Bulletin of

INTERNATIONAL YEAR OF Quantum Science and Technology

www.indapt.org.in

Scan to Read IAPT Bulletin online

ISSN 2277-8950

THE INDIAN ASSOCIATION OF PHYSICS TEACHERS

A MONTHLY JOURNAL OF EDUCATION IN PHYSICS & RELATED AREAS

VOLUME 17 NUMBER 10 OCTOBER 2025

Data from 'NASAs Chandra X-ray Observatory and NASA's James Webb Space Telescope combine to reveal an otherworldly view of the star-forming region IC 348. In this image released on July 23, 2025, X-rays from Chandra are red, green, and blue, while infrared data from Webb are pink, orange, and purple.

The wispy structures that dominate the image are interstellar material that reflect the light from the cluster's stars; this is known as a reflection nebula. The point-like sources in Chandra's X-ray data are young stars in the cluster developing there.

Link: https://www.nasa.gov/image-article/ic-stars/

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:

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

Email: iapt@pu.ac.in

Registered Office
Flat No. 206, Adarsh Complex, Awas Vikas-1, Keshavpuram, Kalyanpur, Kanpur – 208017
E-Mail : iaptknp@rediffmail.com

Secretary :	Treasurer :	Office Assistant :
Sanjay Kr. Sharma	**D. C. Gupta**	**Vinod Kr. Prajapati**
sksharma777@gmail.com	guptadeepchandra117@gmail.com	iaptknp@rediffmail.com
Mob. 9415404969	Mob. 9839035685	Mob. 9935432990

Editorial

The role of IAPT in shaping physics curriculum under NEP

Ever since University Grants Commission has started seeking feedback on model syllabi for undergraduate and post graduate courses for various subjects, lot of media reports are coming on the kind of debate they have generated among the academia and stakeholders for and against the drafted changes. We at IAPT, being an apex subject society, must also initiate an exercise to investigate the draft model syllabi proposed by UGC for physics. So As IAPT prepares to scrutinize the draft physics curriculum under the National Education Policy (NEP), it is essential to recognize the pivotal role subject societies play in ensuring the quality and relevance of educational content. The NEP 2020's introduction of the National Higher Education Qualifications Framework (NHEQF) and the upcoming syllabus for undergraduate and postgraduate courses in physics necessitate careful examination and feedback from experts in the field.

Understanding the NHEQF and its implications

The NHEQF aims to standardize qualifications and promote academic mobility by categorizing education into eight levels, with a focus on learning outcomes, credit accumulation, and flexibility. This framework emphasizes the importance of graduate attributes, such as critical thinking, creativity, and problem-solving skills, which are crucial for physics students. However, concerns regarding the implementation of NHEQF, such as the potential for elitism and the need for broader consultations, must be addressed.

The Four Pillars of physics education

In today's rapidly evolving technological landscape, physics education should incorporate four essential approaches:

- Experimental: Hands-on experiments and laboratory work to develop practical skills and observation techniques.
- Theoretical: Rigorous mathematical formulations and conceptual understanding of physical phenomena.
- Computational: Numerical methods and simulations to analyze complex systems and phenomena.
- AI-Driven: Utilizing artificial intelligence tools to analyze data, simulate experiments, and visualize complex concepts.

By integrating these approaches, physics education can provide students with a comprehensive understanding of the subject and prepare them for the challenges of the 21st century.

Meeting the challenge of Choice-Based Credit System

The choice-based credit system offers students flexibility in choosing their courses, but it also raises concerns about students opting out of physics as a major subject. This could lead to a dearth of talented students pursuing physics as a career option. To address this, it is essential to design a credit structure that allows students to transition smoothly from a minor to a major in physics, if they choose. This flexibility desires carefully to organize in the draft curriculum an overlap between the minor physics course and major physics course at the undergraduate level. Also, draft syllabi must make sure that options available as electives in physics curriculum must incorporate physics-based opportunities to seamlessly go ahead with new job opportunities where physics plays a leading role and the skill set of a physics student has an edge.

Role of IAPT in shaping physics curriculum

As a subject society, IAPT has a critical role to play in ensuring the physics curriculum aligns with the needs of students, educators, and industry. By scrutinizing the draft curriculum and providing feedback, IAPT members can:

- Ensure the curriculum incorporates modern topics and emerging areas in physics.
- Promote the development of graduate attributes, such as critical thinking and problem-solving skills.
- Advocate for a balanced approach to physics education, incorporating experimental, theoretical, computational, and AI-driven methods.

Role of IAPT Regional Councils

In the light of the changing educational landscape, IAPT regional councils are urged to conduct workshops focusing on the overall credit structure for balanced delivery of content for both students opting for physics as a major subject and minor subject. These workshops should emphasize designing a curriculum that allows students to transition smoothly from a minor to a major in physics, providing them with the flexibility to pursue physics as a career option. By doing so, we can ensure that students have a strong foundation in physics and are prepared for the challenges of the 21st century.

Key objectives of the workshops

The workshops should aim to:

- Review the draft physics curriculum carefully.
- Provide constructive feedback and suggestions for improvement.
- Participate in discussions and consultations to ensure the physics curriculum meets the needs of students and educators. Develop a credit structure that allows students to transition from a minor to a major in physics.
- Design a curriculum that provides a balanced approach to physics education, incorporating experimental, theoretical, computational, and AI-driven methods.
- Identify strategies to promote physics as a major subject among students and encourage them to pursue physics as a career option.

Call to action

As we move forward with the implementation of the NEP, it is essential for IAPT members to engage actively in the curriculum development process. By working together, we can shape a physics curriculum that prepares students for the challenges of the future and fosters a deeper understanding of the subject.

It is worth emphasizing again that the role of subject societies like IAPT is crucial in ensuring the quality and relevance of educational content. As we embark on this journey, we must prioritize the development of a physics curriculum that is rigorous, relevant, and aligned with the needs of students and educators. By doing so, we can empower the next generation of physicists and researchers to tackle the complex challenges of the 21st century and bring back the students to physics major as a first choice.

P. K. Ahluwalia

President, IAPT

Physics News

Physicists demonstrate 3,000 quantum-bit system capable of continuous operation

One often-repeated example illustrates the mind-boggling potential of quantum computing: A machine with 300 quantum bits could simultaneously store more information than the number of particles in the known universe. In a paper published in the journal *Nature*, the team demonstrated a system of more than 3,000 quantum bits (or qubits) that could run for more than two hours, surmounting a series of technical challenges and representing a significant step toward building the super computers, which could revolutionize science, medicine, finance, and other fields. The new study advances a fast-developing frontier of research. In fact, this week a team from Caltech published a 6,100-qubit system, but it could only run for less than 13 seconds. The approach allows the connectivity of the processor to be changed during the process of computation. In contrast, most existing computer chips - like the ones in your cellphone or desktop, have fixed connectivity. Realizing this dream is now in our direct sight for the first time, ever - One can really see a very direct path towards realizing it.

Read more at: https://phys.org/news/2025-08-marathon-precise-nucleon.html

Original Paper: Nature (2025). DOI: 10.1038/s41586-025-09596-6

A new approach to magnify wave functions when imaging interacting ultracold atoms

The precise imaging of many-body systems, which are comprised of many interacting particles, can help to validate theoretical models and better understand how individual particles in these systems influence each other. Ultracold quantum gases, collections of atoms cooled to temperatures close to absolute zero, are among the most promising experimental platforms for studying many-body interactions. To study these gases, most physicists use a technique known as single atom - resolved imaging, which allows them to detect individual atoms and probe correlations in their behavior. Essentially, Brandstetter and her colleagues set out to develop a new approach that would allow them to reliably "magnify" a many-body system before it is examined with single-atom imaging. Notably, the results of the team's experiment were closely aligned with theoretical predictions and what is known about the two systems. This suggests that their magnification scheme works, reliably expanding the atoms' wavefunctions. This recent study opens exciting possibilities for the future study and simulation of strongly interacting quantum systems.

Read more at: https://phys.org/news/2025-09-approach-magnify-functions-imaging-interacting.html

Original Paper: Physical Review Letters (2025). DOI: 10.1103/wdjr-m2hg

Preserving particle physics data ensures future discoveries from collider experiments

A lot of the science from our accelerators is published long after collisions end, so storing experimental data for future physicists is crucial. About a billion pairs of particles collide every second within the Large Hadron Collider (LHC). With them, a petabyte of collision data floods the detectors and pours through highly selective filters, known as trigger systems. Less than 0.001% of the data survives the process and reaches the CERN Data Center, to be copied onto long-term tape. The Data Preservation in High-Energy Physics (DPHEP) group, established in 2014 under the auspices of ICFA and with strong support from CERN, estimates that devoting less than 1% of a facility's construction budget to data preservation could increase the scientific output by more than 10%. In the latest issue of the CERN Courier, Cristinel Diaconu and Ulrich Schwickerath recall some of the most remarkable treasures unearthed from past experiments, such as the Large Electron - Positron Collider (LEP) and HERA, which still informs studies of the strong interaction almost two decades after its shutdown.

Read more at: https://phys.org/news/2025-09-particle-physics-future-discoveries-collider.html

Original paper: arXiv (2025). DOI: 10.48550/arxiv.2508.18892

Soumya Sarkar
IISER PUNE

October: This Month in the History of Physics

1995 Discovery of 51 Pegasi b

One of the questions, that has been lingering in the minds of people for a long time is; whether there is any other system in the universe where the celestial bodies like our planets revolve round a star like our Sun? Well, the first encouraging reply came in October 1995. On the 6th of that month, a member of the universe was discovered that is orbiting a sun-like star. The star is about 50 light years away from us and it is called 51 Pegasi as it is the part of the Pegasus constellation. The orbiting body, now called an exoplanet, has a heavy mass, about half of that of the Jupiter. But it is revolving round its star at a distance that is even lesser than the mercury-Sun distance. In fact, this aspect has made the scientists to rethink the theories of planet formation. The prefix 'exo' in exoplanet comes from Greek with the meaning 'external' or outside. The discovery was significant and this exoplanet soon got a name indicating its location in space. The International Astronomical Union, in accordance with the international practice, gave it the name 51 Pegasi b for the use of the astronomers. But another name of this exoplanet has also been fondly given for the use of public. It is known as Dimidium, based on a Latin word meaning half or halved indicating that its mass is about half of that of the Jupiter. The 2019 Nobel Prize in Physics was shared by three scientists. From the Nobel announcement, we learn that the one of the scientists

Michael Mayor

Didier Queloz

The star 51 Pegasi

i.e., James Peebles received the prize "for theoretical discoveries in physical cosmology" and the other two scientists, Michael Mayor and Didier Quilez were bestowed with this recognition "for the discovery of an extrasolar planet orbiting another star like the Sun." It is not difficult to appreciate what a big discovery it was, since by the end of July 2025 nearly 6000 such exoplanets have been discovered.

1897 Discovery of electron

In October 1897, in a paper published in the Philosophical Magazine the author began with the following text in its first few lines "The experiments described in this paper in the hope of gaining some information as to the nature of Cathode Rays. The most diverse opinions are held as to these rays; according to an almost unanimous opinion of the German physicists they are due to some process in the aether – inasmuch as in a uniform magnetic field their course is circular and not rectilinear no phenomenon hitherto observed – another view of these rays is that so far from being wholly aethreal they are in fact wholly material and they mark the paths of the matter charged with negative electricity …..". The British was forthright in his view and

THE

LONDON, EDINBURGH, AND DUBLIN

PHILOSOPHICAL MAGAZINE

AND

JOURNAL OF SCIENCE.

[FIFTH SERIES.]

OCTOBER 1897.

XL. *Cathode Rays.* By J. J. Thomson, *M.A., F.R.S., Cavendish Professor of Experimental Physics, Cambridge**.

THE experiments† discussed in this paper were undertaken in the hope of gaining some information as to the nature of the Cathode Rays. The most diverse opinions are held as to these rays; according to the almost unanimous opinion of German physicists they are due to some process in the æther to which—inasmuch as in a uniform magnetic field their course is circular and not rectilinear—no phenomenon hitherto observed is analogous: another view of these rays is that, so far from being wholly ætherial, they are in fact wholly material, and that they mark the paths of particles of matter charged with negative electricity. It would seem at first sight that it ought not to be difficult to discriminate between views so different, yet experience shows that this is not the case, as amongst the physicists who have most deeply studied the subject can be found supporters of either theory.

First page of Thomson 1897 paper

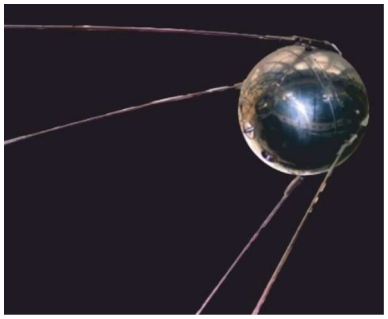
emphatically refuted the alternative views related to the interpretation of his experimental observations that he had already shown during public lectures in London a few months back. This conviction of J. J. Thomson, M.A, F.R.S the author of the paper was evident when he was very loudly announcing the discovery of the first subatomic particle, electron.

Thomson could see the deflection of the cathode ray beams by a magnetic field and he noted down the direction of this deflection. It led him to conclude that the flow must comprises of particles with negative charge. At the same time to rule out the possibility of these particles being negative ions, Thomson calculated the charge to mass ratio of the particles from their deflecting paths and found the particles to be much lighter. So, it excluded the possibility of these being any negatively charged ions. Thomson could conclude that the particles are negatively charged and are much lighter than the ions. These types of particles were hitherto unknown and there could be other external source for them. Thomson was convinced that the origin of these particles was at the interior of an atom, till then considered to be the ultimate unit of a matter with no scope of breaking it further.

The significance of this discovery can only be overemphasized. However, the unusual comments of Thomson towards the 'German physicists' in a scientific paper is interesting. It just goes to show how the physicists from Germany where the cathode ray tube was first developed and their counterparts in England where lot of research were going on using the various designs of the cathode ray tubes were involved in a fierce competition. Competition or not, the research with cathode ray tubes during the second half of the nineteenth century led to various pathbreaking discoveries not only in physics, but also in chemistry.

