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To celebrate the second science anniversary of NASA's James Webb Space Telescope, the team has released a near- and mid-infrared image on July 12, 2024, of two interacting galaxies: The Penguin and the Egg.

Webb specializes in capturing infrared light – which is beyond what our own eyes can see – allowing us to view and study these two galaxies, collectively known as Arp 142. Their ongoing interaction was set in motion between 25 and 75 million years ago, when the Penguin (individually catalogued as NGC 2936) and the Egg (NGC 2937) completed their first pass. They will go on to shimmy and sway, completing several additional loops before merging into a single galaxy hundreds of millions of years from now.

Link: https://www.nasa.gov/image-article/two-years-since-webbs-first-images-celebrating-with-the-penguin-and-the-egg/

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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.

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Editorial

National Quantum Mission and the International Year of Quantum Science and Technology

As the students of physics, it is not very difficult for us to turn back by one hundred years to have a look at the decade that began in 1925. The main stage was set in Europe though the contributions from the other parts of the world could not be overlooked. Quantum mechanics was formally emerged through a series of papers published jointly or independently from 1925. The main players were Max Born, Werner Heisenberg, Pascal Jordan, P.A.M. Dirac and a few more. Erwin Schrodinger in his 1926 paper introduced an equation to deal with the new concepts and that has turned out to be one of the most famous equations in physics. A new frontier had opened.

Pathbreaking works by physicists like Max von Laue, Braggs, Barkla dealt with the wave nature of light have quite justifiably been awarded the Physics Nobel Prizes in 1910s. Things showed signs of change with the 1918 physics Prize going to Max Planck. Nobel Prizes in physics in the 1920s went on to confirm this; with Einstein, Bohr, Compton, De Broglie, Raman becoming winners of the Prize. And then we entered the era of quantum mechanics from mid 1920s. Apart from the authors of the initial pathbreaking papers, contributions from more and more younger physicists like Pauli, Fermi, Wigner, Sommerfeld, Klein, and others put quantum mechanics on a strong foundation. In a way, it was a quest for the truth, that science and scientists have always undertaken without any other immediate goal in mind. And now after one hundred years we know that the word 'quantum' has not only become a part our everyday vocabulary in diverse situations, but it is something more.

Government of India identified the potential of what may be broadly termed as 'quantum research" and in 2023 took a special initiative declaring a National Quantum Mission (NQM). Union Cabinet sanctioned an amount of Rs 6003.25 crore for "aiming to seed, nurture and scale up scientific and industrial R&D and create a vibrant & innovative ecosystem in Quantum Technology (QT)" and to make "India one of the leading nations in the development of Quantum Technologies & Applications (QTA)." The areas that will get special focus through the NQM are broadly Quantum Computing, Quantum Communication, Quantum Sensing & Metrology, Quantum Materials & Devices. And we now know some of these terms have already become common even among the students.

The quantum community is going to celebrate the centenary of an unforgettable decade starting next year. UNESCO has also responded to the expectations by declaring the year 2025 as the "International Year of Quantum Science and Technology". The U.N. declaration is essentially an impetus for academic institutions, government agencies or organizations like IAPT to celebrate 2025 to increase awareness about quantum science and technology. After one hundred years the world knows that the area is no more quantum mechanics or quantum physics only. It has spread its wings beyond physics and is now a multidisciplinary activity that comes under the broad heading of "quantum Science" and "quantum technology" involving many areas of S & T. And it is for our students of physics to take advantage of this scenario.

Bhupati Chakrabarti

Physics News

Freeze-frame: Researchers develop world's fastest microscope that can see electrons in motion

A transmission electron microscope is a tool used by scientists and researchers to magnify objects up to millions of times their actual size in order to see details too small for a traditional light microscope to detect. Ultrafast electron microscopes previously operated by emitting a train of electron pulses at speeds of a few attoseconds. An attosecond is one quintillionth of a second. Pulses at these speeds create a series of images, like frames in a movie—but scientists were still missing the reactions and changes in an electron that takes place in between those frames as it evolves in real time. In order to see an electron frozen in place, University of Arizona researchers, for the first time, generated a single attosecond electron pulse, which is as fast as electrons move, thereby enhancing the microscope's temporal resolution, like a high-speed camera capturing movements that would otherwise be invisible. For the first time, they are able to attain attosecond temporal resolution with our electron transmission microscope - and we coined the term 'attomicroscopy.'

