaonkar welcomed EC members to Goa University campus and wished them a comfortable and fruitful stay. President Professor P K Ahluwalia commended the efforts of RC21

22. **RC 22 Telangana:** Report was presented by President of the RC Prof. H Madhusudan. Following were the highlights of the activities during the year:

Celebration of the Annual Science Day by conducting activities across the region based on this year's theme. Hosted 3-day IYQ 2025 webinar series on the theme around founders of quantum mechanics Heisenberg, Schrodinger and Dirac as part of the nationwide seminar by IAPT. Which was a grand success. A summer workshop on quantum computing for Engineering College teachers was arranged. It is proposed to host Anveshika Physics Bharat Yatra as part of NANI initiative. President Prof. Ahluwalia expressed appreciation for all the efforts and noted that RC Telangana is doing consistent effort to spread the vision and mission of IAPT.

23. **RC 23 Himachal Pradesh:** Annual Report was presented by Dr. Sapna Sharma. Following was reported:

A Mega Quantum Quiz was held to celebrate International Year of Quantum Science & Technology-2025 for 22 weeks. It covered the complete timeline of the development of quantum mechanics from 1900 to present Times. There was an overwhelming response for this quiz. After every quiz episode a booklet based on the questions of the quiz episode was also circulated among the participation. Participation was by registration and every candidate who participated in all the 22 quiz episodes was given a certificate of appreciation and participation. Also, as part of IYQ 2025 webinar series of 6 lectures was hosted by RC 23. Members were also informed that RC is working on a Quantum exhibition for display at Gujarat Science City Council and to be presented as a set of 27 posters in international conference on physics education 2025 at IIT Ropar. A pilot of this exhibition was held in St. Bead's College Shimla in which more than 300 college, school and university students participated. A lecture and a quiz were also conducted for the participants. A presentation was also made on usage of Virtual Laboratories on Quantum Mechanics. RC was very happy to participate in Anveshika Bharat physics Yatra in which almost all the districts of Himachal Pradesh were covered by the volunteers of IAPT. The experience gained to host such a show was also shared with NANI coordinators to help them host this Yatra successfully. Programmes

were led by Him Anveshika coordinator Sh. Dinesh Sharma and his team. Dr. Sapna Sharma said it was no doubt very hectic but very satisfying year full of activities. She thanked the support of central IAPT and the members of RC 23.

24. RC 24 Jammu & Kashmir and Ladakh: Since member of EC was not present, report could not be presented.

4. Updates:

i. On accounts and Budget (2024-25)

Prof. D C Gupta and Prof. Sanjay Sharma presented the accounts for the year 2024-25 and budget proposal for the year 2025-26. The audited account prepared by M/S Jaipuriya and Co. for the year 2024-25 and budget proposal for the year 2025-26 was circulated among the present members. Discussion was held and suggestions incorporated for further approval in the Annual General Body meeting. In a query raised by Prof. Mahesh Shetti that since the central office disburses funds to Maharashtra sub-RCs the breakup of the funds is such that no funds are left with the Regional Council Maharashtra RC 08. He proposed that 20 % of the total disbursement be made available to RC Maharashtra to conduct its activities. Proposal was approved unanimously. Prof. Sanjay also requested that demarcation of different Sub RCs be provided to central office to maintain record for ease of disbursement of funds. Prof. Sanjay Sharma also informed all the members, if they receive any donations, they should seek PAN and Aadhar card for the purpose of filing the income tax return. Another point which was made By Prof. D C Gupta, that if any TDS is deducted, it must be reflected in the submitted in accounts.

ii. IAPT Examinations: Report by Chief Coordinator Examination

Prof. Tyagi informed the members that process of NSE in Physics, Chemistry, Biology, Astronomy and Junior Science is going on and this year we may cross 2 lac students. Prof. Tyagi appealed to the members to send the names of observers from among the members of IAPT to act as observers to maintain the integrity, sanctity and fairness of the NSE conducted by IAPT. He also informed that a National School Science Exam will also be

conducted for school students not fulfilling the International Junior Science qualification criteria. It is proposed to conduct a special set of exams for toppers of this exam. All the members wished Prof Tyagi their best wishes for the smooth conduct of the NSE, which is the flagship program of IAPT leading to selection of Teams for International Science Olympiads.

National Graduate Physics Examination (NGPE) Prof. PK Dube, NGPE Coordinator presented the report.

He informed members, of the successful completion of NGPE experimental camp in Institute of Engineering and Technology in West Bengal under the care of Prof. Minhaz Hussein and thanked him for all the facilities provided for smooth conduct of the experimental part of the test.

Prof Dube expressed his concern on falling number of candidates sitting in NGPE and requested the EC members to improve the situation by taking responsibility of starting one center each and inspire students how this exam opens opportunity to students for direct admission in National Bose Institute Kolkata. On a query whether students appearing in the new 4th year undergraduate program under NEP will be made eligible, he informed not this year but think about it in future. Prof. Ahluwalia thanked Prof. Dube for his dedicated effort in pushing this program forward with lots of personal inputs

iii. Competitions:

a) National Competition on Essay Writing in Physics (NCEWP):

Prof. SK Joshi coordinator of the program presented the report. He informed that this year there has been a good response to essay writing competition in Physics both for students and teachers. The theme was 100 years of quantum mechanics. He shared the practice of receiving entries via Regional Councils through a regional competition. These received entries are subject to a review process further by a team of judges. After receiving reports based on a rubric provided to the judges, final entries are shortlisted and ranked. Before declaring the results, a plagiarism check and AI check is performed using Turnitin software. He also informed the members that winning essays and

incentive essays are being compiled in the form of a book of essays for the last 5 years and their PDFs are available on IAPT website. He thanked judges for sparing their valuable time for making this competition a success. He also proposed to give a book to the jury members as a token of appreciation for their hard work. Members congratulated Prof. Joshi for his hard work in running NCEWP. Prof. Joshi's proposal to give token of appreciation to the members was also approved.

b) National Competition in Innovative Experiments in Physics (NCIEP) 2025:

Prof. Geetha R.S. presented the report. She expressed her concern that large number of participants come forward with their entries on the last date as a halfhearted exercise. EC members who are representatives of regional councils are requested to encourage young faculty members to come forward and try their hand on bringing innovation to the learning of physics by doing experiments. She also informed in this competition School category was also included and there has been an encouraging response from them. In all 30 entries were received. 9 from teacher category 12 from undergraduate/ post graduate category and 9 from High schools. She also informed that a booklet has been compiled consisting of 2022 to 2024 awarded experiments. She also proposed that a time has come to adapt these experiments as part of regular lab experiments highlighting their innovation to explain physics phenomena.