1957 Launching of Sputnik-1 into space

It became a sensation on October 6, 1957 not only because of a great achievement of physics it marked the beginning of a great journey of science and technology. However, at the same time is had a real political overtone as it happened when the cold war was in its peak. An artificial satellite Sputnik 1 was sent to space from the then Soviet Russia became the first object from the earth to enter the space. It also could showcase the Soviet achievement and supremacy in space exploration that among other nations drew a special attention of the USA. Sputnik 1 revolved round the earth in an elliptical low-earth orbit having an average distance of about 550 km from the surface of the earth. It could send signals to the earth for about three weeks before its batteries


Sputnik-1

stopped supplying the necessary 1 W power from the silver-zinc batteries that were drained out. One must note that it was a pre solar cell era. Interestingly these signals could be detected by amateur radio operators. The satellite had a diameter of about 58 cm and a mass of 83.4 kg. The physicists played a big role in its development and launching, but they were not alone. A big team of engineers and other technological personnel from various disciplines made this mission possible. Today it is very difficult to comprehend how Soviet scientists and technological manpower could develop and assemble so many functional equipment for launching an artificial satellite in space and make that revolve round the earth in a designated orbit nearly seventy years ago. In fact, this successful step helped Soviet Russia to send the first manned flight to the space in April 1961 when it launched Vostok 1 and Yuri Gagarin became the first person to revolve round the earth in that spacecraft and coming back safely. If we leave out the political ramifications; the launching of Sputnik 1 marked the space age.

References:

1. Phil. Mag. S. 5. Vol 44. No. 269. Oct 1897
2. Different entries from https://en.wikipedia.org

Bhupati Chakrabarti

Nobel Prize Turns 125

Every year during the first half of October, people spread over the world and virtually everyone connected to science, are found keenly following some very exciting announcements emanating from Stockholm, the capital of Sweden. The names of the Nobel Prize winners in three different areas of science are made public during that time. First comes the announcement for the Physiology or Medicine on October 4th and then we get to know the names of the Physics Nobel laureates on October 6th. The names of the winners in Chemistry come out on October 8th. The Prizes for other three branches viz, Literature, Peace and Economic Sciences come out after these three. While the Nobel Prize winner in peace gets announced from Oslo, the capital of Norway the Noble Prizes for the five areas, began their journeys in 1901 and that way Nobel Prize is turning 125 this year. On the other hand, the Prize for Economic Sciences was introduced in 1969 and is officially the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel. Of course, Nobel Prize could not be announced in all the 125 years mainly because the process got severely hampered during the two World Wars. It goes without saying that in science disciplines, and possibly in other branches as well, the Nobel Prize is now considered as the highest and the most prestigious recognition.

Over the years in all the three areas of science, the Nobel Laureates have kept a permanent mark through their prize-winning work not only in their own branch of knowledge but also have created big impacts for the benefit of humankind. The first Physics Nobel Prize went to the German physicist Wilhelm Roentgen in 1901 for the discovery of x-rays. Physicists took time to ascertain the real identity of the penetrating radiation, but barely a couple of weeks after its discovery it found application in medical science. The 1904 Chemistry Nobel went to Sir William Ramsay of England in recognition of his "services in the discovery of the inert gaseous elements in air, and his determination of their place in the periodic system". And that led to the more completeness to the periodic table of elements. Dimitri Mendeleev the Russian chemist who gave us the modern periodic table did not receive the Nobel Prize despite receiving a few nominations before passing away in 1907. Similarly, Lord Kelvin the stalwart of the 19th century physics and who was one of the nominators of Roentgen for the physics Nobel Prize of 1901 could not make it to the list of winners. He did receive a few nominations in the early years of Nobel Prize, but the Prize remained elusive for him. So, the Nobel Prizes in the different areas of science also have some shocking omissions, if not surprising inclusions that are considered by many as more familiar phenomena in peace and literature Prizes.

The selection of awardees for Nobel Prize has always remained nomination based. The Nobel committees in Physics, Chemistry and Physiology or Medicine under the aegis of Royal Swedish Academy of Sciences and Nobel Assembly at Karolinska Institutet invite nominations from the academicians all over the world following a well chalked-out guideline. The selection of the awardees remains confined among the nominated names but the number of nominations does not necessarily play a clinching role. The nominations received by the area specific committees, and the discussions in the selection meetings remains highly confidential over the years. However, the science historians had a long-standing demand that they should have an access to the Noble Archive to critically examine these documents related to the nominations and selections of the Nobel laureates. It was felt that these could reveal rich historical elements like socio-cultural issues connected to science, reflections of nationalistic sprits, hidden

biases in the selections and the views possessed by the frontline scientists that were beyond their discipline at different points of time etc. Finally, around 1987 the concerned authorities in Sweden and Norway agreed to bring these documents in the public domain with a couple of conditions imposed. First, only the selection related documents that are fifty years old would be made open for the public. It was to ensure that the concerned laureates and most of the nominators will not be able to know these details during their lifetime. This is reflected in an overriding second clause where they included the condition if the concerned Laureate is found to be alive after fifty years of his or her award then the documents will be further kept on hold. The idea was possibly not to allow a Laureate to officially know about his or her nominators, though they might have some inkling about that. For these steps we now know the scientists who nominated Sir C.V. Raman for Physics Nobel of 1930 and how the Prize was clinched in his favour, or how many nominations were received by S.N. Bose and that too when and from whom etc. The fact that Einstein received 66 nominations over a period of 12 years before being handed over the 1921 Physics award in 1922 after keeping it on hold for a year is now known. And we also know that Lise Meitner even after receiving 49 nominations in physics or chemistry over a span of 43 years never received the Prize. Some of these documents may be accessed for free while some others are to be paid for.

Nobel Prize has been awarded regularly, with a few years missing mainly due to World Wars I & II. Occasionally the Prize had been kept on hold for a year. As a result, though this year is 125th year of inception of Nobel Prize the but the Prizes have not been announced for 125 times. If we confine this discussion among the Nobel laureates of science disciplines only, one can note down several interesting, may be surprising events. As per the will of Swedish inventor Alfred Bernhard Nobel a Prize may be shared among upto three living individuals only. That possibly sometimes given rise to questions for the omission of an important contributor of a prize-winning work. Sometimes similar things have been observed and only two or even one scientist had been selected for the Prize, ignoring the same level of contributions of some others. Moreover, owing to a very significant gap of time between the prize-winning work and the actual Prize occasionally quite a few scientists who contributed to the award-winning work had passed away, and their names could not be considered. Nobel committees always want to be double sure about the of robustness of the work that was getting selected for the award and that causes delay sometimes. With all these characteristics the Nobel Prize not only stands out as the most coveted prize but as an enigma giving rise to more surprises.

Bhupati Chakrabarti

Neural Networks: Beyond Hopfield

Vipin Srivastava
Former Professor of Physics at the University of Hyderabad

319We saw in the last article how 'memory catastrophe' spoiled the party for the otherwise extraordinarily successful model for cognitive learning and memory put together by John Hopfield by synthesising ideas from Edwards-Anderson's Spin-Glass model with 'synaptic plasticity', discovered by psychologist Donald Hebb and formalised by physicist Leon Cooper. In the 1990's frantic efforts were made to circumvent this cognitively unrealistic problem. New insights were gained, and the cause for the 'catastrophe' was also understood – It was 'noise' produced by similarities between the patterns being recorded in the memory!

By now we know that the patterns of *+/-1*'s, symbolising firing/non-firing neurons, are represented by vectors (with components *+/-1*), which correspond to what is being stored in the memory. The catastrophe, or the memory breakdown, happens because these vectors overlap each other, i.e., their scalar- (or dot-) products are non-zero (school children who have taken the first course on vectors would know this). Unless the 'similar' and 'dissimilar' components of two vectors are equal in number, they are said to overlap each other. When the prescription for recall is applied to a given test vector its scalar-products with the stored ones, referred to as 'cross-talks', are added up. As the number of stored vectors/patterns increases, it becomes increasingly more difficult for the test vector to stand out from the 'noise' caused by the jumble of cross-talks. And when this number crosses *0.14N* (i.e., 14% of *N*, the total number of neurons) the calculations as well as simulations show that the noise gets too intense to extract a vector out from the memory storage.

The solution to this problem eluded us for long but lay in its crux, namely the cause for the noise. Sam Edwards and I wondered if the brain could "orthogonalize" the vectors that came to be stored with respect to those in the memory.[1] This seemed too obvious a solution, so we subjected the idea to computer simulations and also studied physiology of certain parts of the brain, like 'cerebellum'. It is hard to give the details in this article, but the gist of what we learned is summarised below.

---

[1] '**Orthogonalization**' is a mathematical transformation that makes a given set of vectors mutually perpendicular to each other. It is widely used by physicists and theoretical chemists and was first proposed by Gram-Schmidt (Jørgen Pedersen Gram and Erhard Schmidt) in 1907. In 1940s and '50s Per-Olov Löwdin invented new methods to orthogonalize. If an incoming vector is orthogonalized, using Gram-Schmidt (G-S) scheme, with respect to those in the memory and then stored, then it's overlap with the latter becomes zero, and the noise is eliminated. This abolishes the memory catastrophe! And the memory capacity of the model brain increases drastically from *0.14N* to *N* (i.e., from 14% to 100% of *N*). More importantly, even though the brain stores orthogonalized versions of vectors (in which their components are fractions, not *+/-1*), the raw vectors (with *+/-1*s as components) are recovered when presented for association.

In simple terms, the simulations tell us that while orthogonalizing a new vector with respect to the old ones the model brain is in fact isolating its similarities and differences with the latter. And, most importantly, it stores in its synapses these 'similarities' and 'differences', not the *+/-1*'s of the rawvector – the prescription for storage remains the same as that due to Hebb and Cooper. Furthermore, we find that this brain does it in an **economical manner** wherein the 'similarities' are stored with greater weight, i.e. more emphatically, if they are fewer in number as compared to the 'differences', and the other way round if the number of 'differences' is smaller than the 'similarities'. This is a crucial feature of this brain because it is well known that to optimise the use of its

resources the biological brain follows the principle of economy in all its functions.

Another cognitively appealing feature of the model brain with G-S orthogonalization included in its learning apparatus is that if a vector, already learned and stored, is encountered a second time then it is not stored again. This brain can detect if it is familiar with a presented information and does not overload its resources by learning something repeatedly. This is because orthogonalization uses the same tool as that used by the retrieval mechanism to compare a new information with the stored ones. So, when a vector is encountered, this brain checks if it is familiar; it is saved only if it is not. Thus, the mechanisms for discrimination, storage and retrieval share a common tool – helping the brain economise on its resources!

The big question, however, is: Can we claim that G-S orthogonalization, a man-made mathematical operation, represents a physiological process?

G-S orthogonalization not only fixed a mathematical snag in the Hebb-Hopfield neural network but also made the model cognitively more realistic. To make the proposal credible, we needed to look for experimental evidence that the brain could actually do G-S orthogonalization. This seemed like a tall order until we got David Parker, a Cambridge neuroscientist, on board.

We investigated a seminal work on Cerebellum from 1969 by David Marr, a formal neurophysiologist from Cambridge. Cerebellum came early in the brain's evolution and is responsible for our motor actions among several other functions. We made hypotheses on how neurons and synapses in cerebellum circuitry should function if it were to execute G-S orthogonalization. Some of our proposals were found experimentally tested while others were biologically plausible.

David Parker made a key observation that the proposed Cerebellum circuitry for G-S orthogonalization was essentially a network in which 'inhibitory neurons received feedforward excitatory inputs and provided feedback inhibition to fire'. He pointed out that this network architecture was rather common and was also found in 'Hippocampus', 'Paleocortex' and 'Neocortex', and in lower vertebrates and invertebrates. So, a range of systems doing sensory, motor and cognitive functions use orthogonalization to isolate similarities and differences.

Thus, we can say with reasonable confidence that orthogonalization is consistent with nervous system features. The brain appears to have evolved to do G-S orthogonalization. This is quite remarkable because Gram-Schmidt developed their scheme for something completely unrelated and far removed from neuroscience without ever imagining that the brain might be already doing it all the time as an innate process!

This inspired us to make another conjecture for a common observation about our long-term memory: we remember old things without fail while we may struggle, under certain circumstances, to recall recent happenings; this may hold even if we suffers physical or psychological shocks. So, it is natural to ask – why is the long-term-memory (LTM) robust against trauma as opposed to the short-term-memory (STM)?Could STM and LTM involve different mechanisms to store information?

Neuroscientists tell us that the information received at our sense organs assembles at the brain part called Hippocampus where memories are formed. But the long term memories are stored in the cortex, the surface of the brain. So, the memories should be selectively moving from Hippocampus to the LTM areas in the Cortex.

Whatever be the selection process we have proposed that when the memories are transferred to the LTM areas they are Fourier transformed[(2)]. This should imply that the LTM has a holographic character[(2)]! Our calculations show that in case of a large-scale destruction of neurons and synapses, if the surviving ones hold the information as Fourier coefficients, even their truncated set can be put together to construct the old memories in a similar fashion as they make holograms. A lot of work needs to be done to ascertain the nitty-gratis of Fourier transformation at the level of neurons and synapses like we did for G-S orthogonalization. First, neuroscientists will have to identify the circuitry involved in the transfer of LTMs to the cortex, then together with theoreticians they will work out how neurons and synapses can conspire to perform Fourier transformation, and the new

proposals will have to be checked experimentally. Until then the proposition of LTM being holographic will remain tentative and nascent.

[(2)]In early nineteenth century French mathematical physicist Joseph **Fourier** invented a **transformation** that can isolate the frequencies that constitute a function, which may have a rugged looking waveform. For example, if we subject the sound of a musical composition to Fourier transformation, we can extract all the pitches (or frequences) that constitute that piece of music. It is widely used as a tool by engineers, physicists and mathematicians and is central-to-holography. While trained musicians can identify the notes in a musical composition, even untrained listeners can sense if a wrong note is played or sung by a musician. This might indicate that the brain possesses the competence to perform Fourier transformation as an innate capability.

In respect of orthogonalization also what has been done amounts to scratching the surface. A lot of experimental work is required to firm up the proposal. Nevertheless, this should not deter us from thinking of new ideas. For instance, we have learned only about associative memory; we need to investigate other types of memories we experience in our day-to-day life. Note that G-S orthogonalization is good as a sequential process, like learning of a language. But often we assimilate multiple information at the same time and in batches like in an episode of something happening. We contend that Löwdin's orthogonalization schemes should be helpful in this regard. The Löwdin's methods, which orthogonalize a bunch of vectors in one go and possess some curious geometrical properties, we suspect, should help in modelling the likes of episodic and semantic memories.