Read more at: https://phys.org/news/2024-08-world-fastest-microscope-electrons-motion.html
Provided By: Science Advances (2024). DOI: 10.1126/sciadv.adp5805

New heaviest exotic antimatter nucleus discovered

Scientists studying the tracks of particles streaming from six billion collisions of atomic nuclei at the Relativistic Heavy Ion Collider (RHIC), have discovered a new kind of antimatter nucleus, the heaviest ever detected. Composed of four antimatter particles—an antiproton, two antineutrons, and one antihyperon—these exotic antinuclei are known as antihyperhydrogen-4. To find antihyperhydrogen-4, the STAR physicists looked at the tracks of the particles this unstable antihypernucleus decays into. One of those decay products is the previously detected antihelium-4 nucleus; the other is a simple positively charged particle called a pion (pi^+). The key was to find the ones where the two particle tracks have a crossing point, or decay vertex, with particular characteristics. The STAR team worked hard to rule out the background of all the other potential decay pair partners. In the end, their analysis turned up 22 candidate events with an estimated background count of 6.4. The next step will be to measure the mass difference between the particles and antiparticles.

Read more at: https://phys.org/news/2024-08-heaviest-exotic-antimatter-nucleus.html
Original paper: Nature (2024). DOI: 10.1038/s41586-024-07823-0

Electromagnetic vortex cannon could enhance communication systems

Vortex rings, a mysterious and fascinating natural phenomenon, display breathtaking structures and behaviors in both air and electromagnetic waves. Recently some scientists from various institutes proposed a method using coaxial horn antennas to directly emit electromagnetic vortices. They observed the resilient propagation characteristics and skyrmion topological structures of these vortices. The potential applications of this technology are vast and exciting. In high-capacity communication systems, these vortex pulses could revolutionize how we transmit information by offering efficient and robust methods of data encoding. The unique spectral and polarization characteristics of the vortex rings allow them to carry more information compared to traditional waves, making them ideal candidates for next-generation communication networks. This work not only demonstrates the incredible versatility of electromagnetic vortex rings but also sets the stage for future innovations in wireless technology, creating opportunities to redefine our understanding of electromagnetic phenomena.

Read more at: https://phys.org/news/2024-08-electromagnetic-vortex-cannon-communication.html
Original paper: Applied Physics Reviews (2024). DOI: 10.1063/5.0218207

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Challenges of Incorporating Relevant Quantum Content in Physics Curriculum

P K Ahluwalia

President IAPT

With the launching of National Quantum Mission in the country and need of quantum work force, this news item shared by Professor AG Kulkarni, published in TOI dated 28.08.2024, points to what is happening in the elite science technology institutions in the country and there call for popularizing it at the school level. Buzz is on, and it is a clarion call to remodel course content at all the three levels viz school, undergraduate colleges affiliated to universities and graduate departments running in the Universities.

It requires deep thinking and ground work with a sense of purpose and responsibility, so that students studying in UGC approved institutions/Universities do not miss the bus of quantum revolution. Let us remember that these students make the largest group of physics learners. In the ever-evolving landscape of physics education, it is essential to continually explore new avenues to make the subject not only engaging but also relevant and appealing to students. With the rapid advancement in quantum technologies, there is a growing need to update physics curricula at different levels to incorporate the fascinating world of quantum mechanics and its applications. This editorial delves into three levels of possibilities – school, college, and university – that can make the physics curriculum more attractive to students as a potential career path, particularly in the realm of quantum toolkit.

In the last two years, there have been very good initiatives emanating from different Regional/ Sub-regional councils of IAPT. Focus was on Artificial Intelligence and Quantum Computing targeted to school students. IAPT also partnered with IIT Tirupati/ IISER Tirupati, thanks to Professor PC Deshmukh who made IAPT feel the rise of disruptive technologies resulting from quantum technologies. Sub Regional Council Vidharba undertook this task, a great team effort under the leadership of Professor Anwane and mentoring of Professor Abha Khandelwal by involving dedicated physics faculty from IAPT and experts working in these niche areas. Regional Council Telengana also arranged month long program: How's and Why's in learning Quantum Mechanics at UG level by Professor M Shivakumar.