President IAPT commended the efforts of Prof. Geetha to expand the scope of the competition and collecting the experiments under one cover for easy availability.

c) National Photo Essay Competition in Physics (NPECP) 2025:

Prof. Govinda Lakhotiya, Coordinator of the competition presented the report. Members were informed that this competition had garnered a great response in a short period of time, leading to intense competition. In the three categories of competitors there were a total of 234 entries were received. Theme of the competition was 100 Years of Quantum Mechanics. Shortlisted

photo essays were run before the declaration of results for the gathered audience. Audience applauded the way competition has been hosted and the way competition has caught the imagination of young minds. Prof. Ahluwalia, appreciated the efforts of Prof. Lakhotiya.

d) Indian National Young Physicists Tournament (NYPT): Members were informed that this event report has already been presented in the last EC meeting.

iv. Asian Physics Olympiad (APhO):

APHO Coordinator Prof. Vijay Kumar informed members about follow up actions of APhO cell to bring this competition to the notice of students. Various programmes were conducted in schools at Kolhapur, NOIDA, Bengaluru, Tamil Nadu and Kerala. Prof. Vijay Kumar also informed that APhO cell is preparing videos of past 2023-2024 NSEP papers to encourage students to develop problem solving skills. Efforts of Prof. Vijay Kumar were appreciated to bring awareness about APhO. APhO cell also observed from 1st Nov to 25th Nov, a NGPE fortnight.

v. JSO:

Prof. Achutha B. S. could not attend the meeting. Prof. Rekha Ghorpade briefed the members about the activities of the JSO Cell. Four Resource Generation Camps (RGC) were conducted for setting question papers of INJSO, OCSC. One exposure camp was organized and 28 teachers from across the country participated. Standardization of experiments was carried out with the help of local resource persons at VVS and parallelly at HBCSE. Orientation Cum Selection Camp (OCSC) was conducted during May (15-30), 2025 at Talent Development Centre, Challakere Campus of IISc. Through rigorous tests in theory and practical, six students were selected for the 22nd International Junior Science Olympiad at Russia during November 23 to December 02, 2026. The team will be accompanied by three teachers (one from each subject) and one observer. The Pre departure camp is planned for ten days prior to the departure. The entire JSO program is planned and executed by several teachers of Physics, Chemistry and Biology from across the country under the guidance of Prof. P. K. Ahluwalia President IAPT, Prof. Rekha Ghorpade General secretary IAPT, coordinatorship of Dr. B. S.

Achutha and Dr. Raghavendra as an academic coordinator, who is helped by Chemistry and Biology coordinators.

vi. NANI:

Report was presented by NANI National Coordinator Prof. HC Verma. Following were the highlights of the year till date:

One of the biggest outreach programs in the country was launched by NANI as Anveshika Physics Bharat Yatra on 26th May 2025 from Udhampur in Jammu Kashmir and was inaugurated by Lt. Governor of Jammu and Kashmir Sh. Manoj Sinha in the presence of NANI Coordinator Prof. HC Verma. It has covered a large number of states in the country through volunteers and coordinators of NANI. It is still continuing and will end in May 2026. More than 1 lakh students in schools and colleges were touched through one day program at a place at different legs of the tour. Main motive of the Yatra is to encourage a culture of learning by discovery and research that is anveshan.

A meeting of IAPT Anveshika coordinators was held in Dehradun Uttarakhand to brainstorm on various programs of physics outreach.

Another annual program National Anveshika Experimental Skill test (NAEST) is conducted annually over a period of 3 months. learning Physics Through Nature (LEPTON) is a very important component of this initiative in which focus is on hands on conducting of experiments. Another very significant component of this test is giving students video quiz in which a typical skill activity is performed through a short video quiz of 30 seconds exploring physics in nature and explaining it. In 2025 more than 32,000 participated in this an online format and participants are asked to perform experiments at home which has a supervised learning component helped by volunteers. Participants performance is evaluated by a team of evaluators who also perform these experiments before starting the evaluation process. There are a number of rounds before winners are around. Another unique feature of this program is that students from schools, colleges and Universities can participate in it. This this program is an effort to bridge the gap of non- performing experiments in schools and colleges. Semi-final and final of this program are conducted at Sopan Ashram, Kanpur.

The participants in NAEST come from villages, small towns and cities, creating a lab atmosphere in homes. Every year new experiments are being added, creating a huge resource for sharing with teachers across India.

vii. IAPT-IT Cell:

Proposal by Dr. S. W. Anwane, Coordinator IT Cell shared his plan for strengthening IT initiatives of IAPT and improving further the Official Website of IAPT. He proposed to have a team of social media champions from among the students and teachers for effective usage of various social media platforms such as YouTube, Facebook, Instagram, X and LinkedIn. This team will act as volunteers to manage and enhance digital presence of the Indian Association of Physics Teachers. For managing the tasks, a dedicated IT Associate will be appointed for this purpose with a monthly honorarium. We can also bring in trainee students to assist IT cell as trainees/ interns for science reach out through social media.

Prof. Anwane also proposed to launch to create MOOCS aligned with the latest draft syllabi both at School and college levels through the vast resource of experts available as life members and mentors within IAPT itself particularly for enhancing computational, problem-solving skills and designing of Physics Experiments and simulations. Prof. Ahluwalia welcomed Prof. Anwane and thanked him for volunteering for this responsibility which can be a game changer in the outreach by digital means.

viii. Physics Education Journal:

Members were informed that Physics Education Journal has been revived thanks to a five-year grant sanctioned by DAE under BRNS scheme. An effort is on to clear the backlog. With lot of effort put in by Prof. OSKS Sastri, the Chief Editor. Dr. Jyoti Bhardwaj has been appointed as Secretary cum Executive editor.

Prof. PC Deshmukh underlined the importance of having this very important Journal of Physics Teachers and Physics Education Researchers a worldwide recognition. He further added that journal needs to have DOI label for each past and present papers for listing it in Web of Science/ Scopus.

Members were informed that in the meetings of the editorial board, steps in this direction have been made to go ahead with the process of having subscription for DOI label. It was hoped that things will move on a

fast pace in the coming months. Remarks by Zonal and Central vice presidents.

ix. Announcement of 40th Annual Convention of IAPT

Three proposals were discussed as venue for the Convention one each from Gujarat RC-07, Madhya Pradesh RC-09 and Delhi and Haryana RC-01. There is indeed a queue for hosting Convention which is a good sign for this most awaited annual event in person. After deliberations it was decided to have this convention in RC 01 i.e. Delhi Haryana. Representative from RC-01 Prof. Manish Kashyap thanked the members for giving RC 01 an opportunity.

x. Any other matter with the permission of the Chair:

Prof. Vandana Luthra, Coordinator of RC Exemplar Award underlined the need for revisiting the Award Application form which should focus on: appropriate documentation uploading, impact surveys for the conducted activities, include teacher training programs organized, and a list of best practices and their impact to choose best RC out of all the RCs of IAPT. It was also suggested that Awarded RCs of the year should be invited in the convention to share their best practices.

xi. Concluding remarks by the IAPT National President:

Prof. Ahluwalia thanked the members for their very useful feedback and giving new ideas for implementation in the ground.

He informed the members that an effort is being made to create an IAPT Bhawan at Kanpur providing necessary physical infrastructure and creating space for various activities. As suggested, that a minimum of 1000 sq m plot should be purchased to develop a multi-story building with scope for hosting activities, lab areas, a good auditorium and display spaces etc. He informed that Prof. Sanjay Sharma, Secretary and Prof. DC Gupta, Treasurer have been entrusted with the task for searching such a space at the earliest. Prof. Ahluwalia said that such a long-term investment is the need of the hour and we need to work hard for raising resources to let this happen. He sought help of each and every member for helping IAPT in fulfilling this necessity.

He informed the members that International Conference on Physics Education 2025 is hardly 2 months away which is being cohosted by IIT Ropar, IAPT and IISER Mohali. IAPT as an initiator of this proposal has the duty to see to it that it is success. He expressed confidence that it will be a grand success. He informed the members that a good number of IAPT members have registered for the conference and very good number of IAPT members have been invited for invited talks. A very good set of plenary speakers, invited talks and hands on sessions have been planned for the event. He expressed gratitude to Prof. Rajeev Ahuja, Director IIT Ropar to wholeheartedly support this event in the state of the art campus of IIT Ropar. It is hoped that it will increase collaborations, networking and promote international exposure to the participants. He hoped to see a large delegation of IAPT members in Ropar.

Prof. Ahluwalia thanked members for wholeheartedly supporting the celebration of IYQ 2025. Almost all the RCs came forward to host IYQ events under the banner of IAPT, which still continuing. In this context, Prof. Joshipura wrote an interesting book: A peep into quantum wonderland and allowed IAPT to be part of its publication effort. This book is being given as part of your registration kit. I sincerely thank Prof. Joshipura for this contribution to bring awareness in young minds about quantum science and technologies. Gujarat RC has been bearing the flag of IAPT publications through their quality annual magazine Pragami Tarang. For which they have created an endowment in the IAPT funds.