This area of research is wide open.

Article

Attosecond Physics: A roadmap for pushing away the quantum mechanical boundaries & key to the world of limitless possibilities

Pragya Agar Palod, Nitu Katariya
Department of Physics, Shri Vaishnav Vidyapeeth Vishwavidyalaya,
Indore, 453111, Madhya Pradesh, India.
Email: pragyapalod@svvv.edu.in, nitukatariya@svvv.edu.in

Abstract

The 2023 Nobel Prize in Physics was awarded to Pierre Agostini, Ferenc Krausz and Anne L'Huillier for their pioneering work in the field of attosecond physics. Their research focused on generating incredibly short pulses of light, measured in attoseconds (one quintillionth of a second i.e. 10^{-18} s), which have allowed scientists to study the ultrafast dynamics of electrons in atoms and molecules. These attosecond pulses enable the observation of the processes that occur at the electron level, providing a deeper understanding of the phenomena such as chemical reactions and the behaviour of matter on the smallest time scales, which were so far considered to be instantaneous because of unavailability of precise technology to measure them.

The laureates' contributions span several decades. Notably, Anne L'Huillier discovered in 1987 that infrared laser light passing through noble gases generated overtones, leading to key developments in attosecond pulse generation. L'Huillier is the fifth woman to win the Nobel Prize in Physics. Agostini and Krausz contributed by demonstrating how to generate and control these pulses to study ultrafast phenomena. The techniques developed by these three scientists hold potential for future technological advances to probe the ultrafast world of electron interactions at unprecedented detail.

1. Introduction

The hidden world of electron dynamics within the atoms and molecules can be explored using Attosecond laser pulses. To appreciate the advent of **Attosecond Physics**, it is vital to know that the natural time scale of electron dynamics is on the order

of 20 – 200 attoseconds [1]. Due to their ultrafast motion, electron's movement was, so far considered impossible to measure. The extraordinary theoretical understanding and experimental methods to measure such ultrafast electronic dynamics enables scientists to comprehend crucial physical processes at unprecedented levels of detail; thus, opening new avenues to understand the chemical and physical interactions of materials that underpin various electronic, chemical and medical innovations and technology, holding strong promise for pushing past the limits, in future [2].

2. Time scale matters to observe the events

Scientific advances are the outcome of our ability to measure fast events. The shutter speed of a camera is the parameter that determines the smallest time duration of the events / movements that can be captured. Hence it governs the time resolution of the camera. Faster the shutter speed, smaller will be the time duration of the light exposure and hence the camera will be capable of capturing more rapid movements. As Figure 1 shows the picture of a slow-moving tortoise captured very cleanly by a camera; however, that of a hummingbird flapping its wings (at a speed of around 60 times/s) comes out to be blurred.

Figure 1: Camera captures clean image of a tortoise moving slowly and blur image of a hummingbird flapping its wings fast.

Figure 2 shows various phenomena of scientific importance and the associated time scale such as chemical reactions, molecular vibrations, photosynthesis etc. Amongst all, the electron's motion inside the atom is the fastest one, which occurs at the time scale of attoseconds. Hence to study the electron dynamics, it is required to have light pulses with the duration on the similar scale [3]. Faster the light pulses, faster the movements that can be observed. Thus, ultrashort Laser pulses of attoseconds duration,

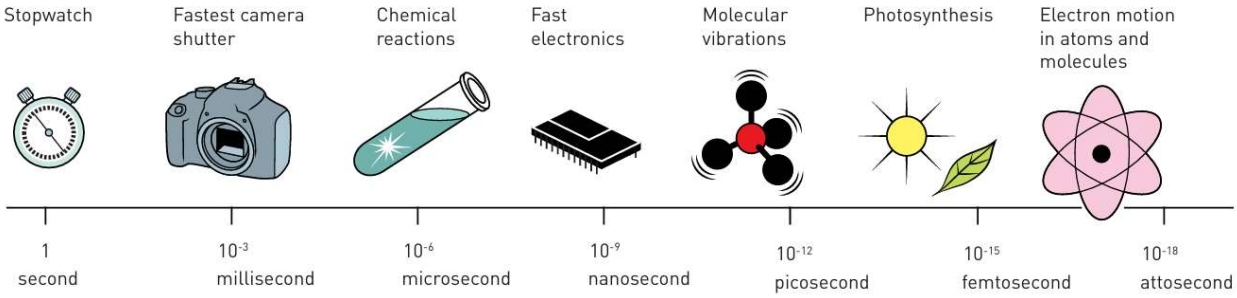


Figure 2: Time scale for observing various phenomena / processes. Source [3]. © Johan Jarnestad / The Royal Swedish Academy of Sciences.

forms the basis of an attosecond camera capable of recording the movement of electrons around an atomic nucleus making it possible to observe the sequences of events, which could once only be guessed at.

3. Interaction of Laser light with matter

Interaction of Laser light is instrumental in revealing the structure of the material. Since the invention of Laser in 1960, scientific community has constantly realised its tremendous power and potential to peer deeper into the atoms and molecules. 2018's Nobel Prize of Physics marks an important milestone achieved in the field of Laser Physics. As half of the prize was for the invention of optical tweezers, while remaining half was for the method of generating high intensity, ultra-short optical pulses of 100 fs duration [3]. After 2018, in year 2023, another Nobel Prize in Physics, in the field of generating light pulses of ultrashort duration (attoseconds), marks the significance of the ongoing research in this field and can pave the way for more advanced techniques for various applications [4].

4. Attosecond Physics: journey to the milestone

Conventional Laser cannot provide attosecond pulses. The journey towards the experimental generation of extremely short Laser pulses is closely related to the technical developments in the Femtosecond Laser technology. Following points can be of vital importance to develop a systematic understanding of the major milestones.

4.1 Origin of Shorter pulses lies in Overtones

The length of a single period of a single period in the light wave (one cycle with one peak and one trough) is referred to as the shortest pulse. It is not possible to reach below a femtosecond time scale by using the ordinary Laser systems.

However, conceptually, Mathematics allows generating shorter pulses by combining various short pulses of required amplitudes in sufficient number. Hence, it is important to add more wavelengths to the Laser light. When Laser light is passed through a gas, it interacts with the atoms and generates many overtones. An overtone is a wave which completes certain number of cycles corresponding to each cycle in the original wave. As shown in Figure 3, the key concept of the generation of overtones from the fundamental tone is quite known and responsible for producing rhythmic sound in a guitar.

4.2 High Harmonic Generation (HHG):

In 1987 Anne and her group demonstrated stronger overtones of the same intensity with shorter wavelengths by passing infrared (IR) Laser light through a Nobel gas. These shorter waves with frequency multiple of the fundamental frequency form the basis for creating attosecond pulses [4]. Conceptually it is simple to understand how HHG can be helpful in generating attosecond pulses. As known from the energy – time uncertainty, a pulse can be compressed in the time domain by expanding it in the spectral domain. Therefore, a number of phase locked frequency components available in the plateau of the HHG spectrum (Figure 4) provide waves to form attosecond pulses [5].

In 1991, Anne et. al. published a report in which they presented the understanding of the HHG process using numerical simulation [6].

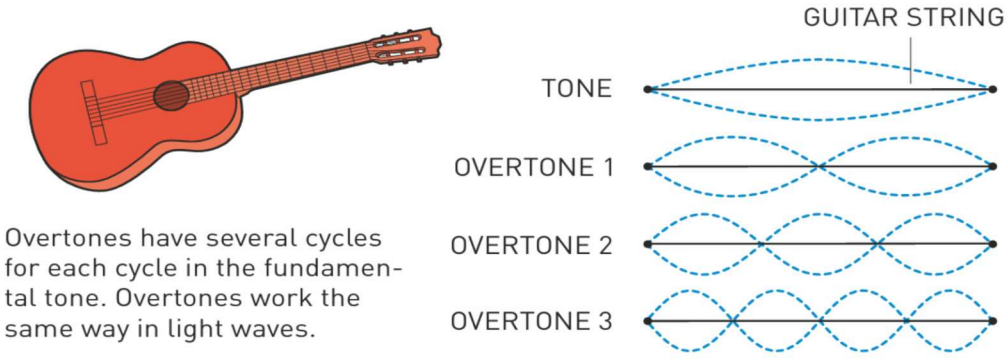


Figure 3: Various overtones generated in guitar string for the fundamental tone. Source [4]. © Johan Jarnestad/ The Royal Swedish Academy of Sciences.

They formulated three step rescattering model to explain the production of short pulses in the XUV (extreme Ultraviolet) range as shown in Figure 5. This model presents a three-step process. Laser light has been shown in red colour. Electron being negatively charged, is attracted towards the nucleus, in the potential provided by the atom's field. In the first step, the Laser light distorts the field during its first half cycle; thereby initiating the tunnelling ionization. In the second step, electron undergoes acceleration because of the ramp-like shape of the field. However, its excitation is small enough for escaping out of the atom. In the third step, the Laser field reverses during

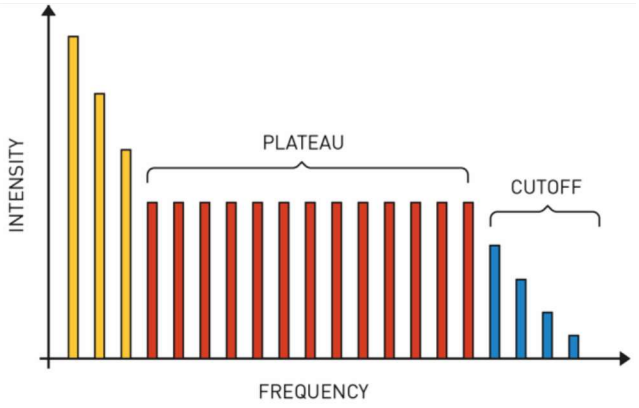


Figure 4: A generic HHG spectrum with fall-off, plateau and cutoff regions Source [4]. © Johan Jarnestad / The Royal Swedish Academy of Sciences.

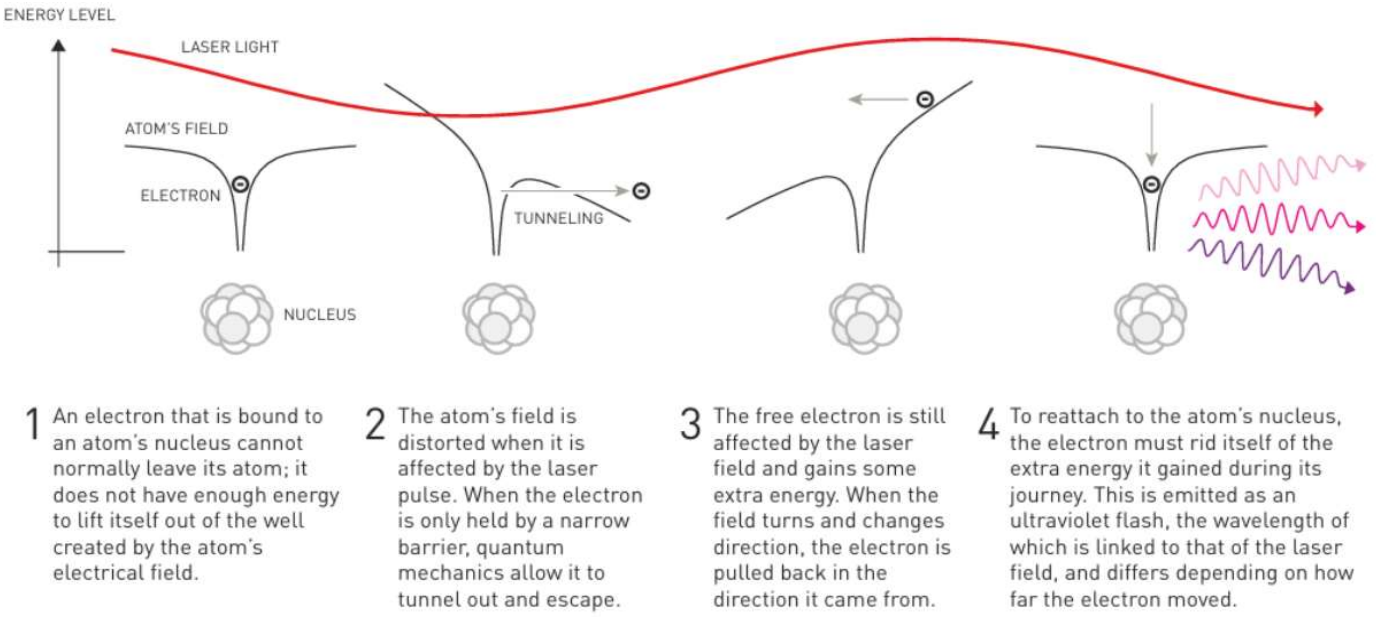


Figure 5: Rescattering model of HHG. Source [4]. © Johan Jarnestad / The Royal Swedish Academy of Sciences.

the second half cycle; hence the electron returns and recombines with the ion and gains its initial state (kinetic energy).

Thus, in the one complete cycle of the Laser light, the difference of the kinetic energy of the electron is emitted in the form of photon, which lies in XUV range [1]. These photons are termed as overtones. This finding was an extension of the understanding of L'Huillier's group about above threshold ionization (ATI), which was originally discovered experimentally by Agostini and coworkers in 1979 [7]. The understanding of HHG played a seminal role in its use for generating attosecond pulses. In year 1988, the first HHG spectra driven by IR Laser were successfully observed by L'Huillier's group at Paris – Saclay [8].

4.3 Superposition of overtones

Generated overtones interact with each other. The principle of superposition states that the intensity maximizes when overtones combine in same phases and minimizes when they combine in opposite phases. For the most appropriate condition, the overtones coincide resulting in few hundred attosecond long pulses of UV light, as shown in Figure 6.