QUANTUM COMPUTING LOOKS TO BE MAKING PROGRESS IN INDIA

Top institutes fuel quantum talent creation

START AT SCHOOL LEVEL, ATTRACT EXPERTS

The real workhorses for incorporation of new ideas are Board of Studies for UG and PG at various Universities and CBSE at secondary level. To Make way for quantum tuned Physics Curriculum requires a complete restructuring for additional content by floating choices for the target audience both at core and elective level. It may also require hand shake of physics faculty with computer science and IT experts. Fortunately, with the implementation of Choice Based Credit System under National Education Policy 2020, it is possible.

Following are the possibilities, which respective board of studies can look at

a) School Level Possibilities

At the school level, it is crucial to ignite students' curiosity and interest in physics from an early age. Introducing basic concepts of quantum mechanics can captivate young minds and provide a solid foundation for future studies. Incorporating interactive simulations and demonstrations related to quantum phenomena can make learning more immersive and exciting. Furthermore, organizing field trips to research facilities or inviting guest speakers from the quantum industry can offer real-world insights and

inspire students to pursue a career in this cutting-edge field.

b) College Level Possibilities

In college, where students delve deeper into physics concepts, integrating hands-on projects and laboratories focusing on quantum tools could be instrumental in bridging theoretical knowledge with practical skills. Offering specialized courses or workshops on quantum computing, quantum cryptography, or quantum optics can expose students to emerging technologies and potential career paths in these areas. Additionally, providing opportunities for undergraduate research projects in collaboration with industry partners or research institutions can give students a firsthand experience of working with quantum toolkits and spark their interest in pursuing advanced studies or careers in quantum-related fields.

c) University Level Possibilities

At the university level, where students are preparing for their professional journey, it is imperative to offer comprehensive programs that encompass both foundational physics principles and advanced quantum concepts. Developing interdisciplinary courses that combine physics with computer science, engineering, or mathematics can equip students with a diverse skill set that is highly sought after in the quantum industry. Encouraging participation in internships or co-op programs at quantum research labs or tech companies can provide valuable experiential learning opportunities and pave the way for future employment in this dynamic field.

Broad outline can evolve around following structure

(i) *Introduction to Quantum Mechanics:* This course may provide an overview of the basic principles of quantum mechanics, introducing students to concepts such as superposition, entanglement, and wave-particle duality.

(ii) *Quantum Phenomena Exploration:* In this course, students may be provided an opportunity to delve deeper into specific quantum phenomena through hands-on experiments and simulations, gaining a deeper understanding of how quantum mechanics shapes our understanding of the universe and in our immediate day today life.

(iii) *Applications of Quantum Technologies:* This part may explore the practical applications of quantum mechanics in fields such as quantum computing, quantum cryptography, and quantum communication, showcasing how these technologies are revolutionizing the way we process information and secure data.

(iv) *Quantum Toolkit Lab:* Here students may engage in laboratory experiments using quantum toolkits and software to conduct simulations, analyze quantum phenomena, and gain practical skills in working with quantum technologies.

(v) *Quantum Industry Insights:* Through guest lectures, field trips, and industry presentations, students can gain valuable insights into the current trends and career opportunities in the quantum industry, inspiring them to consider pursuing further studies or careers in this cutting-edge field.

As we stand at the cusp of second quantum revolution, it is paramount for IAPT Community to adapt and evolve the curriculum to align with the changing demands of the industry and academia in minute details. By embracing the potential of quantum toolkit and integrating it into the physics curriculum at all levels, we can inspire a new generation of students to explore the wonders of quantum mechanics and embark on rewarding careers in this fascinating field. Through collaborative efforts and innovative teaching methods, we can ensure that physics education remains not only relevant but also attractive and impactful in shaping the future of science and technology.

With these possibilities in mind, let us embark on this exciting journey of transforming the physics curriculum with the second quantum revolution toolkit in mind, and empower students to embark on a path of discovery and innovation. This approach can bring back students to the physics courses and bring physics at the center stage to make National Quantum Mission an all-embracing opportunity.

Let us ready ourselves to undertake this initiative, and form a working group to bring an agenda of curriculum reform on the table of physics teachers and learners. Volunteers are needed to accomplish this onerous task.