I must say it that editorial team of bulletin, team of National Standard Examinations, APhO and IJSO, coordinators of various programs have done a great job in making IAPT a foremost subject specific association in the country.

Prof. Rekha Ghorpade, our General Secretary has contributed immensely to IAPT's task with a caring touch. Thank you mam.

xii. Vote of thanks:

Prof. Rekha Ghorpade, General secretary offered a vote of thanks to the chair and the honorable members of Executive Council who have attended the meeting.

Rekha Ghorpade
General Secretary

National Science Day Celebrations February - 2026

Experimental Demonstrations and Activities

It is well known to all of us that we celebrate **National Science Day** on February, 28 every year. On this occasion, I organized National Science Day celebrations throughout the entire month of February across Andhra Pradesh, particularly in the districts of Visakhapatnam, Vizianagaram, and Vijayawada.

The primary objective of these programs was to foster interest and curiosity among students towards science and technology. At the same time, teachers were encouraged to effectively use Teaching-Learning Materials (TLM) while delivering classroom instruction. Workshops were conducted using low-cost, no-cost, and easily available materials to promote activity-based learning.

During this month, I visited 25 schools/institutions over a span of 28 days.

These month-long National Science Day celebrations were jointly organized by **FOCUS IAPT Anveshika, Andhra Pradesh**, members of IAPT, members of Andhra Pradesh Physical Science Teachers Forum (APPSTF), and the Department of Physics, GITAM University.

The program was successfully carried out with the active involvement of resource persons including Dr. Joga Chandrasekhar Rao, RC-11 IAPT Secretary and State Coordinator of FOCUS Anveshika; IAPT life members Sri Botsa Venkata Rao, Sri Panduru Venugopala Rao, Sri Girada Lakshmana Rao, Sri Varanasi Srinivasa Rao; Dr. Baggam Spandana and Dr. V. V. K. Lakshmi.

A total of 993 boys, 1,320 girls, and 619 teachers from 25 educational institutions participated in these programs.

The experiments demonstrated in each institution are detailed below:

At the beginning of the program, during the traditional lighting of the lamp, a sound similar to the blowing of a conch was produced using a 20 cm long PVC pipe. The sound was generated by blowing air through the pipe. The students were surprised to see this simple

demonstration, and many of them enthusiastically tried blowing through the PVC pipe themselves and successfully produced the sound, which created great excitement and joy among them.

During the experimental demonstrations, the first activity involved filling a transparent glass completely with water and placing a cardboard over it. When the glass was inverted, the water did not fall. After explaining the reason behind this experiment as given in the textbook, the experiment was repeated with the glass half filled with water and with only a small amount of water. Students were asked whether the cardboard would fall or the water would spill. The demonstration showed that in all these conditions the cardboard remained in place due to atmospheric pressure (Upthrust and surface tension). Through this activity, students were encouraged not only to read the textbook but also to think beyond the textbook..

Two straws of equal length were arranged in a T-shape and shown to the students. When asked which straw was longer, most students said that the vertical straw appeared longer. However, both straws were actually of the same length. This demonstration illustrated how visual perception can sometimes mislead us.

A transparent glass partially filled with water was used to demonstrate refraction by placing a straight pencil inside it. Students observed that the pencil appeared bent, thicker in water, thinner in air, and even appeared broken near the boundary of the glass. In reality, the pencil remained straight, demonstrating how light refraction creates optical illusions.

An A4 paper sheet was rolled into a tube and held near one eye while the other hand was placed beside the tube. When both eyes were opened and the hand was moved slightly, it appeared as if there was a hole in the hand. This illusion is known as the “Hole in the Hand” experiment. Through such experiments, students were explained that what we see is not always the truth, and one should carefully observe and analyse before drawing conclusions.

Using springs and straws, the concept of waves was

explained. Students learned what waves are and how wave motion occurs without the actual movement of matter. Mechanical and non-mechanical waves were explained along with longitudinal waves (compressions and rarefactions), transverse waves (crests and troughs), and stationary waves (nodes and antinodes). Important wave characteristics such as amplitude, wavelength, frequency, the relationship between wavelength and frequency, and the dependence of wave speed on tension and mass per unit length were also explained. The DNA structure was also demonstrated using straws.

Students were guided to prepare a paper helicopter using a paper strip of 1 cm width and 15 cm length and the working principle was explained. The Galileo book experiment was demonstrated using a sheet of paper and a book. A reaction time experiment was shown using a scale. Using a weighing machine, the concept of 1 Newton force was demonstrated. A setup using a weighing machine, PVC pipe, and three ring magnets was used to demonstrate Newton's Third Law of Motion.

Using a slinky, the concept of weightlessness was demonstrated. The centre of mass was explained using an arrangement of 11 nails and a stand, while an eagle toy was used to explain centre of gravity. The law of conservation of angular momentum was demonstrated using a used pen, thread, small weight, and heavy weight. It was also shown how a small weight can lift a heavier weight using this principle.

Boyle's Law was explained using a small balloon and syringe. The jumping coin experiment was used to explain the working principle of a pressure cooker. Atmospheric pressure was demonstrated using a long transparent tube filled with coloured water. The variation of pressure with height was explained using a bottle with three holes.

A plank placed on balloons demonstrated how a student standing on it did not burst the balloons due to distributed pressure, whereas a balloon burst when pierced with a single nail. When pressed against a cardboard containing many nails, the balloon did not burst, clearly explaining the concept of pressure and area.

Bernoulli's theorem was explained using long balloons. The equation $P = h\rho g$ was demonstrated using two bottles of equal volume with straws of different lengths.

Sound and resonance were demonstrated using a small straw, long straw, bird toy, and a transparent U-tube filled with water, explaining the concept of pitch and resonance. A paper cone and PVC pipe were used to demonstrate the concept of range.

In electricity related demonstrations, experiments were shown on electric charges, Oersted's experiment, Right Hand Thumb Rule, solenoid and its magnetic field, pole determination of a circular coil, working model of an electric motor, magnetic field due to current through a circular loop, electromagnetic induction, and electric generator.

In optics-related demonstrations, a parallel rays producer device was used to explain rectilinear propagation of light, reflection, laws of reflection, and the principle that when a mirror rotates by an angle θ , the reflected ray rotates by an angle 2θ . Further concepts such as refraction, laws of refraction, total internal reflection, lenses and mirrors with their focal lengths, relation between focal length and radius of curvature, spherical aberration, and common eye defects such as myopia and hypermetropia were also explained through demonstrations.



Joga Chandrasekhar Rao



Orientation Camp for Science Excellence OCSE-2026 - PHYSICS & BIOLOGY

The Origin - SEHSS

Professor BP Tyagi, Chief Coordinator of Exams at IAPT made this exam Standard Examination for High School Science (SEHSS) for students in class 10 who are generally not eligible to write Junior Science Olympiad and not prepared well for senior Olympiads and for them there was no official Olympiad exam which they can dedicatedly prepare. So to give them opportunity to prepare and experience this exam SEHSS was coined by Prof BP Tyagi and conducted on 30th November, 2025 in which more than ten thousand students participated across the country. The purpose of this exam was to induce Olympiad level thinking among students studying in grade 10.

The SEHSS exam question paper comprised the content and syllabus of grade X in Science & Mathematics. Participants across country were divided in five zones – East, West, South, North and Central India. Based on performance in exam, top 35 students were selected for a 10 days residential camp. (OCSE) is to enhance the mental aptitude of these students and provide them training in applications of theory and experimental understanding in the subject of their interest.

OCSE 2026 (THE CAMP) – PHYSICS & BIOLOGY

The purpose of this residential camp was to give Olympiad level theory and experimental exposure and training to enhance overall subject level understanding and application based learning to the selected students.