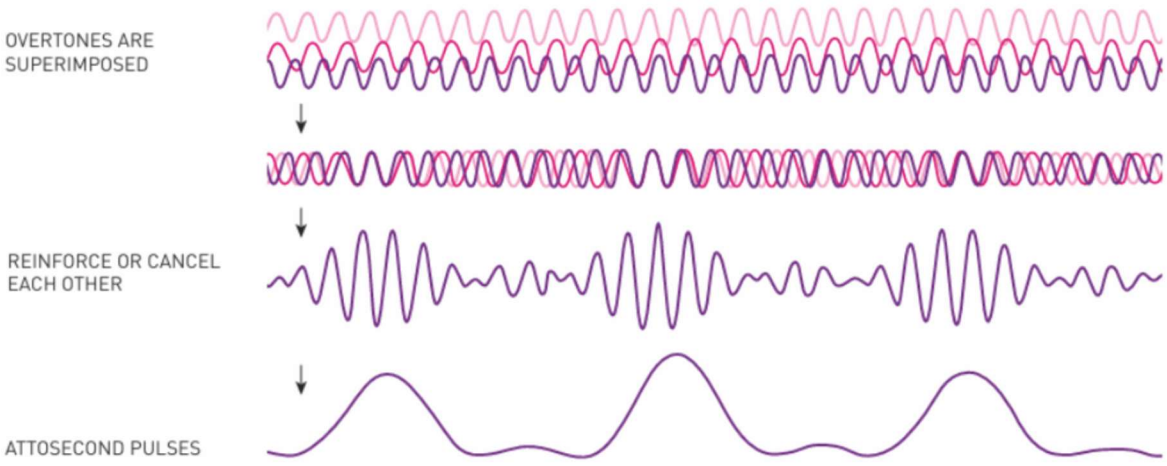


Figure 6: Superposition of overtones resulting in attosecond pulses. Source [4]. © Johan Jarnestad / The Royal Swedish Academy of Sciences.

4.4 Techniques for measurement of isolated attosecond pulses

Streaking and RABBIT are the two techniques for the measurement of photoemission time delay between different valence electrons. Both are pump – probe techniques, each utilizing phase locked IR probe pulse. In streaking, a single attosecond pulse excitation is used as a pump, while in RABBIT, attosecond pulse train acts as the source for excitation / pumping. The relative timing information between photoelectrons emitted from different initial states of the same or different atoms can be extracted using these techniques [9].

Ferenc Krausz and his group was quite actively involved in generating isolated attosecond pulses and succeeded in producing pulses of duration 650 attoseconds in their research lab in Vienna [2]. The development of technology for the measurement of the generated attosecond pulses was the next important target. They measured the time delay between the emission of photoelectrons from 2s and 2p orbitals of ionized Neon resulting in 21 attoseconds delay in the emission of 2p electron in comparison to the 2s electron. This technique of recording the photoelectron's kinetic energy as a function of the timing offset between the XUV photons and IR pulses is known as **Streaking** [10]. Figure 7 depicts the schematic of this

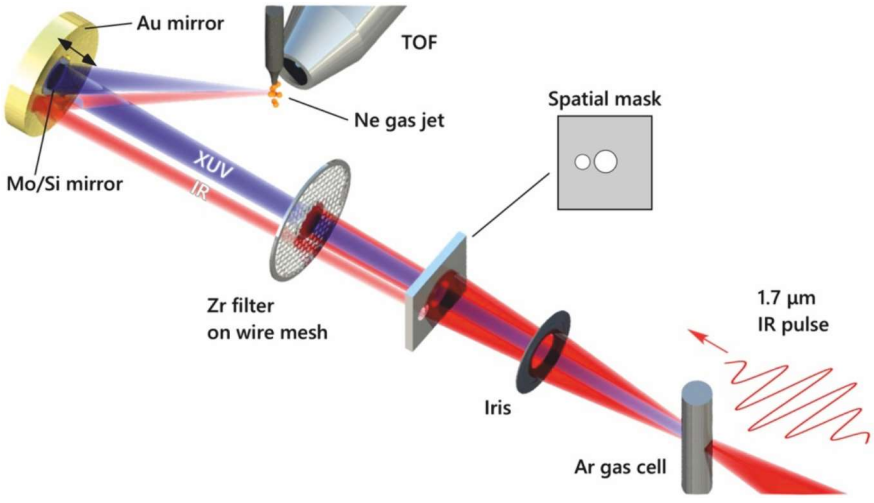


Figure 7: Schematic of instrument used for streaking. Source [11].

Streaking and RABBIT are the two techniques for the measurement of photoemission time delay between different valence electrons. Both are pump – probe techniques, each utilizing phase locked IR probe pulse. In streaking, a single attosecond pulse excitation is used as a pump, while in RABBIT, attosecond pulse train acts as the source for excitation / pumping. The relative timing information between photoelectrons emitted from different initial states of the same or different atoms can be extracted using these techniques [9].

Ferenc Krausz and his group was quite actively involved in generating isolated attosecond pulses and succeeded in producing pulses of duration 650 attoseconds in their research lab in Vienna [2]. The development of technology for the measurement of the generated attosecond pulses was the next important target. They measured the time delay between the emission of photoelectrons from 2s and 2p orbitals of ionized Neon resulting in 21 attoseconds delay in the emission of 2p electron in comparison to the 2s electron. This technique of recording the photoelectron's kinetic energy as a function of the timing offset between the XUV photons and IR pulses is known as **Streaking** [10]. Figure 7 depicts the schematic of this technique. IR pulse focussed onto Argon cell generates XUV high harmonics, which upon passing through spatial mask and filter module, separates from IR beam. The separated XUV and IR are incident upon a double concave mirror. The central part of the mirror reflects XUV and outer part reflects IR. Both are incident on the target Neon gas jet. Photoelectrons emitted from the target are measured using time of flight (TOF) spectrometer [11].

At Paris - Saclay research Centre, Agostini's group produced a train of pulses of 250 attosecond duration in year 2001 [4]. They invented **RABBIT**, an important technique for measurement of attosecond pulses. RABBIT stands for reconstruction of attosecond beating by interference of two photon transitions. In this technique, XUV pulse and light from a drive Laser are focussed onto a rare gas target. This causes emission of photoelectrons from the target, whose analysis enables the measurement of the pulse duration of a train of attosecond pulses [12]. Agostini's group used RABBIT technology to measure the attosecond pulses generated by them for the first time in year 2001 [5].

As shown in schematic in Figure 8, incident IR pulse (800 nm) moves on two paths after passing through beam splitter. A train of XUV pulses is created because generation of high harmonics, upon passing through neon gas. Overlap of IR pulse from drive Laser and XUV leads to attosecond pulse in XUV range. This attosecond pulse ionizes the target neon, which can be analysed by magnetic bottle spectrometer [13].

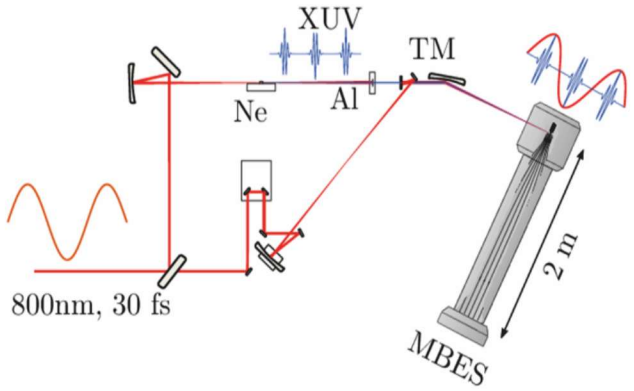


Figure 8: Schematic of instrumentation of RABBIT. Source [4]. © Johan Jarnestad / The Royal Swedish Academy of Sciences.

5. Scientific outcomes

Inception of Attosecond Physics has challenged the argument given by Werner Heisenberg about the uncertainty in the measurement of the observables [14]. Now it is possible to observe the phenomena in the laboratory with extreme precautions, beyond the uncertainty limit, which, earlier were considered to be unobservable.

The establishment of Attosecond Physics has revolutionized the role of “time” in the quantum mechanical processes. Before this, Photoelectric effect was believed to be an instantaneous effect, as there was no technique available to measure the time delay between striking of photon and emission of electron from the atom. The current study signifies the fact that photoemission is a result of complex multielectron correlations and not a single electron process [1]. Schultze et. al. performed experiments which showed

that the same ultrafast pulse results in a time delay of 20 attoseconds in the photoemission of electrons from different orbitals of the atom [15]. Reconstruction of quantum mechanical wave packets for the photoionization process is also an outcome of attosecond time delays in the emission of electrons, resulting in a new field known as attosecond photo ionization spectroscopy [16].

The ongoing constant efforts towards technological improvements in conducting attosecond time resolved experiments will pave the way to outstretch this seminal discovery from research journals to the textbooks.

6. Applications

Establishment of attosecond science, expeditiously followed by its sub-branches have propelled the nascent fields to probe into uncharted territories to understand various electronic interactions, ionization and charge transfer processes. One of the most fascinating aspects of the developed techniques for generating and measuring isolated attosecond pulses is the ability to monitor and control the quantum world on the natural time scale for electrons in various complex molecules [17]. This new science signifies the possibility of tracing precisely the distribution of electrons oscillating from place to place in molecules of the materials, which earlier could only be measured as an average [4]. This groundbreaking work has made many contributions to enrich our fundamental understandings about various phenomena and has proven to be instrumental in pushing the quantum mechanical boundaries, so far considered to be strictly hard, beyond the limits suggested by the eminent scientists of 20th century. These new Laser techniques have great potentials to bring substantial technological changes towards faster electronics, more effective solar cells, better catalysts, more powerful accelerators, new sources of energy and medicines.

References

[1] Nat. Phys. 19 (2023) 1520.

[2] M. Hentschel et al., Nat. 414 (2001) 509.

[3] 'The Nobel Prize in Physics 2018', NobelPrize.org. https://www.nobelprize.org/prizes/physics/2018/summary/

[4] 'The Nobel Prize in Physics 2023', NobelPrize.org. https://www.nobelprize.org/prizes/physics/2023/summary/.

[5] P. M. Paul et al., Sci. 292 (2001) 1689.

[6] A. L'Huillier et al., J. Phys. B: At. Mol. Opt. Phys. 24 (1991) 3315.

[7] P. Agostini et al., Phys. Rev. Lett. 42 (1979) 1127.

[8] M. Ferray et al., J. Phys. B: At. Mol. Opt. Phys. 21(1988) L31.

[9] L. Cattaneo et al., Opt. Express 24 (2016) 29060.

[10] J. Itatani et al., Phys. Rev. Lett. 88 (2002) 173903.

[11] N. Saito et al., Sci. Rep. 6 (2016) 35594.

[12] H. G. Muller, Appl. Phys. B 74 (2002) s17.

[13] C. L. Arnold et al., Photoniques S3 (2018) 28.

[14] W. Heisenberg, Z. Phys. 33 (1925) 879.

[15] M. Schultze et al., Sci. 328 (2010) 1658.

[16] Y. Xu et al., Opt. Lett. 49 (2024) 3412.

[17] F. Calegari et al., Sci. 346 (2014) 336.

Article

Revisiting the Newton's Prism Experiment

Basanta Deka
Retired Assistant Professor, Department of Physics, Handique Girls' College, Guwahati - 781001
email: basanta.deka@gmail.com

Abstract: Solar photons of different frequencies originate, propagate and fall independently on the surface of a prism in Newton's experiment to diffract differently due to frequency changes on impacting a different medium to produce the spectrum of visible light.

1 Introduction

Newton thought (1666) of 'white light being an aggregate of different homogeneous groups ' [1] and white light was split into seven colours in a simple experiment using prism to prove that 'Light consists of Rays differently refrangible' [2]. Newton further said that light consisted of 'multitude of unimaginable small and swift corpuscles of various sizes, springing from shining bodies at great distances one after another' [3]. It appears Newton thought of light as corpuscles of different energies ('sizes') moving 'great distances one after another' and each corpuscle was a ray of light. Quantum mechanics has rechristened a light corpuscle as photons. A photon of energy E is again characterised as a wave packet of center frequency E/h, h being Planck constant. On the basis of our understanding of light as photon packets a re-look at the prism experiment has become possible.

2 The Prism Experiment

Newton pierced a small hole in his lab wall, allowed rays of sun-light to fall on the surface of a prism on his table. The world saw the seven colours on the opposite wall. Light changes direction when it falls on a surface of another transparent medium . The process is known as refraction. Light from the Sun passing through the hole is 'white', which breaks up

into seven colours due to refraction when falls on a prism. When the Newton disc, with distribution of the seven colours is rotated, the seven colours merge

into 'whiteness'. It follows from the experiment that the differently refracted colours made the 'white light' Newton thought of and which fell on the prism.

3 Solar Radiation

A Sun-like star emits photons of different energies due to various interactive collisions occurring in its outermost layers. A part of the solar radiation is VIBGYOR which forms the visible range of light. We confine our attention to the solar photons reaching the Earth. Innumerable photons of different energies keep falling on an object on the Earth. The VIBGYOR photons which enter our retina decide the colour of the object we see. The brain processes the photons to enable our 'seeing' of the object. A recent experiment at Berkeley Lab [4] has shown that a photon, just one photon, initiates the process of photosynthesis in a plant. The result establishes that solar photons originate and move independently and individually. This is the core idea utilised in this re-look at the prism experiment. It appears we should use our interpreting language in terms of individual photons when we discuss decomposition of light into seven colours by a prism.

4 Possibility of a new Interpretation

The Berkeley experiment straightway takes us to probably a new language of interpretation of the experiment Newton performed. It appears that all the varieties of photons, including the VIBGYOR photons, enter individually through the small hole pierced on the wall to fall on the prism surface. When a VIBGYOR photon strikes the prism surface, a different medium, momentum of its photon wave packet is changed resulting in a new center frequency E/h. The change in momentum and center frequency leads to a new photon packet, distorted from the earlier form, causing a change in direction. The process is refraction. Different VIBGYOR photon packets deviate differently to form the spectrum of sun-light. The process of refraction is repeated on the other inclined refracting surface as the medium changes again. The seven colours leave the prism separately and form the spectrum on the screen.

5 Conclusion

The photons which originate in the Sun move independently in a narrow band through the wall-hole before falling on the prism surface. They fall individually and refract differently. The VIBGYOR photons refract twice separately to produce the spectrum of visible light.