Experimental Determination of Potassium-40's Half-Life

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Radioactivity occurs when an unstable nucleus transforms into a stable one, emitting radiation in the process [1]. This transformation is represented by half-life, which is the time required for characteristics half of a given amount of a radioisotope to decay. The range of half-lives varies dramatically, from an incredibly short $\approx 10^{-23}$ seconds to an astonishing $\approx 10^{24}$ years. For isotopes with shorter half-lives, which range from minutes to hours, experimental methods involve plotting decay curves to determine the half-life. However, for radioisotopes with much longer half-lives, the decay rate is so slow that measurement of half-life becomes challenging. Traditional methods are not practical for the very long-lived isotopes due to the large time required for accurate radiation counting. To address this, researchers use innovative experimental setups and advanced detection techniques to study and determine the half-lives of these isotopes. These approaches enhance our understanding of nuclear decay processes and contribute to various scientific fields. The focus of the present study is to determine the half-life of the naturally occurring isotope Potassium-40 (^{40}K), which is found in nature in abundance at approximately 0.0118%. This isotope, a radioactive form of potassium, possesses a remarkably long half-life of $\approx$ 1.251 x 10^9 years. The radioactive decay of ^{40}K involves three distinct processes: β^-emission, electron capture (EC), and the gamma (γ) emission. The majority of ^{40}K nuclei decay (89.2%) results in the production of ^{40}Ca through the emission of a β-particle (E_β = 1.31 MeV) accompanied by an antineutrino. Additionally, about 10.7% of the decay events lead to the formation of ^{40}Ar via electron capture, with the emission of a neutrino, followed by gamma emission with an energy of E_γ = 1.460 MeV. The occurrence of these radioactive decays' sheds light on the considerable abundance of Argon gas (approximately 1%) in the Earth's atmosphere, as well as the prevalence of the ^{40}Ar isotope compared to other isotopes. In rare instances (0.001% of events), ^{40}K decays to ^{40}Ar by emitting a positron (β^+) and a neutrino. Figure 1, illustrates a typical decay scheme for ^{40}K. Potassium, in its natural form, consists of three isotopes, of which ^{40}K (0.0118%) is radioactive, while the other two isotopes, ^{39}K (93.3%) and ^{41}K (6.7%), are stable. Traces of ^{40}K can be found in almost all potassium samples, making it the primary source of radioactivity, in both healthy animals and the human body, second only to the presence of ^{14}C. For instance, a human body weighing about 70 Kg provides approximately 4,400 decays of ^{40}K nuclei per second.

One of the most significant applications of ^{40}K nuclei lies in the field of Potassium-Argon dating, commonly known as K-Ar dating. This technique allows for the estimation of the age of rocks containing potassium, providing valuable insights into the age of the Earth. It has played a crucial role in the development of the theory of plate tectonics and the calibration of geological time scales, contributing significantly to our understanding of Earth's history. One fascinating aspect of the decay of ^{40}K is the production of ^{40}Ar, an

inert gas with a significantly long half-life of 13,000 million years. The radioactive isotope of potassium also undergoes decay, ultimately leading to the formation of radioactive ^{40}Ca ($t_{1/2} > 3.0\times10^{21}$ years) which undergoes double electron capture (EC) decay. By measuring the ratio between the radioactive forms of ^{40}K, ^{40}Ar, and ^{40}Ca, valuable insights into the age of a samples may be obtained. Using the K-Ar method, scientists have dated meteorites back to approximately 450 million years. Volcanic rocks, on the other hand, can be accurately dated to as recent as 20,000 years using this approach.

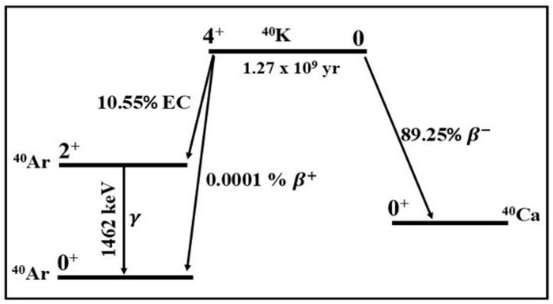

Fig.1: A typical decay scheme of ^{40}K radioactive nuclei.