Based on subjects selected by students out of Physics, Chemistry, Biology and Maths OCSE 2026 camps were organised by IAPT at different locations. For Physics and Biology the camp was organised from 6th to 15th April at IIS University, Jaipur. In these 10 days students were given exposure of fundamental as well as advanced Physics theory and practicals by multiple theory and practical lab sessions.

Theory Sessions at OCSE

Everyday morning from 9am to 1pm slots for theory

sessions were kept. 17 Theory Sessions were conducted during the camp in each subject (Physics & Biology) by eminent resource persons called to enhance the mental aptitude in respective subjects by theory and demonstrations.

Practical lab Sessions at OCSE

Every day from 2pm to 6pm multiple slots were kept for lab sessions. In Physics & Biology multiple experimental setups were divided into several clusters. Each cluster was planned to learn and experience concepts of Physics & Biology in-depth with eminent mentors who facilitated students in detailed understanding of each.

Happy Hour Everyday

Everyday evening at 6pm after completion of lab sessions students were given exposure to innovative and out of the box demonstrations and concerned theory. Daily students were asked to write innovative practical procedures using the lab apparatus they had used in lab sessions on same day or previous days. Based on selected writeups students were awarded with chocolates. Purpose of keeping Happy Hour is to end each day of the camp with Interactive Physics to create strong memories of time spent together with peers and their mentors.

THE EXCURSION - Vatsalya Science Centre

On 10-April all students at camp were taken to a Science Centre – Vatsalya at Achrol in outskirts of Jaipur to get additional exposure of practical demonstrations of science and astronomy through field visits which gave additional dimensions to students for working and enjoying learning as a team in field.

Assessments & Grading at OCSE

During all the 10 days of the camp, continuous evaluation was done for all the participants based on their continuous learning through theory lectures, practical sessions and five assessments conducted separately to judge their skills in theory and

experiments. For each of lab sessions, experimental skill assessments and theory assessments during all 10 days 100% attendance was observed by all participants.

Conclusion & the Way Forward

The camp provided strong foundation for future scientific pursuits. Further objectives include the nurturing and preparing the students for International Physics Olympiad in coming year and expecting them to be the future scientists of India who will contribute in development 'Atam Nirbhar' India. On 15th April, valedictory ceremony was held in which all zonal toppers were awarded with gold medals and certificates of participation. Top three performers were awarded with cash award of Rs 20,000/-, Rs. 15,000/-

and Rs. 10,000/- and a medal. Certificates of appreciation were also awarded to students who performed well in theory and experiments.

OCSE Physics Winners

1st Position : Arjun Jugal Kishor Chitlange

2nd Position : Atharv Singhal

3rd Position : Mihir Kumar

Topper in Experiments: Shubhanshu Jaiswal

Topper In Theory : Arjun Jugal Kishor Chitlange

OCSE Biology Winners

1st Position : Arpit Aggarwal

2nd Position : Indrashis Dutta

Topper In Experiments: Arpit Aggarwal

Topper In Theory : Indrashis Dutta



Y K Vijay

National Level Online Science Quiz QuantiPhy 2026

On the occasion of National Science Day, the Indian Institute of Information Technology Vadodara (IIITV), in collaboration with RC-07 (Gujarat, Daman & Diu), organized a national-level online science quiz competition, “*QuantiPhy 2026*”, based on the theme “*Quantifying Science in Daily Life.*” The event was conducted on 2nd-3rd March 2026 for undergraduate (UG) and postgraduate (PG) students.

The event was inaugurated at 5:30 PM by Prof. Dharmendra Singh, Director, IIIT Vadodara; Prof. P. K. Ahluwalia, President, IAPT; Prof. P. C. Vinodkumar, President, IAPT RC-07; Dr. Dharendra Sinha, Head, Department of Applied Physics, IIIT Vadodara; and Dr. Preeti from DPS Varanasi.

Prof. Dharmendra Singh emphasized the importance of learning Physics as a fundamental discipline for understanding and effectively applying concepts across various fields of Science and Engineering. Prof. P. K. Ahluwalia highlighted the role of keen observation in scientific thinking and underscored the contribution of *QuantiPhy* in nurturing analytical and problem-solving skills among Physics students. Prof. P. C. Vinod Kumar briefly outlined the initiatives of IAPT RC-07 across India and underscored the importance of Physics education.

A total of 970 students from premier institutions across India registered for the competition, including participants from IITs, IISERs, NISER, JNU, NITs, Central Universities, and other reputed institutions. Of these, 230 students actively participated in the quiz.

The competition was conducted in two rounds. The first round consisted of a multiple-choice question (MCQ)-based quiz, from which 50 students qualified for the next stage. The second round involved an essay-writing component, where participants articulated their ideas based on scientific images. Across both rounds, participants displayed remarkable enthusiasm, creativity, and curiosity. In the final round, ten students (five from UG and five from PG) were recognized as *Outstanding Performers*, while four students (two from UG and two from PG) were

awarded prizes.

Aditya Sagar Shukla (PG, Jawaharlal Nehru University, Delhi) secured the First Prize. The Joint Second Prize was awarded to Varshini S. N. (UG, M. S. Ramaiah University of Applied Sciences) and Hrishikesh Pathak (UG, IIIT Vadodara). Diksha Maurya (PG, IIT Ropar) secured the Third Prize.

The Outstanding Performers in the UG category were Varshini S. N. (M. S. Ramaiah University of Applied Sciences), Hrishikesh Pathak (IIIT Vadodara), Agrima Singh (IIT Delhi), Nitigya Nimesh (St. Xavier's College, Ranchi), and Akshay Bhatia (St. Stephen's College, Delhi). In the PG category, the Outstanding Performers were Aditya Sagar Shukla (Jawaharlal Nehru University, Delhi), Diksha Maurya (IIT Ropar), Aditya Raman (Jawaharlal Nehru University, Delhi), Aakash (University of Delhi), and Parvesh Garg (IISER Mohali).

In the essay writing round, Aditya Sagar Shukla demonstrated strong analytical insight by addressing atomic clock precision, per-capita oxygen needs in the context of deforestation, and medical applications of quantum harmonic oscillators. Varshini S. N. examined light–matter interactions, including Rayleigh scattering, human vision, and the photoelectric and Compton effects in medical physics. Hrishikesh Pathak explained the photovoltaic effect in solar panels and the use of the photoelectric effect in QR code scanning. Diksha Maurya discussed monolayer graphene formation, touchscreen technology, and the relationship between LED colors and band gap values.

Other Outstanding Performers also demonstrated commendable analytical skills, creativity, and the ability to relate scientific concepts to real-world applications.

All aspects of the quiz, including question design, theme development, organization, anchoring, evaluation, and result compilation, were carefully carried out by Dr. Payal Wadhwa (Department of Applied Physics, IIIT Vadodara).

The quiz was conducted in a proctored environment and evaluated with the dedicated efforts of student volunteers: Palin Jena (B.Tech, First Year, IIIT Vadodara), Yagnik Tank, and Kushal Shah (both M.Tech, First Year, IIIT Vadodara). Technical support for the smooth conduct of the event was provided by

Mr. Suneet Kumar (Junior System Administrator, IIIT Vadodara).

The successful organization of *QuantiPhy 2026* reflects a collective commitment to fostering scientific curiosity, critical thinking, and a deeper appreciation of Physics in everyday life.



Payal Wadhwa

Report (Ammani Anveshika)

Science Workshop

Seva Bharati State Syllabus School

Location: Chamarajanagara **Date:** March 31, 2026 **Time:** 10:30 AM – 1:00 PM

Resource Person: M K Uma **Class:** X **Number of students:** 105

Subject: Practical Applications of Physics in Daily Life.