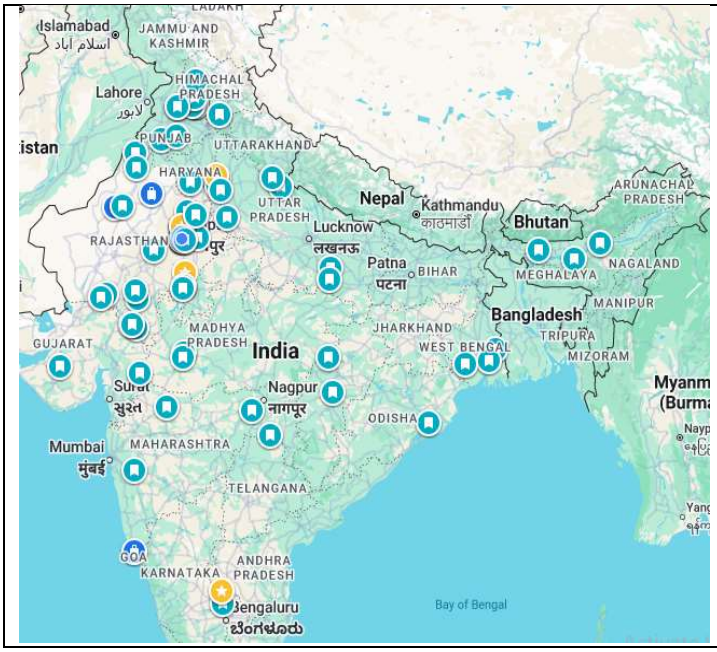
References

[1] John Fauvel, Raymond Flood, Michael Shortland & Robin Wilson: Let Newton Be, Oxford University Press, 86.
[2] ibid. [1], 87. [3] ibid. [1], 91.
[4] Quan Wei Li et al. : Single photon absorption and emission from a natural photosynthetic complex, Nature Vol 619 13 July 2023, 304.

Diamond Jubilee Calibration of IAPT Innovation Hubs in India

The journey of Innovation Hub as Science Gallery with the theme: Play Enjoy and Learn, through the innovative experimental models has started from Jaipur to HMV College Jalandhar, Punjab, in April 2018, initiated by Dr. Minakshi Siyal. In last five years, the IAPT RC-6 has taken it up to design developed and installed in over 50 institutions across INDIA.

The concept of science through experimental demonstration has been a legacy of late Prof. B L Saraf and Prof. D P Khandelwal pioneer builder of the IAPT, since 1984 and even the leading Centre for Development of Physics Education at University of Rajasthan, Jaipur has been a key source of inspiration and motivation.



Innovation Hub

We have developed over 50 working models so far and any institution can chose any 5,10,20 or 30 models to be housed in a Hall, size 500-1000 sq. ft.

A set of flexes of the fundamental discoveries and contributions of Indian scientists has been compiled and displayed.

Handouts and literature has been developed on each models with operating instructions and parameters.

All innovation hubs are personally installed, demonstrated and Training is provided to teachers for further use.

Prof. Y. K. Vijay, Director – Centre for Innovation in Science Teaching (CIST) IIS University Jaipur, has been Vice-Chancellor, Vivekananda Global University Jaipur, Professor, Department of Physics, Director, Centre for Development of Physics Education, and Director, Centre for Non-conventional Energy Resources at the University of Rajasthan, Jaipur, India. He received his M.Sc. degree in Physics and a PhD degree from the University of Rajasthan, Jaipur (India) in 1975 and 1980 respectively. He has spent one year at Uppsala University Sweden. Prof. Vijay is a passionate science teacher who has led the development of many innovative working models for teaching and learning Physics through simple instruments as INNOVATION HUB.

All the models of innovation hub are fabricated by Mr. K C Sharma, Retd. From CDPE.

The List of Innovation Hubs installed at different institutions includes, Government and Private Schools, Colleges, universities, IISER, IIEST, IIT and Science Museum and Adventure Parks.

1. Vivekananda Global university Jaipur
2. Hans Raj Mahila Maha Vidyalaya Jalandhar
3. SV Public School Jaipur
4. Rani Laxmibai Mahila Mahavidyalaya Parola Jalgaon
5. Amity University Noida
6. Govt. College Kota
7. Kanya Mahavidyalaya Jalandhar

8. Regional Institute of Education, Bhubaneswar
9. Bajaj Science Centre Wardha
10. GLA University Mathura
11. University of Kota, Kota
12. IIS University Jaipur
13. Anaveshika Jaipur
14. SS Jain Subodh College Jaipur
15. Amit University Jaipur
16. Pune University Pune
17. Scince Park Chandarpur
18. Regional Institute of Educaation, Ajmer
19. Bansur PG College Bansur (Alwar)
20. Pryan Innovation Sanganer Jaipur
21. DAV Collge Bathinda
22. Amity University Raipur
23. Rawat Public School, Pratap Nagar Jaipur
24. Ben Hur Public School Pilibhit UP
25. Adventure Park, New Kufri, Shimla
26. Midnapore College, Midnapore, WB
27. SD College Barnala Punjab
28. Govt Model Sr Dec School, Thana Kalan HP
29. DPS School, Rudrapur Uttrakhand
30. Dr H N Regional Science Centre Hosur, Karnataka
31. IIS School Sitapura Jaipur
32. IISER Kolkata, West Bangal.
33. Sri Vaishnav Vidyapeeth University Indore MP
34. IPS Academy, Khandawa road, Indore Madhya Pradesh Mahrawal
35. Government Sr. Sec. School, Dungarpur, Rajasthan
36. Veer Bala Government Girls College, Dungarpur
37. Guru Nanak Public School, Ballarsha, Maharashtra
38. Marwadi University, Rajkot, Gujarat
39. Maharani College Jaipur
40. Government Senior secondary school, Charatgarh HP
41. Government Senior secondary school, Basderah
42. IIIT Allahabad Prayagraj Uttar Pradesh
43. Government Model Senior Secondary School, Amb HP
44. Government Model Senior Secondary School, Mubarikpur HP
45. Government Model Senior Secondary School, Saloh, HP
46. Government Senior Secondary School, Takoli, HP
47. Government Senior Secondary School, Dhundala, HP
48. Government Senior Secondary School, Kangar, HP
49. Government Senior Secondary School, Pubwal, HP
50. Government Senior Secondary School, Samoor Kalan, HP
51. Government Senior Secondary School, Basal, HP
52. Government College, Dharmshala Himachal Pradesh
53. Indian Institute of Engineering Science and Technology, Shibpur, Kolkata WB
54. Inter University Accelerator Centre, New Delhi
55. JDB Government College, Kota rajasthan
56. NVD Govt. Model School, Jaipur
57. Eklavya Model Residential School, Kawant, Gujrat.
58. PM Shri Navodaya School, Khelri, JNV Dausa, Rajasthan
59. PM Shri Navodaya School, JNV Patan, Rajasthan
60. Central University of Haryana, Mahendragarh, Haryana
61. VARDHAMAN International School, Manarovar, Jaipur Rajasthan
62. Narayana Education Ecnter, Jaipur Rajasthan
63. PM Shri Navodaya School, JNV Shri Ganganagar, Rajasthan
64. PM Shri Navodaya School, JNV Suratgarh, Rajasthan
65. Rainbow International School, Dharmshala HP
66. South Point School, Guwahati, Meghalaya
67. PM Shri Navodaya School, JNV Banswara, Rajasthan
68. PM Shri Navodaya School, JNV Dungarpur, Rajasthan
69. PM Shri Navodaya School, JNV Mavli, Rajasthan

70. PM Shri Navodaya School, JNV Rajsamand, Rajasthan
71. PM Shri Navodaya School, JNV Bhilwara, Rajasthan
72. PM Shri Navodaya Schooli, JNV Pratapgarh, Rajasthan
73. PM Shri Navodaya Schooli, JNV Sirohi, Rajasthan
74. PM Shri Navodaya Schooli, JNV Jalore, Rajasthan
75. The Riverside School, Ahmedabad, Gujrat.
76. Government Sr. Sec School, Chhoti Sadri, Pratapgar, Rajasthan
77. Chaudhary Bansi Lal University (CBLU), Bhiwani, Haryana
78. Centre for Education and Technology for Education (CETE) IIT Jodhpur Rajasthan
79. Manipal University Jaipur, Rajasthan
80. Professor Rajendra Singh Science Exploratory, Nagpur Maharashtra.
81. Bodoland University, Kokrajhar, Assam.

Y. K. Vijay

Report (RC – Kerala)

Rainbow to Quantum – The Story of Light

Kerala RC organised a program titled "Rainbow to Quantum – The Story of Light", at GHSS, Kannur, Kerala, a school known for its international-standard infrastructure and modern teaching facilities. The program was conducted on 27-08-2025, from 10:00 AM to 1:00 PM for 9th standard students. It was inaugurated by Mr. Manoj Kumar M, Principal and presided over by Mrs. Ramlath Beevi, Head Mistress, with coordination by Mr. Firdouze COT. The event featured expert guidance from Dr. K M Udayanandan, Mr. M C Linu Kumar, Dr. Nishanth P, and Mr. Ajith Kumar, and aimed to take students on an engaging journey exploring light—from classical phenomena to cutting-edge quantum applications.

The session began with an introduction to the fundamental properties of light, emphasizing that, unlike biology or chemistry, light cannot be studied directly and must be understood through its observable effects. Students performed hands-on experiments on reflection and refraction using mirrors and glass slabs. To demonstrate lateral inversion, the letter 'F' was used, and students applied the law of reflection to observe that the image is laterally inverted—a direct consequence of law of reflection. The wave properties of light were then explored, including interference and diffraction. After the demonstration of interference in a soap bubble, a lively discussion ensued. A question was asked, "How many colours can we see?" Initially, many answered "7," but upon closer observation under light, students realised that some colors were missing, illustrating destructive interference. This sparked further discussion and questions, reflecting the students' deep engagement and curiosity.

K M Udayanandan

Report (RC – 17)

Celebration of the International Year of Quantum Science and Technology

The United Nations has declared 2025 as the **International Year of Quantum Science and Technology (IYQ 2025)** to commemorate 100 years of quantum mechanics. To mark this occasion, the Department of Physics and the Internal Quality Assurance Cell (IQAC) of Dera Natung Government College (DNGC), Itanagar, Arunachal Pradesh, in collaboration with, RC-17, organized an invited talk and a quiz competition for B.Sc. students on **23rd September 2025**.

The invited talk, titled *"Quantum Information and Computing: A Brief Overview"*, and the quiz competition were conceived and coordinated by Dr. Bandana Gogoi and Dr. Nabaratna Bhagawati of the Department of Physics, DNGC.

Dr Gogoi, Head of the Department of Physics, delivered the welcome address and spoke about the significance of IYQ 2025. The Chief Patron of the programme, Dr. M. Q. Khan, Principal of DNGC, addressed the gathering, highlighting that this is the age of information and computing, and that everyone should engage with its advancements.

The highlight of the programme was the invited talk by Dr. Arnab Chakrabarti from the Department of Physics, Rajiv Gandhi University, Doimukh. Dr. Chakrabarti explained the complex concepts of quantum information and computing with remarkable clarity and ease. He also emphasized the transformative potential of quantum computing in shaping a data-driven future.

A large number of students from various science departments of DNGC participated enthusiastically in the quiz competition, which was conducted by Dr. Tarh Achi and Dr. B. K. Mishra, both from DNGC. The event was also graced by the IQAC Coordinator and Heads of the Science Departments.

The programme concluded with a vote of thanks by Dr. Nabaratna Bhagawati, followed by the distribution of prizes to the quiz winners

Bandana Gogoi

Report (RC – 15)

International High School Teacher Programme (HST 2025) at CERN, Geneva, Switzerland

The CERN High School Teacher (HST) Programme 2025 was held from **6–19 July 2025** at the European Organisation for Nuclear Research (CERN), Geneva, Switzerland. Since its inception in 1998, this prestigious residential programme has provided opportunities for high school science teachers

worldwide to deepen their understanding of modern particle physics, explore innovative teaching resources, and foster international collaboration in science education.

This year's programme brought together forty-seven teachers from thirty-six countries. I had the privilege of representing **India**, along with another assistant teacher from Bengal. In addition, I was honoured to represent the **RC-15**, as well as my institution, **Anandapur High School, Paschim Medinipur, West Bengal**.

The two-week programme offered a balanced mix of lectures, laboratory visits, workshops, and discussions. The lecture series covered the Standard Model of particle physics, detector technologies, accelerator physics, data analysis techniques, and ongoing developments such as dark matter searches and neutrino experiments. Sessions also explored pedagogical strategies for introducing these advanced topics into school curricula. For instance, simplified approaches to Feynman diagrams and hands-on demonstrations with low-cost materials were highlighted as ways to make particle physics accessible to students.

Practical learning was central to the programme. Visits to major CERN facilities—including ATLAS, CMS, the Synchrocyclotron, and the CERN Data Centre—offered first-hand exposure to the scale and complexity of modern experiments. A visit to the Antimatter Factory provided insights into experiments designed to study antiprotons and antihydrogen, including future tests of gravitational behaviour. These visits are linked directly to school-level teaching themes such as electromagnetic fields, conservation laws, and nuclear processes.

A hallmark of HST2025 was the study group project work. Participants were organised into small, internationally mixed teams to develop projects connecting CERN's research themes with classroom teaching. Over the two weeks, groups met regularly to exchange ideas, refine resources, and prepare final outputs. The programme concluded with a plenary session in which each group presented its work before peers and CERN scientists. These presentations were recorded and archived, ensuring wider access for the teaching community.

The academic content was complemented by social activities designed to foster intercultural exchange. Activities such as *exploring CERN* through a treasure hunt, a guided tour of Geneva, an international gift exchange in traditional attire, and the screening of the documentary *Particle Fever* all contributed to building networks of trust and collaboration.

From a pedagogical perspective, HST2025 addressed the central challenge of how to make abstract and mathematically demanding ideas accessible to students. Workshops demonstrated that even everyday materials—such as dry ice, alcohol, and simple containers—can be used to build a functioning cloud chamber, allowing students to observe cosmic ray tracks directly. Similarly, analogies and metaphors were recommended to communicate complex ideas, such as the Higgs mechanism or detector operations, in ways that school students can grasp.