The ability to determine the age of such diverse objects through the K-Ar method demonstrates its wide-ranging applicability and its significance in unraveling the timelines of geological events and processes. In the radioactive decay process, each step follows a unique and consistent rate specific to the isotope involved. This rate remains constant for any sample of the same isotope, but with some statistical uncertainty. One describes this constant rate of decay using a parameter known as the decay constant (λ). To conveniently describe the rate at which a radioisotope decays, we commonly use the concept of half-life ($t_{1/2}$). The half-life represents the time required for half of the nuclear atoms in a radioisotope to emit radiation and decay into other products. It serves as a useful measure of the decay rate. It is important to note that all radioactive processes occur as first-order rate processes. This means that the number of disintegrations that occur within a given time interval (t) is directly proportional to the number of nuclides (N) present. By understanding and quantifying the behaviour of radioisotopes through their decay constants and half-lives, one can make accurate predictions and calculations related to radioactive decay. The events decay per unit time is given as decay constant x Number of radioactive atoms i.e,

$$-\frac{dN}{dt} = \lambda\, N \qquad (1)$$

The negative sign indicates the decreasing of radioactive nuclei with time. Now integration of equation (1) will give the fraction of parent nuclei left after a given time *t*.

$$\ln\left(\frac{N_1}{N_0}\right) = -\lambda\, t \;\; or \;\; \left(\frac{N_1}{N_0}\right) = e^{-\lambda t} \qquad (2)$$

Where, N_0 is the number of radioactive nuclei at zero time and N_1 is the amount left at any instant of time t. By employing the above equation to plot decay curves one can experimentally determine the half-life of radioactive substances with measurable half-lives on the scale of minutes to hours. As an illustrative example, let us consider the decay curve of ^{190}Hg(5n) nuclides (produced in the irradiation of ^{14}N+^{181}Ta) a specific isotope with a half-life of 20 min [2]. Figure 2(a) and (b) depict the decay curve ^{190}Hg(5n) on linear and logarithmic scales, respectively, indicating the behavior of the decay process as a function of time. However, plotting the decay curve for radionuclides with extremely long half-lives poses a challenge due to the extended duration required to record the activity of irradiated samples. To overcome these difficulties, an attempt has been made in an innovative way to determine the half-life of the longer-lived radioisotope, ^{40}K. For this purpose, potassium chloride (KCl) salt obtained from the laboratory, has been used as the sample material, which is not classified as a radioactive substance and can be handled

safely without specific precautions. Given the low abundance and extremely long half-life of 40K, the radiation emitted by a sample of KCl will only be slightly higher than the background level. As such, to obtain the actual counts related to the sample, it is necessary to suppress the low-level background counts. To obtain this, KCl salts of varying amounts such as 1.0g, 2.0g, 3.0g, and so on, were used, and the recording was conducted for a duration of 15 min each. The use of different sample runs with varying amounts of KCl is essential because, as the sample mass increases, the depth of the KCl layer in the sample holder also increases. As a result, the radiation emitted by decaying ^{40}K nuclei at the top of the KCl heap get partially absorbed by the sample itself in the lower portion of the heap. Consequently, the counts do not increase linearly with the mass of KCl but begin to level off. Since the emitted radiation during decay may be partially absorbed by the KCl salt itself and does not reach the detector, it is necessary to determine what the counts would have been in the absence of any reabsorption. This determination can only be made at zero mass thickness. Therefore, by plotting a graph of log(counts/gm/sec) versus the mass of KCl, the y-intercept of the graph can provide the value of the decay constant (λ) at zero mass thickness. This approach allows for the accurate determination of the decay constant and provides insights into the behavior of ^{40}K decay in different sample masses. Recalling eq. (1), where the relation between the decay constant (λ) and half-life is given by $t_{1/2} = 0.693/\lambda$. Before deducing the value of decay constant λ, it is desired to know the number of ^{40}K (radioactive) atoms in the KCl salt itself. The number of atoms in 1gm of natural potassium [consisting of three isotopes viz., ^{39}K(93.3%), ^{40}K(0.0118), ^{41}K(6.7%)] can be calculated as;

No of atoms (N_K) in 1gm of naturally existing potassium

$$N_K = \frac{Given\ mass}{Atomic\ mass} \times N_A \qquad (3)$$

Where, the Avogadro Number N_A=6.023 x 10^{23}

Therefore, $N_K = \frac{1}{40} \times 6.023 \times 10^{23} \approx 1.5 \times 10^{22}\ atoms$

It may be pertinent to mention that the radioactive isotope ^{40}K occurs naturally at an abundance of 0.0118%. Therefore, number of ^{40}K atoms will be approximately equal to, 0.0118 % of N_K, which may be deduced as;