Students were organized into groups to encourage collaboration and peer-to-peer learning. The session was a Hands-on Physics & Structural Concepts

The workshop was designed to familiarize students with key scientific pillars: Stability of Structures, Electrostatics, Capillary Action, Hygroscopy, Thermal Expansion and Mechanical Force.

The two-and-a-half-hour session was divided into two distinct, interactive segments:

Phase I: Active Experimentation (90 Minutes)

Students were organized into collaborative groups and

provided with a kit of common materials, including balloons, bottle caps, clay, colour papers, straws, marbles, and toothpicks etc. and were tasked with performing specific activities

Students first observed the physical outcomes of their experiments. Following the activities, formal scientific explanations were provided to connect their observations to the relevant laws of physics.

- **The Approach:** A "discovery-first" model was used where students performed activities before the formal scientific explanation was provided.

- **Outcome:** This encouraged students to observe phenomena firsthand, fostering a deeper curiosity about the "how" and "why" behind the results.

Phase II: Visual Analysis & Guided Inquiry (90 Minutes)

The second half shifted toward contextualizing physics in the real world through observation and critical thinking.

- **Multimedia Integration:** One-minute video clips depicting various daily life situations were screened.
- **Guided Discussion:** A guided Q&A session followed each clip. Students were prompted to identify the hidden physics within the footage, moving from "what" happened to "why" it happened.
- **Student Centricity:** The defining feature of this workshop was the high level of student involvement. Participants were not merely observers but were responsible for setting up and executing the experiments themselves. The transition from hands-on play to theoretical explanation ensured that the concepts were accessible and memorable.
- **Resourcefulness:** The use of low-cost, everyday materials demonstrated that scientific inquiry does not require expensive laboratory equipment.

Conclusion

The session empowered students to view their daily environment through a scientific lens. The enthusiasm shown by the students in the experimental setup suggests a strong foundation for future practical learning initiatives.



Seva Bharati State Syllabus School

Workshop in Seva Bharati CBSE School:The session opened with an energetic warm-up activity designed to engage the students immediately. To demystify the fundamental properties of matter, the facilitator utilized a "hilarious story" and interactive **role play**. By personifying concepts like **Density** and **Volume**, students were able to visualize the relationship between an object's mass and the space it occupies in a memorable, light-hearted context.

To bring the **Equations of Motion** to life, the workshop tapped into a real-world sporting icon: **MS Dhoni**.

- **The Case Study:** Using Dhoni's legendary stumping speed as a benchmark for unmatched reaction time.
- **The Activity:** Students participated in a "Reaction Time" experiment, calculating their own response speeds.

The principles of **Pressure**, **Pascal's Law**, and **Thermal Expansion** were demonstrated through a series of high-impact, interactive experiments.

- **Pressure & Pascal's Law:** Students observed how force applied to a confined fluid is transmitted undiminished in all directions.
- **Heat & Expansion:** Visual demonstrations showcased how molecular motion increases with temperature, leading to the physical expansion of materials.

One of the most impactful moments of the workshop occurred during the Optics segment. Students were visibly captivated as they observed the physical manipulation of light rays. The demonstrations included:



Seva Bharati CBSE School

Rectilinear Propagation, Refraction, Total Internal Reflection:

The hallmark of the session was the palpable sense of wonder and curiosity. By shifting the focus from passive listening to active "doing," students remained

enthusiastic throughout. The transition from witnessing a phenomenon to understanding the underlying physics created a powerful learning loop, leaving the participants with a newfound appreciation for the science governing their daily lives.

U M A M K

Report (RC-02)

Eureka 2.0 – World Physics Day Celebrations

On 5th May, under the inspiring leadership of Principal, Mrs. J.K. Sidhu, Vice President, RC-02, DAV Public School, BRS Nagar, Ludhiana celebrated, Eureka 2.0 – World Physics Day with great enthusiasm and scientific spirit. The event featured a series of inter-school competitions and expert sessions, bringing together more than 150 students from various schools of Ludhiana and Amritsar.

Dr. Jaswinder Singh, Dr. Sushil Kumar, President and Secretary, RC-02 graced the occasion.

Key Highlights and Competitions Physics Olympiad

A written test conducted on April 19, 2026, witnessed participation from 66 students. The competition tested students' analytical thinking and problem-solving abilities in Physics.

Physics Preneur

This science and technology business pitch competition featured 15 teams presenting innovative prototypes based on seven different themes, showcasing creativity and entrepreneurial thinking.

Quiz Competition

Eighteen teams comprising 36 participants from various schools competed in an engaging Physics quiz that assessed conceptual understanding and scientific awareness.

Physics in Motion (Online Video Competition)

Students demonstrated laws and applications of Physics through creative short videos.

- Junior Category: 14 teams
- Senior Category: 14 teams

Each team consisted of three members.

The programme also featured a keynote address by Dr. Gagandeep Singh Sodhi, Training and Placement Officer, Guru Nanak Dev Engineering College, Ludhiana, on the topic “**Teaching Machines to See**”, which inspired students to explore the fascinating intersection of Physics and Artificial Intelligence.

The judging panel comprising Dr. Randhir Singh, Dr. Sachin Bagga, and Dr. Mahesh Kumar Sharma ensured transparency and fairness in all competitions.

The event concluded on a highly inspiring and successful note, fostering scientific temperament, innovation, and collaboration among students. Eureka



2.0 – World Physics Day Celebrations not only deepened students' appreciation for Physics but also encouraged them to think creatively and apply scientific concepts to real-world challenges. The organizers expressed confidence that the experience

and learning gained through the event would leave a lasting impact on the participants and pave the way for continued collaboration with young innovators and educational institutions in the future.

Ashish Kapoor

Report (RC-02)

Annual Convention-cum-Workshop “Quantum to AI: Scientific Roadmap to Viksit Bharat @2047”

Organized by: Hans Raj Mahila Maha Vidyalaya, Jalandhar

Under the aegis of: IAPT- RC-02

Convener: Dr. Sushil Kumar (Hans Raj Mahila Maha Vidyalaya)

Inaugural Session

The programme commenced with the inauguration of the *Quantum Mechanics Centenary Exhibition* held in the Science Lawn in the esteemed presence of Dr. P. K. Ahluwalia (President, IAPT), Dr. Ekta Khosla (Principal, HMV), Justice N.K Sud (Chairman LAC, HMV), Dr. Sanjay Sharma (Secretary, IAPT), Dr. Meenakshi Sayal (Vice President, IAPT North), Dr. Jaswinder Singh (President, IAPT RC-02), Dr. Jaswinder Kaur (Vice President, IAPT RC-02), Dr. Major Singh (Former President, IAPT RC-02), Dr. Sushil Kumar (Secretary, IAPT RC-02) and Mr. Aashish Kapoor (Treasurer, IAPT RC-02). The exhibition featured 27 flex posters illustrating the evolution and milestones of quantum mechanics over the past century, offering an insightful overview of its scientific journey.

The inaugural session began with a welcome address by the Principal, Khosla, who warmly welcomed the distinguished guests, delegates, faculty members and students. She highlighted the significance of such academic platforms in promoting intellectual growth, collaboration and innovation and appreciated the efforts of IAPT in strengthening physics education and scientific temperament. She also encouraged young learners and researchers to remain curious, think critically and actively engage in scientific exploration for the nation's development.

Addressing the gathering, Prof. Ahluwalia outlined the vision, mission and key initiatives of IAPT to enhance physics education and research. He emphasized the evolving nature of science and the need for interdisciplinary approaches, particularly the

integration of physics with fields like artificial intelligence and data science. Dr. Jaswinder Singh presented the concept note of the convention, focusing on its theme and objectives and highlighted the role of AI, quantum technologies and advanced research in shaping India's future, while emphasizing the importance of bridging theory with practical applications. In his keynote lecture, Dr. Sumit Bhardwaj discussed the growing importance of data analytics, artificial intelligence and advanced computational tools in modern research. He explained how these technologies are transforming research methodologies by enabling faster processing, greater accuracy and deeper insights. He also stressed the importance of digital awareness and responsible, ethical use of technology, particularly regarding data security and online safety. The session effectively set the academic tone for the convention, paving the way for a series of invited lectures, poster presentations and technical sessions. Subsequently, Prof. Lokesh Kumar shared valuable insights into recent advancements and emerging trends in physics. He encouraged participants to cultivate analytical thinking, scientific curiosity and a research-oriented mindset, emphasizing the importance of continuous learning and innovation in the ever-evolving field of science.