The closing ceremony on **18 July 2025** celebrated the achievements of all participants and reaffirmed the role of teachers as ambassadors of science. For us from India, the experience was profoundly enriching. Engaging with frontier science at CERN, learning from world-class researchers, and collaborating with peers from diverse educational contexts has expanded our teaching repertoire. Most importantly, it has strengthened our ability to inspire students—whether in rural or urban schools—to appreciate particle physics as a living, evolving science. The continued success of the CERN High School Teacher Programme lies in its capacity to combine rigorous science with innovative pedagogy and to create a global community of educators committed to science literacy. As the sole representative of **IAPT RC15** and a teacher at Anandapur High School, I consider it a privilege to have participated in this programme and to share the knowledge, experiences, and teaching strategies I gained with my colleagues and students.

Sanjoy Kumar Pal
Anandapur High School, Paschim Medinipur, West Bengal, 721122, India
Email: sanjoypal83@gmail.com

Report

Minutes of the IAPT Central Online EC Meeting, June 22, 2025

A Joint meeting of current and the former EC members was conducted.

Following members were present:

1. Prof. P. K. Ahluwalia, President IAPT
2. Prof. Rekha Ghorpade, General Secretary, IAPT
3. Prof. Prof. Meenakshi Sayal, Vice President North Zone
4. Prof. Ranjita Dekha, Vice President East Zone,
5. Prof. Y. K. Vijay, Vice President West Zone
6. Dr. V. Rajeshwar Rao, Vice President South Zone
7. Prof. Vipul Rastogi, Vice President Central Zone
8. Prof. P.C. Deshmukh, Vice President, General
9. Prof. Neetu Verma RC 02
10. Dr. Sheoji Singh RC 03
11. Prof. Sunder Singh RC 04
12. Prof. P.P. Pathak RC 05
13. Prof. Y. C. Sharma RC 06
14. Prof. Chetan Limbachia RC 07
15. Dr. Shivanand A. Masti RC 08
16. Prof. Uttam Sharma RC 09
17. Prof. A. K. Srivastava, RC 10
18. Prof. Madhurima, RC 13
19. Prof. K. M. Udayanandan, RC 14
20. Dr. Makhanlal Nanda Goswami, RC15
21. Dr. D. K. Bisoyi, RC 16
22. Dr. Kalipada Adhikari, RC 18
23. Dr. Rishi Sharma, RC 20
24. Dr. Dinesh Sharma, RC 23
25. Prof. B.P. Tyagi, CCE
26. Prof. Vijay Singh, Ex-officio member
27. Prof. K. N. Joshiipura, Ex-officio member
28. Dr. Sanjay Kr. Sharma, Secretary
29. Dr. D.C. Gupta, Treasurer

Invitees/Coordinators:

30. Prof. Geetha R. S.- NCIEP
31. Prof. Pradipta Panchadhyayee – NCICP

32. Prof. Govinda Lakhotia, NPECP
33. Prof. Raghavendra M. K. (On behalf of Prof. Achutha B. S. JSO-Cell)
34. Prof. Reshma Raut Desai, Convenor, 39th annual convention, Goa(RC-21)

Former EC members (Invitees)

35. Prof. Bhupati Chakraborty
36. Prof, P. Nagaraju
37. Prof. M. S. Jogad
38. Prof. C. N. Kumar
39. Prof. Swapan Majumdar
40. Prof. Vandna Luthra
41. Prof. P. K. Dubey(Coordinator-NGPE)
42. Mr. Vinod Prajapati (IAPT Office)

1. Welcoming the New and the previous members of Central Executive Council (2025-27):

Prof. Rekha Ghorpade. GS IAPT welcome all the members present in an online meeting and requested Prof. P. K. Ahluwalia to accept the chair. On his acceptance the proceedings of the meeting have started.

2. To read and confirm the minutes of previous meeting: The minutes of the meeting held on October 15, 2024 were read and confirmed by all the members.

3. Report on activities by Central IAPT (November 2024-May 2025) by GS:

Prof. Rekha Ghorpade presented a comprehensive report of the activities of Central IAPT. She updated the members on the following:

- IAPT Election process for the term 2025-27 was completed in December 2024. She expressed the sincere gratitude to prof. P. D. Lele, the Returning Officer, IAPT for completing the task well in time and also thanking members of SRC 08B(Mumbai), Prof. Sanjay Sharma and the central office Kanpur.
- 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 a effective manner.
- **IAPT-JSO Cell:**

  IJSO-2024 was held at Bucharest, Romania (December 01-10), 2024.

  Indian team won all **6 Gold Medals, 4 subject Medals and the Country Winner Trophy.**

  Detailed report on Activities of JSO cell was presented by Prof. Raghavendra, Subject coordinator (Physics) on behalf of Prof. Achutha B. S., Coordinator, JSO Cell.
- **IAPT-APhO Cell:**

  Indian Team participated in APhO-25 at Saudi Arabia and won **2 Silver Medals, 4 bronz 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 IYQST-2025:

a) 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). Sincere gratitude to Prof. A. G Kulkarni, Prof Sarmishtha sahu and other members.

b) Webinar Series by Central IAPT and Regional Councils:

January 2025: Curtain Raiser by RC 07 (Gujrat)
February 2025: RC 14 (Kerala)
March 2025: RC 22 (Telangana)
April 2025: RC 06 (Rajasthan)
May-June 2025: RC 15 (WB)

- Important Meetings:

  Zonal Vice Presidents (February 18, 2025)
  Finance Committee (April 20, 2025)
- **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
- NSE and NGPE were successfully completed as

per the schedule.

Detailed report by Prof. B. P. Tyagi, CCE

Our sincere thanks to Prof. B. P. Tyagi, CCE and the Exam teams.

- **IAPT Anveshika Bharat Yatra** with the guidance from Prof. H. C. Verma, Coordinator, NANI is on its way…

  Yatra started in Jammu & Kashmir, now in Himachal Pradesh.

- **NASNI (National Astronomy Network of India)**

  A new Initiative started by RC 23 (H.P.) under the coordinator ship of Prof. Hemant Kumar and the team of dedicated IAPT members.

  Along with many Astronomical activities, NASNI organizes a guest lecture on first and third Wednesday of every month.

- **IAPT-NDLI Agreement:**

  IAPT will sign the MoU with NDLI(National Digital Library of India).

  All the issues of IAPT bulletins (right from 1984) will be uploaded in the repository of NDLI.

  Sincere thanks to Prof. Bhupati Chakraborty for taking the lead and following it up.

- **GIREP-EPEC-2025 Conference:**

  Prof. P. K. Ahluwalia, President IAPT will attend the conference online, organized in Leiden, The Netherlands from June 30 to July 2025.

  Best wishes to him on behalf of IAPT.

  He will also sign IAPT-GIREP agreement on July 1, 2025.

- **ICPE-2025:**

  The International conference in Physics Education will be organized at IIT Roper with IAPT & IISER Mohali as cohosts, in December 2025.

- **Prof. R. M. Dharkar Memorial Workshop on 'Designing and Analyzing Cognitively Aligned Question Items for Quality Driven Assessment in Physics'** is organized from June 23 to July 07, 2025, every day from 5:00pm to 7:00pm 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.

4. Filling of coopted positions in EC:

Prof. Ahluwalia proposed 3 names; 1) Prof. C. K. Ghosh, 2) Prof. S. W. Anwane & 3) Prof. Vandna Luthra. Prof. Rekha G. seconded and all the members approved these names.

5. Announcement of names of members who have been identified for certificate of Appreciation and gratitude.

President and GS felt that there are coordinators of various competitions, examinations and programs whose contribution to IAPT needs to be acknowledged and appreciated. It is decided that these members will be awarded a certificate during an annual convention or in a function online. The list is getting ready and will be published soon. Honorable members are requested to suggest names for the same.

6. Updates:

i. On accounts and Budget (2024-25 & 2025-26):

Prof. Sanjay Sharma, Prof. D. C. Gupta and Mr. Vinod Prajapati.

Highlights of the Presentation:

- Expenditure on bulletin is reduced considerably. Prof. B. Chakraborty appreciated it. Prof. Ahluwalia added, all the members can help us in updating the profiles which will reduce the expenditure still further. Dr. Vandna suggested, RCs should be motivated to conduct GBM which will enhance the connectivity with the members.
- It was reminded that the online election process be initiated.
- Expenditure against proposed budget under various heads was discussed and the members approved the budget for the next FY2025-26.
- It was conveyed to the members that as per the guidelines from IT department, Central office and RCs must spend at least 85% of the amount in their respective accounts. Else seed money due to them in subsequent financial year may not be

disbursed.

- Seed money to RCs has been disbursed for those whose audited statement of accounts are received.
- EC representatives of RCs whose audited accounts are not received were requested to do the needful.
- President appreciated RC 21 Goa for being very active and organizing the regional convention every year in spite of very small amount of seed money is given from central IAPT, as they generate funds from other resources,
- The Income-Expenditure document along with the audit report will be published in the bulletin after completion of Audit.

ii. Examinations: Prof. B. P. Tyagi, CCE:

The National Standard Examination 2024 (NSE 2024) was successfully conducted at 1,477 centers across the country and 2 centers overseas, with a record enrollment of 2,07,834 examinees (NSEP: 58403, NSEC: 51647, NSEB: 35195, NSEA: 18918, NSEJS: 43671). The examination was postponed in NCR due to Supreme Court orders, but was rescheduled and completed by MetaI Technologies. The final results were declared on December 29, 2024, with 2,51 students shortlisted for INPhO Group A, 201 for INPhO Group B, and similar numbers for other subjects. A new high school science examination was announced for 2025, aimed at students in classes 10 and below, with equal weightage for biology, chemistry, mathematics, and physics.

NGPE-2025: Report by Prof. P. K. Dubey:

The exam was conducted on January 19, 2025 at 161 centers in the country with 3680 student enrolment. The exam has two Parts A & B.

The top 25 students from Part B were shortlisted for Part C, which was conducted at the Indian Institute of Engineering, Science and Technology, Sipur, with generous support from the director. CCE expressed sincere gratitude to the Director of IIEST. Also,thanks to Prof. Panchadhyayee and his team from RC 15 for excellent experimental set ups.

The meeting highlighted the need to promote NGPE enrollment, especially in light of the new education policy and declining student participation. Suggestions were made to create a bursary for students from rural backgrounds, document experimental setups, and improve communication through a centralized website and email outreach. In this discussion we place on record the extraordinary efforts by Prof. H. C. Verma to support 170 students to appear for NGPE by paying their registration fees, almost more than Rs. 40000 from his pocket. Prof. Tyagi expressed heartfelt gratitude to him. A brainstorming session was proposed to address the declining enrollment in NGPE. Prof. Ahluwalia suggested that the documentation of the experiments of NGPE part-C must be done and the documents should be made public.

iii. Competitions:

a) NCEWP - Prof. S. K. Joshi (Invitee), coordinator could not attend the meeting, he sent his report and was read by GS. He informed that the announcement was published in the January 2025 issue of the bulletin. He appealed that all the EC members can make the publicity of the competition.

b) NCIEP - Prof. Geetha R. S. (Invitee): She informed that the announcement of the competition was made in May and again in the June issue of the bulletin. She has made a short ppt which can be used by anyone who wants motivate teachers and students to participate.

c) NCICP - Prof. Pradipta Panchadhyayee (Invitee): He made a ppt explaining the objective, deadline and the conduct of competition. It involved online interaction with the experts, final submission, presentations and interaction for evaluation. Project demonstration will be during annual convention at Goa. The Expert Evaluators were: 1) Dr. Abha Khandelwal 2) Prof. Ananda Dasgupta 3) Prof. S. Minhaz Hossain 4) Dr. Jagdish Kumar.

d) NPECP: Prof. Govinda Lakhotia (Invitee), coordinator presented the report. He informed that there were 115 participants from all the categories and the panel of 8 judges evaluated the Photo essays. Valedictory function and the prize distribution was organized in an online mode on April 21, 2025. President and GS attended the function. All the essays are uploaded on the website.

e) NYPT: Mr. Gyaneshwaran (Invitee) presented the

Indian National Young Physicists' Tournament (INYPT), a competition aimed at nurturing curiosity and experimental research skills among students. He highlighted its format, which mirrors the International Young Physicists' Tournament, and emphasized its success in developing critical skills despite being a long and challenging process. Participants discussed the need for more volunteers to manage the program and suggested involving other organizations to expand its reach. The conversation ended with a request for finding dedicated individuals to take over the INYPT program, as Gyaneshwaran is currently unable to continue due to health issues.

iv. NSSP:

Prof. Ranjita Deka (Invitee), coordinator reported that the NSSP-2024 was organized by RC17between October 12-14, 2024 at USYM, Meghalaya. Total 88 students from across the country participated. There were 20 oral and 23 poster presentations. 7 distinguished speakers were invited. Prof. Ahluwalia, president was also one of the speakers. He emphasized India's role in creating forums like NSSP to nurture budding physicists. The event also featured Institutional visits, Sky observation and 5 technical sessions. Prof. Ahluwalia appreciated the overall organization of NSSP and congratulated the entire team from RC17 under the leadership of Prof. Ranjita.

v. APhO:

Prof Vijay Kumar (Invitee), coordinator could not attend the meeting.

vi. JSO:

Dr. Raghavendra, subject coordinator(Physics) presented the report on behalf of Prof. Achutha B. S. (Invitee), coordinator, JSO Cell. He gave an overview of the JSO Cell activities viz. RGCs(for INJSO, OCSC), Exposure camp, OCSC and PDC. He acknowledged the contributions from IAPT members for paper setting, evaluation, Experimental designing and standardization etc. Prof. Ahluwalia appreciated the efforts and the quality of work that JSO cell has done. He expressed the gratitude to Vidya Vardhaka Sangh, Bengaluru for taking the initiative to set up the JSO cell and providing the necessary infrastructure. He suggested that the video must be made and uploaded on IAPT YouTube channel, which was accepted by Prof. Raghavendra.

vii. NANI: Prof. H. C. Verma/ Anveshika Bharat Yatra & Anveshika Buzz: Report by Prof. Dinesh Sharma:

Prof. Verma Could not attend the meeting, detailed report for NANI was not available. Prof. Dinesh briefed about Anveshika Physics Bharat Yatra (APBY). He informed the idea was to unite IAPT community through Anveshika Coordinators and also to bridge the gaps between 31 Anveshikas in the country. The yatra started from Udhampur in J & K on 26th May 2025 and now it is in H P. It will travel through all the states and culminate in Kerala. The Yatra has the guidance from Prof. H. C. Verma, coordinator, NANI. Reprts on programs in every state will be uploaded on the website.