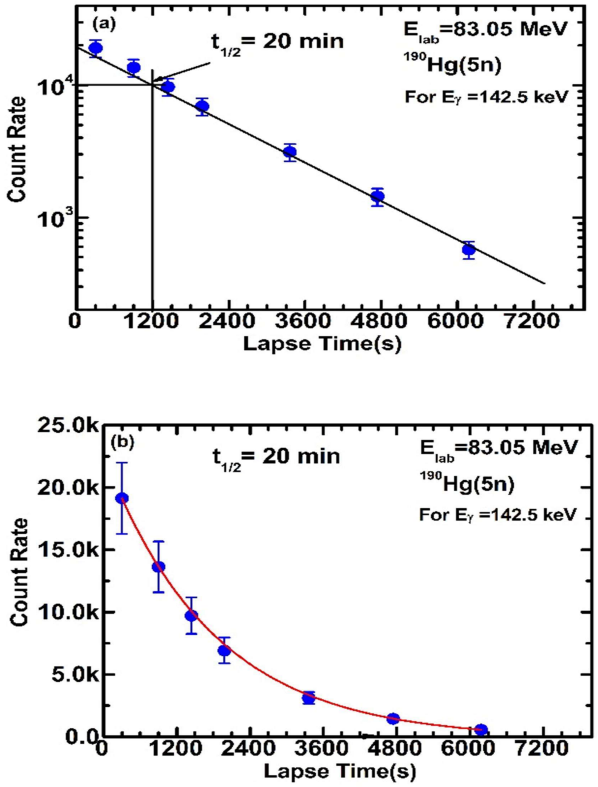

Fig.2 (a): A typical decay curve of ^{190}Hg residues having half-life of 20 min on log scale and (b) on linear scale [2].

$$= \frac{0.0118}{100} \times 1.5 \times 10^{22} \approx 1.8 \times 10^{18}\ atoms\ of\ ^{40}K$$

Hence, 1 gm of natural potassium contains ≈ 1.8×10^{18} number of ^{40}K atoms, which are radioactive. Now considering 1gm of KCl

salt, the number of atoms of natural potassium in KCl can be calculated using the eq. 3. Taking the molar mass of KCl as 74.6 gm per mole, the Avogadro's number, 6.02 x10^{23} atoms per mole and putting all these together to get the number of ^{40}K radioactive nuclei given below;

$$N(^{40}K) = 1\text{gm KCl} \times \frac{1 \text{ mol KCl}}{74.6 \text{ gm KCl}} \times \frac{1 \text{ mol K}}{1 \text{ mol KCl}} \times \frac{6.022 \times 10^{23} \text{ atoms K}}{\text{mol K}} \times \frac{1.18 * 10^{-4} \text{atom } 40_K}{\text{atom K}} \quad (4)$$

Which turns out to give number of ^{40}K atoms as;

$$N\ (^{40}K) = \frac{9.52\ x\ 10^{17}}{gm\ KCl} \text{ of } ^{40}K \text{ atoms} \quad (5)$$

The experimental setup for this study is illustrated in Figure 3. The scintillation counter, along with lead shielding, is positioned. To ensure proper alignment, a vertical arrangement is used for the detector, facing the glass beaker. For a clearer understanding of the experimental setup, a block diagram is provided in Figure 4. This diagram highlights the various components and their connections, indicating the overall arrangement used to carry out the measurements and recordings in this study. The presence of background radiation may interfere with the gamma-ray spectrum measurements. Precautions have been taken to shield the experimental setup, with the help of lead bricks, from external sources of radiation and such background radiations have been accounted for in the analysis. To optimize the experimental setup for calibration, the gain of the amplifier is carefully adjusted until the photopeak of the 1.332 MeV gamma rays of standard ^{60}Co aligns with channel number around 300 for a given gain setting in the Multi-Channel Analyzer (MCA) setup. This specific adjustment ensures that the photopeak corresponding to the 1.462 MeV gamma rays emitted by ^{40}K falls around 370 channel number or so. Once the amplifier gain is properly set, a pulse height spectrum of the gamma rays from the KCl sample is recorded. This spectrum captures the distribution of pulse heights generated by the detected gamma rays, providing information about their energies and intensities.

By analysing this spectrum, one can extract the important data regarding the radioactive decay of ^{40}K and accurately determine its half-life.