Technical Sessions and Participation

The convention witnessed enthusiastic participation from over 150 academicians, researchers, and students representing various institutions, reflecting its wide academic reach and relevance. The technical sessions provided an effective platform for participants to

present their research findings, exchange ideas and engage in meaningful scholarly discussions. These sessions fostered an environment of intellectual interaction, encouraging collaboration and critical evaluation of emerging research trends. Special highlights of the first day included an engaging robotic demonstration featuring “Chichi Dog,” which captivated the audience and showcased the practical applications of technology and innovation. Another notable feature was the release of the LUCI poster, which added a distinctive academic dimension to the event and generated keen interest among the participants.

Second Day Highlights

The second day of the convention, coordinated by Dr. Jaswinder Singh, focused on intensive experimental and demonstration-based learning to strengthen conceptual understanding through hands-on experience. The sessions were conducted by distinguished resource persons, including Prof. Y. K. Vijay (FRSC, Director, CIST, IIS Jaipur) and Prof. Hemant Kumar (Former Director, SCERT, Himachal Pradesh). They presented innovative experiments demonstrating fundamental physics concepts through live illustrations of phenomena such as light diffraction, atomic pressure and material structures. Their engaging approach simplified complex ideas and fostered scientific curiosity and deeper understanding among participants. Dr. B. S. Sidhu presented simulations that clearly and visually explained complex physical concepts, offering a modern, technology integrated approach to learning physics.

Further enriching the programme, Dr. Jaswinder Singh, through his initiative “**Jaswin Lab on Wheels**” delivered highly interactive and captivating experimental demonstrations. His session particularly

stood out for its ability to connect theoretical principles with real life applications, making physics both accessible and engaging for the audience. Overall, the second day sessions emphasized experiential learning, successfully bridging the gap between theory and practice while inspiring participants to adopt innovative and activity-based approaches in the teaching and learning of physics.

Valedictory Session and Awards

The valedictory session was chaired by Dr. Khosla . The session marked the formal and successful conclusion of the two-day convention, bringing together all participants for a reflective and celebratory closing. While concluding the session, Dr. Meenakshi Syal expressed her heartfelt gratitude to the host institution for organizing a well-structured and intellectually enriching convention. She appreciated the meticulous planning and dedicated efforts of the organizing committee in ensuring the smooth and successful conduct of the programme. The session concluded with the distribution of certificates to all participants, recognizing their active involvement and contribution to the convention.

Awards for Best Poster Presentations were conferred in various categories:

- UG: Dharampreet Kaur (BUC, Batala)
- PG: Rajdeep Kaur (HMV, Jalandhar)
- Research Scholar: Harpreet Kaur (HMV, Jalandhar)
- Faculty: Pawanbir Singh (BUC, Batala)

Best Oral Presentation awards were awarded to:

- UG: Palak (HMV, Jalandhar) and Prerna (Hindu College, University of Delhi)
- PG: Deeksha Kakkhar (HMV, Jalandhar)
- Research Scholar: Vivek Mahajan (IKG PTU)
- Faculty: Kritika (DMS, Model Town, Jalandhar)



Meenakshi Syal

When the Sky Became a Classroom

Report (NASNI)

Under a vast canopy of stars, more than 250 eager minds gathered not just to observe the night sky—but to *experience* it. This overnight sky-watching session transformed a regular night into a living laboratory, where curiosity met the cosmos and learning extended far beyond textbooks.

The event was a collaborative initiative between Professor Rajendra Singh Science Exploratory, Swami Narayan Gurukul International School, Nagpur, and NASNI. Students from multiple schools, along with parents and educators, came together in a rare celebration of science, culture, and shared wonder.

Structured Beginnings: Planning Meets Passion

The program was thoughtfully designed and executed under the guidance of Dr. Seema Ubale, Dr. Govind Lakhotiya, Mr. Rahul Ambati (Principal, Host School) and Dr. Hemant Kumar, Coordinator –NASNI.

Their vision ensured that the event balanced scientific rigor with accessibility, making astronomy approachable for all age groups.

Opening Moments: Aligning Spirit and Science

The evening began on a serene and reflective note, with participants attending the prayer session at Swami Narayan Gurukul. This moment of calmness set the tone for the night—reminding everyone that exploration of the universe is as much about inner curiosity as it is about outer discovery. Following this, participants shared dinner on campus, strengthening a sense of community before embarking on the night's scientific journey.

The Sky Unveiled: Telescopes and First Observations

As darkness deepened, five telescopes of varying specifications were carefully deployed. For many participants, this was their first close encounter with celestial observation instruments.

The excitement peaked as Jupiter came into view—accompanied by its four Galilean moons, appearing like tiny beads of light aligned beside the giant planet. The waning gibbous Moon revealed intricate details of its surface—craters, ridges, and vast lunar “seas”—sparking awe and countless questions.

In those moments, the Moon was no longer distant—it was tangible, textured, and real.

Inspiration Ignited: A Talk that Reached the Stars

A powerful and motivating session by Prof. Hemant Kumra titled “**You Too Can Be an Astronomer – From Backyard to ISRO**” became a cornerstone of the event. Through relatable examples and engaging storytelling, he conveyed a simple yet profound message:

“The journey to the stars does not begin in space agencies—it begins in your backyard.”

The talk was followed by vibrant group interactions, where students expressed their curiosity, aspirations, and newfound enthusiasm for astronomy.

Mapping the Night: Constellations and Cultural Astronomy

As the night unfolded, participants were guided through the celestial map above them. Constellations such as Gemini, Leo, Virgo, Libra, Scorpius, Sagittarius, and Capricorn were identified and explained.

The session beautifully integrated modern astronomy with traditional Indian knowledge systems, as participants traced Nakshatras from Punarvasu to Jyeshtha and Mula.

Learning to locate Polaris (the North Star) using Ursa Major, Ursa Minor, and Cassiopeia became a particularly engaging exercise—turning the sky into a navigational guide.

Additional constellations like Hydra, Draco, Cygnus, Ophiuchus, and Boötes further enriched the experience.

Deepening Understanding: Concepts Under the Stars

At around 2:30 AM, when silence and stillness enveloped the surroundings, participants gathered for a deeper conceptual session. Key astronomical ideas such as Meridian, Ecliptic, Celestial Equator, and Horizon were explained not through diagrams—but directly under the sky itself.

This was learning in its purest form—where theory met reality above their heads.

Moments of Wonder: Satellites and Silent Motion

As dawn approached, a surprising and thrilling spectacle unfolded—numerous satellites became visible, gliding silently across the sky in different directions.

For many, it was a revelation:

The sky is not still—it is alive with motion, technology, and human presence.

Excitement rippled through the group as participants tracked these moving points of light, realizing the dynamic nature of space around Earth.

A Gentle Farewell: Sunrise and Reflection

The night concluded with a calm and reflective sunrise. Emerging through a slightly hazy, grey horizon, the Sun marked the end of an extraordinary journey.

Breakfast was shared, conversations lingered, and a quiet sense of fulfillment settled in.