7. Report on the bulletin, its email reach and information about signing of the MoU with National Digital Library IIT Kharagpur: Prof. Bhupati Chakraborty: Prof. Bhupati Chakraborty briefly informed about it in the meeting.

8. Report on status of Rejuvenation of IAPT Physics Education Journal: Prof. O. S. K. S. Sastri: Prof. O. S. K. S. Sastri could not attend the meeting, President informed the members that work is in progress and soon we will see Physics education journal in a new avatar. Team is working hard.

9. Update on IAPT-GIREP agreement signing on July 1, 2025 & ICEP-2025: Prof. P. K. Ahluwalia informed the honorable members about these two international outreach initiatives of IAPT and hoped that these will greatly enhance the presence of IAPT members and contribution in the international community of physics educators. He specially emphasized the participation of IAPT members in ICPE 2025, a rare opportunity which has come to India after a gap of 20 years. He especially thanked Prof. Arun Grover, IUPAP C14 Commission on Physics Education member for making a consistent effort for bringing this event to India and giving IAPT a key role in its success.

10. Update on 39th Annual Convention of IAPT from RC 21(Goa)

Members expressed happiness on holding the convention at Goa. Goa Regional Council is on the

job and hopes to provide a wonderful experience both academic and sightseeing across this beautiful state. Dr. Reshma Rawat Desai RC general secretary and convener has already published a first circular in the bulletin. EC members, Zonal Vice-presidents and central vice president were requested to come to goa to feel the pulse of IAPT and be present their for an offline interaction for carrying forward the agenda of IAPT.

11. Any other matter with the permission of the chair. None was raised.

12. Address by the President, Prof. P. K. Ahluwalia:

Prof. Ahluwalia thanked all the members of past EC and the new members for their hard work which is now visible in various activities of the IAPT and emergence of young active volunteers on the IAPT horizon. He commended the new initiative by the members of the IAPT in providing a broader bouquet of activities in the form of well-knit networks inspired by NANI. He reminded the members that RC's are the neural network of IAPT and if it remains active visibility of IAPT gets enhanced. He exhorted members to regularly visit the website which is 24x7 dynamic window of the activities of IAPT and its ten thousand plus strong members. He also thanked the central office team for their effort in streamlining various processes in the central office and remaining continuously in touch with the community, especially office bearers of Regional Councils.

13. Vote of thanks: Meeting ended with thanks to the chair and honorable members by Prof. Rekha Ghorpade, GS

Rekha Ghorpade
GS, IAPT

Report (RC-07)

One-Day Seminar
"Quantum Reflection: Celebrating the Past, Inspiring the Future"

As a part of the celebration of the International Year of Quantum Science and Technology (***IYQ-2025***), the Physics Club of the Sir P. T. Sarvajanik College of Science, in collaboration with RC-07, organized a one-day seminar titled "*Quantum Reflection: Celebrating the Past, Inspiring the Future*". The event was held with the aim of inspiring young learners through the legacy of quantum science while exploring its modern-day applications and prospects.

The seminar commenced with a welcome address by the Principal Dr. Pruthul Desai, who highlighted the importance of celebrating the International Year of Quantum Science and Technology and encouraged students to actively participate in such academic platforms.

Session I: Expert Talk

The inaugural session featured an expert talk by Prof. Debesh Roy (SVNIT, Surat). His lecture provided a comprehensive journey from the classical to quantum theory, helping participants understand the historical transition that shaped modern physics. He elaborated on the fundamental postulates and hypotheses of quantum mechanics, clarifying the conceptual foundations of the subject. The talk concluded with a discussion of advanced applications of quantum science, including quantum computing, quantum communication, and emerging technologies. The session was highly engaging and helped students connect theoretical principles with practical innovations.

At the end of the session, a lively question–answer round was conducted, during which students posed several thought-provoking questions. Prof. Roy patiently addressed each query, offering clear explanations and valuable insights. This interactive exchange made the session even more interesting and intellectually stimulating for the participants.

Session II: Poster Presentation Competition

The second session was dedicated to a Poster Presentation Competition on the theme "Quantum

Science and Technology." A total of eight posters were presented, both individually and in teams. The participants showcased innovative ideas and their understanding of quantum concepts through creative visual presentations. The posters highlighted topics such as quantum computing, quantum science-whisper to stellar roar, and Quantum Timeline, demonstrating the enthusiasm and curiosity of the young participants.

Session III: Quiz Competition

The final session of the seminar was a Quiz Competition based on the same theme. A total of 17 teams participated in the elimination round, from which 5 teams were selected for the final competition. The final consisted of six engaging rounds, including Rapid Fire, Audio-Visual, Nobel Prize Round, and other concept-based challenges. The quiz created an exciting and competitive atmosphere, testing participants' depth of knowledge while also entertaining the audience.

The seminar concluded on an enthusiastic note, with students and faculty appreciating the diverse sessions that offered both knowledge and skill-based exposure. The event not only celebrated the contributions of quantum science in the past but also motivated the participants to envision its future potential.

The one-day seminar, with its blend of expert discourse, student-led poster presentations, and a stimulating quiz competition, successfully achieved its objective of making the celebration of IYQ-2025 memorable and impactful for the college community.

Nisha Patel

Report (Ammani Anveshika)

Anveshika Physics Bharat Yatra-
Ammanni Anveshika Pathfinder Bharat Yatra (APBY)

Jagruta Jatra – Day 3

Venue: JT College, Gadag

Date: 29 Aug 2025, 10:00 am - 4:30 pm
Participants: UG & PG students, faculty, IQAC coordinators, and guests

Theme: Awakening Curiosity through Physics – **A Warm and Thoughtful Beginning**

The day began with a heartfelt gesture from the boarding students, who formed a welcoming team and received the APBY representative at the station. Their attention to comfort and logistics set the tone for a day rooted in care and collaboration. Even senior faculty and HODs joined early to ensure a smooth start—reflecting the deep respect for the initiative.

Inaugural Ceremony at the Pride of Gadag

JT College, the oldest and most reputed institution in the region, hosted the event amidst a sprawling campus shared by schools, colleges, and technical institutes—a true educational hub of rural Karnataka.

- The Principal personally welcomed the guest and engaged in a meaningful breakfast conversation about Prof. H.C. Verma and the APBY.
- The auditorium was filled with eager UG and PG students, ready to absorb and engage.

- The **Mashaal of APBY** was ceremoniously lit by the Principal, symbolizing the ignition of curiosity and inquiry.
- A digital poster unveiling followed, showcasing the yatra's theme and upcoming events.
- The **APBY anthem**, tailored to student aspirations, was sung in harmony—an emotional and unifying moment.

Presidential Address: A Physicist's Call to Awaken

Principal Prof. P.G. Patil delivered a stirring address, urging students to pursue curiosity relentlessly. He shared:

- The inspiring story of Prof. Verma's scooter rides and his generous donation of royalties from *Concepts of Physics*—a testament to selfless dedication.
- A journey through physics history: from Newton's corpuscular theory to Huygens' wave theory, Einstein's quanta, and de Broglie's duality—each a product of curiosity.

Prof. Rajkumar Badiger, the senior most Prof, at the heart of the event, reinforced the message: **Physics becomes interesting when we take interest.**

Hands-On Challenges: From Shyness to Spark

The interactive segment saw students—especially rural girls—overcome initial hesitation and dive into physics challenges with enthusiasm.

- Over **10 challenges**, 10 live demos, and many activities transformed abstract concepts into tangible experiences.
- Students tackled puzzles, explored principles, and engaged in collaborative problem-solving.
- Hunger couldn't dampen their spirit—their engagement was unwavering.

A Taste of North Karnataka

A traditional lunch of **jowar roti**, homemade curries, chutney powder, and fresh salad nourished body and soul. Students returned to the auditorium with renewed energy and charm.

Learning by Doing: The Puzzle Room

The afternoon session turned into a vibrant lab of ideas:

- Students designed units, debated layouts, and tested hypotheses.
- The final puzzle, crafted by JT College juniors, showcased teamwork, creativity, and scientific reasoning.
- Their names deserve a place on the honor roll—symbols of budding inquiry.

Conclusion: Lighting the Path of Inquiry

The APBY Mashaal lit more than a flame—it ignited minds. For the 200 students present, it marked the beginning of a journey toward curiosity, inquiry, and skill-building.

JagrutaJatra – Day 4

Venue: P C Jabin Science College, Hubballi
Occasion: Anveshika Physics Bharat Yatra (APBY)

The day began with a heartfelt welcome to the Mashaal and the APBY navigator. A ceremonial lighting of the Mashaal and the release of a commemorative poster—led by students and staff—set the tone for the day. Dignitaries including the Principal, IQAC Coordinator, and HOD of Physics graced the occasion..

The Principal's address beautifully framed the vision and grassroots impact of APBY, highlighting its role in connecting students to the broader scientific community across Karnataka.

Technical Session: "Doing Activity Beyond Textbooks"

Students were reoriented into collaborative groups of 6–8, diving into hands-on conceptual challenges. Each group brainstormed, analyzed, and iterated through problem-solving steps.

The collective achievement was celebrated with a shared moment over badam milk—symbolic of the warmth and camaraderie fostered throughout the session.

NAEST & LEPTON: A Glimpse into Joyful Science

The next segment introduced students to the excitement of NAEST and LEPTON. A video quiz was launched via QR code, encouraging students to observe, interpret, and make thoughtful choices.

While some students left due to fatigue, those who stayed till the end expressed genuine appreciation and gave enthusiastic feedback.

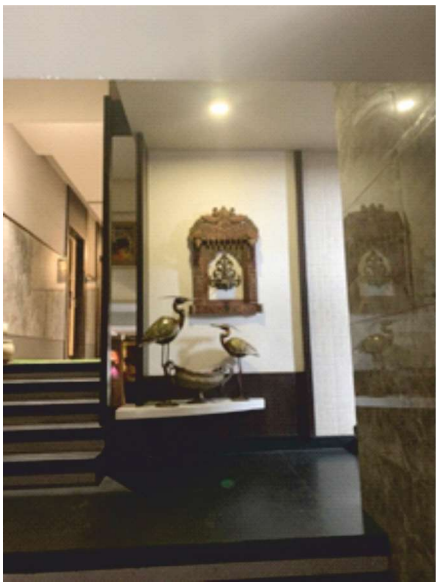
Looking Ahead: Sustained Collaboration

The Physics Department, already active in student engagement, expressed interest in formalizing a partnership with Anveshika through an MoU—an encouraging sign of sustained impact and shared vision.

Day 4 of Jagruta Jatra was a testament to how thoughtful outreach, hands-on learning, and symbolic rituals can ignite curiosity and foster community. The event not only deepened scientific understanding but also planted seeds for long-term collaboration and joyful exploration.

Sarmistha Sahu
Coordinator

A Challenge for readers



One object, two stories.
Decode the reflector to uncover the reality.

Report

NATIONAL COMPETITION IN COMPUTATIONAL PHYSICS - 2025 (PHYSICS SIMULATIONS & SOFTWARE-BASED PHYSICS EXPERIMENTS) (NCICP 2025)

The result of the National Competition, NCICP 2025, was published on September 08, 2025.

Objectives:

The National Competition in Computational Physics (NCICP-2025) aims to:

- **Promote** computational thinking, simulation-based analysis, and AI-driven problem-solving in physics.
- **Encourage** students and researchers to develop innovative solutions for real-world physics challenges.
- **Foster** deeper engagement with computational physics through hands-on simulations and software-based experiments.
- **Empower** educators to integrate generative AI and advanced computational teaching tools.
- **Enhance** modern scientific exploration by leveraging technology-driven methodologies.

This competition serves as a platform for participants to explore cutting-edge computational techniques,

drive innovation, and contribute to the future of physics research and education.

NCICP-2025 will have **three (03) categories**:

1. **Undergraduate (UG) students**
2. **Postgraduate (PG) students & Research Scholars**
3. **Educators**

The following heads will be considered for final judgement: Literature Survey, Software/Methodology & Implementation, Analysis of Results & Interpretation, Discussion & Critical Insights, Conclusions & Impact, Scope for Future Work, Bibliography & Quality of Resources, Novelty & Innovativeness, Presentation & Engagement in Interaction, Documentation. **The work to be presented should be an original one.**

The **best three presentations** in **each sub-category** will be awarded with prizes, anda certificate. **THE DECISION OF THE JUDGES WILL BE FINAL.**

Competition Theme: Innovation in Physics Experiments and Simulations **(*Exploring new ideas, new methods, new devices, or algorithms in physics.*)**

NCICP-2025 encourages **creative and innovative** approaches to **physics-based experimentation and simulations** across different academic levels.

Category 1: Undergraduate (UG) Students – Foundations of Computational Physics

This Category is expected to focus on **fundamental computational skills**, **numerical methods, and digital tools** for physics problem-solving.

- **Computational Methods in Introductory Physics** *(Basic numerical techniques & programming applications in physics)*
- **Sensor-Based Data Acquisition & Analysis** *(Using Arduino/Raspberry Pi for data collection & processing)*
- **Simulations & Visualization in Physics** *(Graphical representations using Python, MATLAB, etc.)*
- **Basic AI & Data Science Applications** *(Applying AI for experimental data analysis in physics)*

Category 2: Postgraduate (PG) Students & Researchers – Advanced Computational Physics & AI

This Category is expected to focus on **general-purpose and advanced simulations, AI-driven applications, and quantum computing techniques** to solve complex physics problems.

- **Advanced Computational Techniques in Physics** *(Solving real-world physics problems with computational methods)*
- **Quantum Computing for Physical Simulations** *(Hands-on IBM Quantum, Qiskit & quantum algorithms)*
- **Machine Learning for Physics-Based Predictions** *(AI for pattern recognition, simulations & optimization)*
- **Multiscale Modelling & Complex System Simulations** *(Addressing interdisciplinary physics challenges)*

Category 3: Educators – Computational Physics in Classroom Teaching

This competition challenges educators to develop innovative ways to integrate computational physics into classroom teaching while ensuring **accessibility for students to learn and practice at home**.