Fig. 3: Experimental setup and electronics for ^{40}K half-life determination

To establish a comprehensive understanding of the experimental procedure, several steps were followed. Firstly, a background spectrum was recorded for a duration of 15 min to account for any ambient background radiation present. Next, a known mass (m=1.0g) of KCl was placed inside a thin base glass beaker and thoroughly spread to ensure an even distribution of the salt. The beaker, with the salt, was positioned on top of the detector. The spectrum of the radiations emitted by the KCl salt was then recorded for 15min. The photopeak counts corresponding to the 1.462 MeV gamma line were extracted from this spectrum. Similarly, the total counts over the corresponding channels were also recorded in the background spectrum and converted to the same time interval as that of the KCl spectrum. The process was repeated

for other masses of KCl (2g, 3g, and 4g) to the beaker. Each time, the salt was evenly distributed and the top surface made flat with the help of forceps. The emitted photons were recorded, and the photopeak counts was obtained for each mass. Figure 4, illustrates the arrangement of the KCl salt on the NaI(Tl) detector, while Figure 5, provides a block diagram representation of the experimental setup. As an example, Figure 5, displays a recorded spectrum of KCl with a mass of 4g, highlighting the prominent gamma peak at 1462 KeV. The counting data for both the background and sample spectra for different masses are tabulated in Table 1.

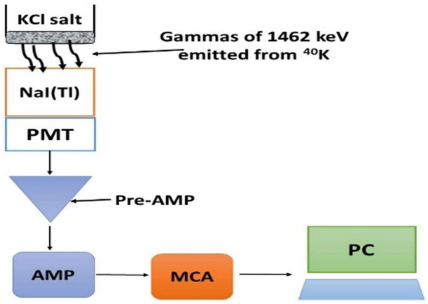

Fig.4: A block diagram of experimental setup used in the experiment.

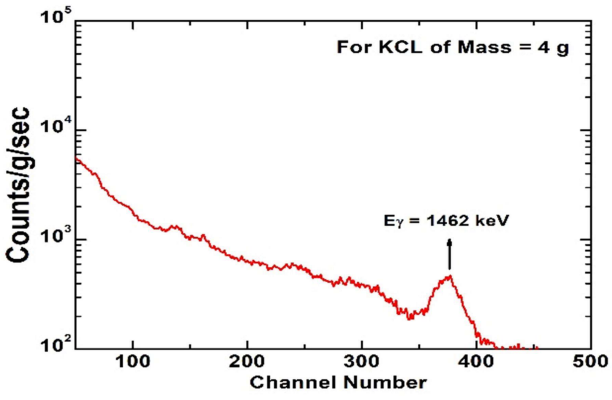

Fig.5: Typical gamma ray spectrum of KCl salt for a mass 4g recorded for 15 min. The gamma ray emitted from ^{40}K is marked.

To determine the half-life of ^{40}K, a plot was generated, depicting the Counts/sec/gm as a function of the mass (m_K) of the KCl sample. The area under the photopeak was extracted from the recorded spectra for various masses, allowing for the calculation of counts/gm/sec. These values are essential for further analysis and determination of the half-life of ^{40}K. To account for the absorption of gamma rays by the KCl sample and determine the true counts without attenuation, it is necessary to consider zero-layer thickness. Figure 6, displays a plot of counts/sec/gm as a function of the mass (m) of the KCl sample. The fitting line passing through the data points is extrapolated to zero mass, providing the activity (A) without any correction for attenuation. From the graph in Fig. 6, the obtained activity (A) is approximately 0.402 counts/gm/sec. Additionally, we considered the efficiency of the NaI(Tl) detector, which was assumed to be 20% (as given by supplier).

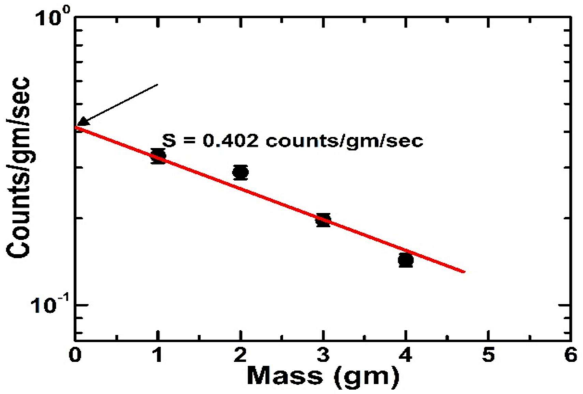

Figure.6: The logarithmic decay plot of 1462 keV gamma from ^{40}K. The red line is to get the activity at zero mass thickness (see text for more details).