Hemant Kumar

New Chief Coordinator of Examination (CCE)

An online meeting of the Search Committee constituted for the appointment of the new Chief Coordinator of Examinations (CCE) was convened on **1st May 2026 at 6:00 PM.**

The following members were present:

1. Prof. P. K. Ahluwalia : Chairperson
2. Prof. Rekha Ghorpade : Convenor
3. Prof. B. P. Tyagi : Incumbent CCE
4. Prof. M. L. Oglapurkar : Member
5. Prof. Ranjita Deka : Member

Prof. Rekha Ghorpade welcomed all the members and initiated the proceedings with the permission of the Chair. She informed the committee that an announcement inviting applications for the post of Chief Coordinator of Examinations had been published in the March 2026 issue of the IAPT Bulletin. In response to the announcement, only one application was received, namely from Prof. M. K. Raghvendra.

She further stated that the application, curriculum vitae, and vision document submitted by Prof. Raghvendra had already been circulated among all committee members on 26th March 2026 for their consideration. Considering his prior experience of working under the guidance of Late Prof. G. Venkatesh and his familiarity with the examination system, it was proposed that he may be entrusted with the responsibilities of the CCE.

During the discussion, Prof. B. P. Tyagi expressed his desire to continue serving as the Chief Coordinator of Examinations until the year 2027 and stated that he would voluntarily relinquish the position thereafter.

Prof. Rekha Ghorpade clarified that the entire process for the selection of the new CCE had been conducted strictly in accordance with the guidelines published in the December 2024 issue of the IAPT Bulletin. She further noted that these guidelines had been recommended by an authorised committee and

subsequently approved by both the Executive Council (EC) and the Annual General Meeting (AGM) during the Dharamshala Convention.

After detailed deliberations and extensive discussions, the Chairperson, Prof. P. K. Ahluwalia, proposed the following resolution:

“The Search Committee approves the name of Prof. M. K. Raghvendra as the new Chief Coordinator of Examinations (CCE). However, the examinations during the year 2026 shall continue to be conducted under the supervision of Prof. B. P. Tyagi. During this period, Prof. Raghvendra shall work under his guidance to ensure a smooth transition as provided in the Guidelines. From the year 2027 onwards, the responsibilities of conducting the examinations shall be formally entrusted to Prof. M. K. Raghvendra as Chief Co-ordinator Examination (CCE).”

Although Prof. B. P. Tyagi did not agree with the above proposal, the following members supported and approved the resolution by majority:

1. Prof. Rekha Ghorpade
2. Prof. M. L. Oglapurkar
3. Prof. Ranjita Deka

IAPT President, Prof. P. K. Ahluwalia, placed on record the committee's deep appreciation for the untiring efforts, dedicated service, and remarkable contribution of Prof. B.P. Tyagi in strengthening and efficiently conducting the examination activities of the Association during his tenure as CCE since 2019.

It was unanimously decided that the outcome of the selection process along with the Minutes of the Meeting would be published in the June 2026 issue of the IAPT Bulletin.

Conduct of the meeting was assisted by Dr. Sanjay Kr. Sharma, Secretary IAPT. Meeting ended with a vote of thanks to the chair.

Rekha Ghorpade
General Secretary

National Competition for Innovative experiments in Physics (NCIEP)

4–6 October 2026 | Amity University, Noida (Delhi NCR)

The National Competition for Innovative Experiments in Physics (NCIEP), conducted since 2003, invites curious minds and creative thinkers to explore physics beyond textbooks.

This platform encourages participants to design, build, and demonstrate original experiments that reveal the beauty of physics through simple yet innovative ideas.

Think. Explore. Create.

Innovation—not sophistication—is the guiding principle.

WHO CAN PARTICIPATE?

Category A: Teachers, M.Phil./Ph.D. scholars, scientists, and science communicators

Category B: Undergraduate and postgraduate students (with mentor)

Category C: Students of Classes 9–12 (with teacher guidance)

All participants must personally demonstrate their experiment.

WHAT WE LOOK FOR

Originality, conceptual clarity, effective demonstration, and simplicity with insight.

Your idea matters more than expensive equipment.

PRIZES

	Amount
First Prize	₹ 7000
Second Prize	₹ 5000
Third Prize	₹ 4000

SUBMISSION DETAILS

Send entries to: nciepiapt03@gmail.com

Include title, participant details, category, affiliation, and contact details in covering letter.

Declaration: The experiment is original and not submitted elsewhere. Format given at the end.

WRITE-UP GUIDELINES

- Submit Word and PDF versions. Font: Times New Roman, Size 12, Line spacing: 1.5
- Include: Title, Abstract (≤ 300 words), Theory, Procedure, Observations, Calculations, Results, References
- Do not include name or institution in the document.

SELECTION & PRESENTATION

- Selected participants will present the experiment at the 40th IAPT Convention.
- In case you have been already selected in regional level experiment competition you can submit the same. If you are unable to participate in the regional level send the entry directly to the e mail mentioned in the announcement before closing date.
- Travel support as per IAPT rules. In case of joint authorship only one person will receive the travel allowance.
- Top student entries in Category B and C may receive ₹1000 support.
- Participants must bring their own setup.

IMPORTANT INFORMATION

- **Judges' decision will be final.**
- **Selected abstracts will be published in the IAPT Bulletin (ISSN: 2277-8950).**

DEADLINE: 31 August 2026

A NOTE TO PARTICIPANTS

Great discoveries often begin with simple questions. Bring your curiosity, test your ideas, and let your experiment tell a story.

COORDINATOR

Dr Geetha R S Email: nciepiapt03@gmail.com
Mobile: 8088812890 (WhatsApp)

DECLARATION FORM

Title of the Experiment:	Mentor Name if applicable:
Participants:	Mobile:
1.	Email:
2.	Address:
3.	
Institution Address:	Declaration: The experiment is original.
Category:	
Class:	Signature (Participant)
Date of Birth:	Signature (Mentor)

Geetha R S

Donation received in the account of IAPT at 40 Corpus Fund till 31st March 2026

Sr. No.	Date	Name	Place	Amount
1.	21.10.2024	Prof. P.D. Lele	Mumbai	250000.00
2.	03.11.2024	Prof. P. C. Deshmukh	Bangalore	100000.00
3.	09.11.2024	Prof. P. K. Ahluwalia	Shimla	100000.00
4.	13.03.2025	Suraj J Shah	Rajkot	5000.00
5.	13.03.2025	Debapriya Syam	Kolkata	25000.00
6.	18.03.2025	Ravindra Limaye	Indore	51000.00
7.	22.03.2025	Dr. Vishwamitter	Panchkula	3500.00
8.	22.03.2025	Dr. Dipankar Das	Agartala	500.00
9.	22.03.2025	Dr.TA V Sharma	Hyderabad	10000.00
10.	23.03.2025	Supriya Dattatraya Raut	Badlapur	1000.00
11.	23.03.2025	Akhil Tripathi	New Delhi	100.00
12.	23.03.2025	Dr. D. H. Gadani	Ahmedabad	5000.00
13.	24.03.2025	Hariharan M	Karur	100.00
14.	24.03.2025	Dr. Vinod Kumar Gupta	Ujjain	15000.00
15.	24.03.2025	Sanjeev Kumar	Chandigarh	5000.00
16.	24.03.2025	Davuluru Sarala	Hyderabad	500.00
17.	25.03.2025	Khongiang Longkhraw	Shillong	1000.00
18.	25.03.2025	Manjula Patra	Raurkela	10000.00
19.	27.03.2025	Dr. Kuldeep Kumar Sharma	Hamirpur	5000.00
20.	28.03.2025	Prof. K. N Joshipura	Anand	21000.00
21.	28.03.2025	Dr. R. R. Kothawa le	Barshi	1000.00
22.	04-03-2025	Dr. M. J. Ponnambalam	Tirunelveli	1,00,000.00
23.	09-04-2025	Dr. C. Salma	Nellore	500.00
24.	15-04-2025	Dr. H. S. Virk	Mohali	1,00,000.00
25.	05-05-2025	Vishwanath Barve	Sawantwadi	100.00
26.	08-05-2025	Dr. S. K. Nataraju	Bengaluru	10,000.00