- **Open-Source Computational Lesson Plan Challenge**
- **Virtual Lab & Simulation Development for Home Learning**
- **Computational Physics for Interdisciplinary Home Projects**
- **Data-Driven Physics Education for Real-World Problems**

Finally, nine teams in Student-category and three teams in Teacher-category participated in the concluding part of the competition. The final result is given below:

Result – Student Category (UG)

Name of the Project	Award Winners	Place
Simulation of Relativistic Jets Around A Supermassive Black Hole	**Sanket Das, Mihika Hetamsaria & Tarannum** Punjab Engineering College, Chandigarh	First (7000/-)
Particle Physics: Simulations and Machine Learning	**Aryan Shrivastava** School of Physical Sciences NISER, Bhubaneswar	Second (5000/-)
SimuPhys: An Interactive Toolkit for Visualizing Classical and Quantum Physics Simulations	**Kartik Gupta, Abhinav Chhajed, Suraj Singh** Indian Institute of Information Technology Vadodara	Third (4000-/)

Student Category (PG & Research Scholars) – No participants

Result – Teacher Category

Name of the Project	Award Winners	Place
The Simulated World of Physical Laws: Interactive Physics Simulations	**Shah Harsh and Prajapati Devarsh** Gujarat University	First (7000/-)
Speed of Sound Measured by Acoustic Resonance in Air Column	**Ujjwal Ghanta** Department of Basic Science, NIET NSHM Knowledge Campus, Durgapur, WB **Dibyadyuti Pramanik** Dept of Applied Science and Humanities Haldia Institute of Technology, WB	Second (5000/-)
A vehicle tracking system with emergency alert during accident	**Susant Kumar Daxinray** Dhabaleswar Govt. High School, Kalinga, Keonjhar, Odisha	Third (4000-/)

We extend our heartfelt thanks and gratitude to the esteemed Judges — Dr. Abha Khandelwal, Founder, AACST; Professor Ananda Dasgupta, Department of Physical Sciences, IISER Kolkata; Professor S. Minhaz Hossain, Department of Physics, IIEST Shibpur; Dr. Jagdish Kumar, Department of Computational Sciences, Central University of Punjab; and Dr. Bhakti Rajvaidhya, Raisoni Engineering College, Hingna, Nagpur — for their expertise, assessment, and thoughtful judgment. Their wholehearted participation has been invaluable in ensuring that the competition was conducted with the highest standards of academic integrity and excellence. Last but not least, I take this opportunity to convey my deepest gratitude to the members of the Organising Committee (Dr. Shinjinee Das Gupta, Sanjoy Kumar Pal, and Soumen Sarkar, serving as the Secretary and members of the executive body of IAPT RC15) for their unwavering support, wholehearted cooperation, and steadfast commitment, which have been instrumental in the successful organisation of the National Competition on Innovations in Classroom Physics (NCICP-2025).

Beyond the judgment process, our respected experts have generously offered their constructive feedback. Their observations not only acknowledge the strengths of the participating teams but also highlight areas for

further growth and innovation. We are pleased to present their feedback below, which will serve as a valuable guide for future initiatives. The experts' feedback are as follows:

Dr. Abha Khandelwal: The National Competition in Computational Physics – 2025 (NCICP-2025) was truly aligned with its objectives. This year, we witnessed a remarkable leap in both performance and

presentation skills—the progress felt like a seven-fold jump! Participants brought their ideas alive with creativity and confidence. A few of the entries were so impactful that they could serve as teaching tools with little or no modification. It gives me immense joy to share this wonderful achievement.

Prof. S. Minhaz Hossain: It's a great pleasure and privilege to be a part of this nationwide competition on computational Physics for last several years. It's great to note that the number of competitors is increasing. However, we need to explore all possible avenues to get a really good number of participants in all the categories specialty from the PG and the RS category.

This year, the theme of the competition was really exciting and attractive. It was on 'Innovation in Physics Experiments and Simulations'. It is good to note that we received several entries catering innovation in experimental physics using computational techniques and interfacing. However, in my opinion the final result does not reflect this fact.

In my view, innovation in presenting Physics concepts often deserves greater attention than coding or packaging when assessing projects. To ensure a fair and standardized evaluation platform, collective brainstorming is essential for effective assessment.

Dr. Jagdish Kumar: It was a great experience to be among the team of judges in NCICP-2025. Overall, the competition was conducted nicely. This is a platform where the students, researchers and the teachers can showcase their abilities to find Computational Solutions for many interesting problems. Through this platform, many innovative teaching/demonstration tools were proposed. Such competition definitely inculcate spirit of doing more than your routine stuff among participants.

In my opinion, there is a need to increase the outreach of this competition to a wider audience. IAPT's different public outreach platforms may be utilized to increase the visibility/outreach of this competition.

To popularize this competition at broader scale, some 4-5 broad domains may be identified in different areas of Physics with specific focus on computational physics in the area of their expertise. Expert groups of leading researchers/teachers from Indian academia may be constituted for floating problems/broad ideas for the competition in each domain. Instead of single team of judges, these expert groups may be requested for evaluating the entries submitted in their respective domains.

Dr. Bhakti Rajvaidya: The NCICP-2025 has been a game-changer, showcasing incredible growth and innovation in computational physics. Participants' projects were truly impressive, reflecting their dedication and passion. What stood out was the sheer quality and impact of their work, with some entries having the potential to inspire future generations. This competition is clearly nurturing scientific excellence and celebrating outstanding talent.

The NCICP-2025 has once again reaffirmed the importance of innovation, collaboration, and creativity in advancing Physics education and research. The insights shared by our distinguished experts, along with the enthusiasm of participants, have made this year's competition truly memorable. We look forward to building on this success and continuing to inspire the next generation of innovators in Physics.

Pradipta Panchadhyayee
Coordinator, NCICP 2025

Report (RC-15)

Physics Experiment Workshop 2025

A one–day **Physics Experiment Workshop** was organized on **23 September 2025** at **Banamalipur Santosh Bhattacharya Memorial High School (Co-Ed, HS), Barasat**, in collaboration with **IAPT Medinipur College CSC** and **IAPT RC – 15**.

Originally it was scheduled for two days (23-24 Sept), but due to torrential downpour the entire city of Kolkata and large part of the suburbs got inundated. Still the students and some resource persons braved the inclement weather and could join on the first day. Under the given circumstances, the program was curtailed to one day.

Forty selected students of Classes IX and X from five nearby schools actively participated in **26 hands-on physics experiments** covering key areas of mechanics, properties of matter, heat, optics, electricity, magnetism, and electromagnetism. The experiments included:

Motion and Mechanics: Uniform motion of a pea seed inside castor oil, non-uniform velocity on an inclined plane, non-uniform motion of a water surface in a bottle with a draining hole, friction on horizontal and inclined planes, study of a simple pendulum and conservation of mechanical energy, measurement of mass by lever principle, demonstration of circular motion, impulse and verification of Newton's third law of motion.

Properties of Matter: Buoyancy and weight loss of an immersed body, determination of the density of a solid, reaction of buoyant force, elastic modulus of a rubber strip, surface tension and capillarity demonstrations, and determination of air pressure using a vacuum bush.

Heat and Thermodynamics: Use of a thermistor as a thermometer, determination of the water equivalent of a thermo flask, measurement of the specific heat of sand, and determination of the latent heat of fusion of ice.

Fluid Pressure: Demonstration of Boyle's Law and Bernoulli's Principle using simple devices.

Optics: Verification of the laws of reflection and refraction, direct proof of equality of object & image distances for plane mirror reflection, determination of the focal length of convex, concave lenses and mirrors using a filament bulb, and measurement of the refractive index of a prism.

Electricity and Magnetism: Preparation of a potato cell and measurement of its electromotive force, internal resistance, lost volt, and current using a digital multimeter; verification of Ohm's law; and demonstrations of Lenz's law.

The concept and guidance for the workshop came from **Dr. Subhas Chandra Samanta**, who was supported by IAPT RC 15 members Dr. Asit Chakraborty, Sri Prasun Majumdar, Dr Sukumar Bera and others. The programme was effectively conducted by the science teachers of the school under the leadership of the **Teacher-in-Charge Bijan Sarkar.**

Given above are some photographs taken during the workshop. Dr Samanta and others can be seen with the students.

Bijan Sarkar

100 Years of Quantum Physics
IAPT Announcement

Indian Association of Physics Teachers(IAPT) has decided to bring out a commemorative volume in connection with the 100 years of the discovery of Quantum Physics.

Earlier, it was planned to publish two special editions of '**The Bulletin**' (November and December issues). However, an overwhelming number of contributions received —articles, poems, plays, creative writings, and more—which could not have been accommodated within the limited space of the two issues.

In view of the enthusiastic response, it is decided to shift the plan from publishing special issues to a **commemorative volume**, to include all the submitted creative works without any restrictions pertaining to the limited number of pages in each issue.

IAPT is pleased to invite **all members**, and indeed **anyone interested**, to contribute to this centenary collection dedicated to the Quantum Mechanics of the Century. You may submit your works in the form of:

- Articles (popular or scholarly)
- Poems
- Short plays or dramas
- Essays and reflections
- Stories with a scientific/quantum theme
- Any other creative writing related to Quantum Physics

Both **LaTeX (.tex)** and **Word (.doc/.docx)** formats of submissions are welcome.

The commemorative volume is scheduled to be released on December 15, 2025.

Please send your contributions to: udayananadan@gmail.com

This is a wonderful opportunity to showcase the imagination and creativity of the IAPT members and the wider community, while celebrating a century of one of the greatest scientific revolutions.

Papers received

1. **K. V. Shajesh** (Illinois University) – Commutation Relations Status: Under modification
2. **Lakotiya Govind** – Redirected to regular edition
3. **V. P. N. Nampoori** (Cochin University) – Quantum Optics
4. **Ranjana Abangh** – Article earlier published in Resonance.
   Requested republication: Making Introductory Quantum Mechanics Understandable and Interesting
5. **Amitabh Bhattacharya** (Sikkim University) – Drama: God Plays Dice with a Cat on the Table
6. **Prof. Joshipura** – Poem: Quantum Poem
7. **Prof. Nisarg K. Bhatt** – *2025* – International Year of Quantum Science and Technology, and Centenary of Three Landmark Developments.

K. M. Udayanandan

Scientific, Technological Advancements: And Sustainability Concerns !

In this column, we continue our discussion about socio-cultural issues intertwined with scientific and technological advancements. These issues are not physics-specific; however, physics and the reductionist way of thinking it expounds are in many ways central to some of the major challenges we consider here. In particular, we will be discussing issues pertaining to sustainability and an impending adaptational breakdown looming over us. As a community excited about the second quantum revolution and eager to introduce machine learning and artificial intelligence in our classrooms, the work we cite (like the paper below) can provide food for thought and prompt critical reflection.

Chandrasekharan, S., Sinha, R., & Date, G. (2025). Making cognition: a mechanism account of the way humans develop the ability to build and alter their environments. ***Synthese*, *206*(1), 7.**
https://link.springer.com/content/pdf/10.1007/s11229-025-05081-9.pdf

The paper discusses how building activities undertaken by humans, exemplified by engineering and technology, have led to problems like global warming, depletion of the biosphere, and the sustainability crisis we are facing today. The exacerbating role played by the scientific and associated industrial revolutions is highlighted. Particular attention is drawn to the automation aspect that permeated manufacturing activity as part of these advancements. The contemporary relevance of such a discussion is that we are at the cusp of another giant stride in this regard, namely generative AI-based manufacturing. The paper cites "integration of AI with computer-aided design, 3D printing, and autonomous systems for chemical synthesis" as examples of such manufacturing/making activities and shares concerns about the impact they can have if left unexamined.

It may be noted that the argument is not against technology or making per se, but against the unexamined, runaway nature of it. In fact, the authors consider the ability to make or build as key to human adaptive success. However, they maintain that our making behavior is modulated significantly by cultural factors and associated value systems. A stance that imbues and celebrates an outsized role for material artifacts, along with the value system of opulence it brings forth, is problematized. The notions of productivity, progress, attitudes towards the environment and biosphere etc. and their cognitive underpinnings are critically examined in conjunction with our engineering/making abilities. The educational implication is that by outlining a cognitive account of how human building and making develop and advance, the paper provides insights into how new cultural patterns and learning can help rethink the runaway nature of current human making.

We conclude our discussion by addressing another related problem - the unprecedented pace of change we are going to experience as a result of advancements in science and technology. Highly influential work like the one by Alvin Toffler had initiated discussions on this issue as early as the 70s.
Toffler, A. (1970), *Future Shock*, Bantam Books, New York.

Another useful reference is: **Rosa, H. (2013). Social Acceleration: A New Theory of Modernity. Columbia University Press.**
The advent of AI and machine learning necessitates renewed attention to these discussions. The avalanche of change currently underway due to these advancements will significantly alter the very texture of our existence, our institutions, values, and taken-for-granted constancies of life. The radical nature of the changes, combined with the fact that they will unfold upon us in such a short span of time, makes the challenge unparalleled in the entire history of the planet. As educators, we need to reflect on how to help our students (and ourselves) understand these issues, adapt and cope in the turbulent times ahead!

K K Mashood
HBCSE - TIFR, Mumbai

Postal Regd. No. Kanpur City-28/2024-26 Date of printing 01-10-2025 Date of posting 08-10-2025 RNI No. UPENG/2009/29982 ₹ 25/-

BULLETIN OF THE INDIAN ASSOCIATION OF PHYSICS TEACHERS

FOUNDED BY (LATE) DR. D.P. KHANDELWAL

VOLUME 17 NUMBER 10 OCTOBER 2025

IN THIS ISSUE

If undelivered please return to :

Dr. Sanjay Kr. Sharma

Managing Editor

Flat No. 206, Adarsh Complex,

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

Published by Dr. Sanjay Kr. Sharma on behalf of Indian Association of Physics Teachers. For circulation amongst IAPT members/subscribers only.
Flat No. 206, Adarsh Complex, Awas Vikas-1, Keshavpuram, Kalyanpur, Kanpur-208 017, Mob. 9415404969.
Printed at Sharda Graphics Pvt. Ltd., 123/766, Factory Area, Fazalganj, Kanpur-208012, Ph. 9336845329
Chief Editor: Prof. Manjit Kaur