27.	16-05-2025	B. Venkat	Hyderabad	200.00
28.	07-06-2025	Priya Mange	Junagarh	500.00
29.	07-06-2025	Prabodh Thakur	Hamirpur	500.00
30.	07-06-2025	Kavita V. Bhagiani	Mumbai	500.00
31.	07-06-2025	B. G. Shitab	Sangli	1,000.00
32.	08-06-2025	Dr. Neelam Upadhyay	Thane	2,000.00
33.	09-06-2025	Sushma Kumari	Biharsharif	500.00
34.	09-06-2025	Jalluri Panduranga Rao	Vijayawada	500.00
35.	10-06-2025	Nityandra Keshav Oke	Akola	500.00
36.	10-06-2025	Prof. R. Vijaya	Kanpur	1,00,000.00
37.	16-06-2025	Dr. K. K. Jyothi	Hyderabad	5,000.00
38.	18-06-2025	Murugandam Sithu	Chennai	2,000.00
39.	21-06-2025	Prabhat Kumar	Muzaffarnagar	1000.00
40.	24-06-2025	B. Venkat	Hyderabad	200.00
41.	16-06-2025	Ajay Kumar Ghatak	New Delhi	10,000.00
42.	06.07.2025	Ashok Kamble	Sangola	1,000.00
43.	12.07.2025	Shashank Mishra	Hamirpur	100.00
44.	12.07.2025	Dr. Hemant Kumar	Sirmour	5,000.00
45.	03.09.2025	Prof. K Madhukar	Hyderabad	5,000.00
46.	29.10.2025	Ajay Kumar Sharma	Kathua	3,000.00
47.	25.11.2025	Dr. Bikas Ranjan	Cuttack	1,000.00
48.	12.02.2026	Dr. Halim Sagir Ahamad	Nagpur	1,000.00
49.	20.02.2026	Payal Wadhwa	Gandhinagar	2,000.00
50.	26.03.2026	Mamta Chauhan	Gwalior	1,000.00
51.	31.03.2026	Saurabh Rindani	Ahmedabad	1,00,000.00
			Total Rs.	10,64,300.00

DC Gupta
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Analyzing Concept Inventories and MCQs in General - Part II

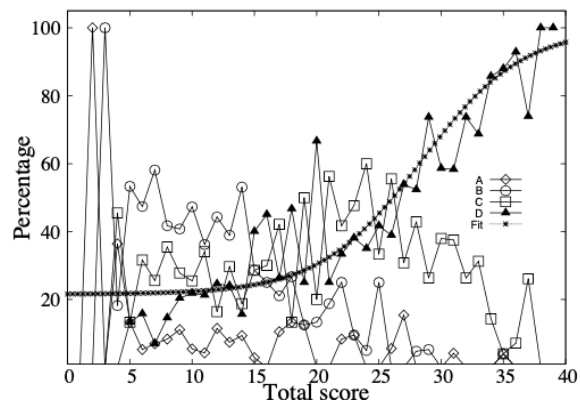
In this article, we continue our discussion of approaches to analyzing data collected from administering concept inventories and multiple-choice questions in general. In particular, we discuss item response curve (IRC) analysis, a visually rich and versatile tool for analyzing student responses. IRCs provide information about items/questions and samples that the statistical indices discussed earlier do not provide. IRC analysis involves plotting the percentage of students, $P_i(\theta)$, selecting choice i for an item/question against their ability, θ . We take the total score of the students on the test to represent their ability level, θ . In most cases there are four choices, and thus i is a, b, c, or d. A detailed description of the technique, its merits, and theoretical underpinnings can be found at:

Morris, G.A., Branum-Martin, L., Harshman, N., Baker, S.D., Mazur, E., Dutta, S., Mzoughi, T. and McCauley, V., (2006). Testing the test: Item response curves and test quality. *American Journal of Physics*, 74(5), pp.449-453. <https://pubs.aip.org/aapt/ajp/article/74/5/449/1044302>

Consider the following question from the Rotational Kinematics Inventory (RKI) we developed at HBCSE, as an illustrative example. The question concerns the direction of the angular velocity of the second hand of a wall clock. The clock lies in the x-y plane, with the z-axis coming out of the plane of the paper. The unit vectors in the x, y, and z directions are \hat{i} , \hat{j} and \hat{k} , respectively. We consider the angular velocity about the center, O, of the clock.

The clock is transparent and the second hand can be viewed from both the front and the back side. Then,

- if viewed from the front, the second hand moves anticlockwise with angular velocity in the $-\hat{k}$ direction.
- if viewed from the front, the second hand moves clockwise with angular velocity in the \hat{k} direction.
- if viewed from the back, the second hand moves anticlockwise with angular velocity in the \hat{k} direction.
- if viewed from the back, the second hand moves anticlockwise with angular velocity in the $-\hat{k}$ direction.



As can be seen, apart from fluctuations, the IRC for the correct choice d correlates positively with ability level. To facilitate clear interpretation, we modeled it with a logistic response function. As shown, the fit closely resembles a sigmoid that remains flat until the ability level $\theta=18$. The percentage of students selecting d increases steadily thereafter. Choice a is insignificant, as inferred from the low-lying curve close to the x-axis. A closer look at the item response curves for the distractors reveals that options b and c constitute the prominent incorrect choices. However, IRCs allow us to meaningfully distinguish between these two distractors. The IRC for distractor b is prominent in the ability range [3:15], while c is more popular among students with ability levels greater than 17. Thus, distractors b and c exhibit discriminatory power. Analysis of the content of these distractors reveals that choice c is closer to the correct answer than b is. Choice c requires visualizing the movement of the hand of a transparent clock from the rear side and ascertaining the direction of its angular velocity. In contrast, b requires the same analysis while looking at the clock directly. In summary, IRCs provide a visual display of most attributes conveyed by indices such as difficulty level and discrimination index. The curves help identify the ability range of students for whom a particular distractor is appealing, and this in turn can help in tailoring instruction accordingly.

K K Mashood
HBCSE - TIFR, Mumbai

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VOLUME 18**NUMBER 6****JUNE 2026****IN THIS ISSUE****EDITORIAL**

- The Doctoral Glut Manjit Kaur 187

PHYSICS NEWS

- Soumya Sarkar 188

THIS MONTH

- June: This Month in the History of Physics Pradipta Panchadhyayee 189

ARTICLE

- Facets of the Heisenberg's Uncertainty Principle V. Potbhare, N. D. Chavda 191

REPORTS

- Minutes of the EC Meeting: October 04, 2025 Rekha Ghorpade 198
- RC-11 : National Science Day Celebrations February - 2026 Joga Chandrasekhar Rao 208
- Orientation Camp for Science Excellence OCSE-2026 - PHYSICS & BIOLOGY Y K Vijay 210
- RC-07 : National Level Online Science Quiz - QuantiPhy 202 Payal Wadhwa 212
- Ammani Anveshika : Science Workshop Uma M K 213
- RC-02 : Eureka 2.0 – World Physics Day Celebrations Ashish Kapoor 215
- RC-02 : Annual Convention-cum-Workshop Meenakshi Syal 216
- NASNI : When the Sky Became a Classroom Hemant Kumar 218

ANNOUNCEMENT

- New Chief Coordinator of Examination (CCE) Rekha Ghorpade 219
- National Competition for Innovative experiments in Physics (NCIEP) Geetha R S 220
- Donation received in the account of IAPT at 40 Corpus Fund D C Gupta 221
till 31st March 2026

TRENDS AND THEMES IN PHYSICS EDUCATION RESEARCH (PER)

- Analyzing Concept Inventories and MCQs in General - Part II K K Mashood 223

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

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