This means that only 2 out of 10 extrapolated events, or 0.20 percent of all the events, are counted. By utilizing the following expression, the half-life of ^{40}K may be deduced:

$$t_{1/2} = (0.693 * m_K) / (A \times \varepsilon) \qquad (6)$$

Where, m_K represents the mass of the KCl sample, A represents the activity obtained from the graph in Fig. 6, the term ε represents the detector efficiency of 20%. Using equation 7, the half-life of ^{40}K can be calculated based on the experimental data. and the activity determined without any attenuation correction

$t_{1/2} = \frac{0.693}{A}$ x N x ε x branching ratio of 1462 keV of γ's (7)

Now from Fig. 6, the value of A (counts at zero mass) is found to be 0.402 counts/gm/sec.

Using the value of A and N from eq. 6, we get.;

$$t_{1/2} = \frac{0.693}{\frac{0.402 \text{Counts}}{\text{gm}}/\text{sec}} \text{ x } \frac{9.52 \times 10^{17}\ atoms\ of\ {}^{40}_{19}K}{gm\ of\ KCl} \text{ x } \frac{1hr}{3600sec}\ x\ \frac{1\ day}{24hr}\ x \frac{1\ yr}{365days}$$

$$\Rightarrow t_{1/2} \approx 5.2 \text{ x } 10^{10} \text{ years}$$

Now putting the value of $t_{1/2}$ in equation 7 we get;

$$t_{1/2} = 5.20\ x\ 10^{10} \text{ years x } 0.20 \text{ x } 0.11$$

$$t_{1/2} = 1.14\ x\ 10^{9} \text{ years}$$

Table 1: Data of KCl sample and background recorded for 15 min.

S. No	Mass of KCl (gm)	Counts For KCl	Average of Counts	Background counts	Counts after background subtraction	Counts/sec/gm
1.	1	1226 1234 1220 1238	1230	934	296	0.323
2.	2	1486 1466 1469 1462	1470	950	520	0.288
3.	3	1480 1459 1466 1463	1467	940	527	0.195
4.	4	1430 1455 1443 1466	1449	935	514	0.143

The half-life of ^{40}K, as reported in the literature, is 1.25 x 10^9 years. The experimental measurements from the present work yielded half-life of ^{40}K that demonstrated remarkable agreement with the standard value. The deviation between our measured value and the accepted standard was approximately 8.8%. This level of consistency reinforces the validity and reliability of experimental approach employed in extracting the half-life of the ^{40}K nuclei.

Finally, it may be remarked that accurate knowledge of the half-life of ^{40}K has significant practical applications. One notable application is in the field of geochronology, where the decay of ^{40}K is employed to date rocks and estimate geological ages. By refining our understanding of the decay process through precise determination of the half-life, one can enhance the accuracy and reliability of these dating techniques. Furthermore, our results also have relevance in the calibration of geological time scales. The half-life of ^{40}K plays a crucial role in establishing the chronology of events in Earth's history. By providing a reliable measurement of the half-life, our study contributes to the ongoing efforts to refine and improve the calibration of geological time scales.

It is important to note that further investigations and advancements in experimental techniques hold the potential for reducing the percentage of error in determining the half-life of ^{40}K. These studies will contribute to the ongoing progress in the field of nuclear physics and aid in expanding our understanding of radioactive decay processes.

References:

1. Radiation & Detection Measurement by G. F. Knoll Wiley (2010).
2. M. Shariq Asnain et al., Phys. Rev. C **104**, 034616 (2021)

C. K. Majumdar Memorial Summer Workshop in Physics, 2024

(Held at S. N. Bose National Centre for Basic Sciences, Salt Lake, Kolkata)

C. K. Majumdar Memorial Summer Workshop has been jointly organised with the S.N. Bose National Centre for Basic Sciences (SNBNCBS), Kolkata, from 22nd July to 31st July, 2024 in the campus of the Institute. This happens to be the 25th version of the initiative that began in 1999 with lot of encouragement and guidance of Prof C.K. Majumdar who was an IAPT vice President and the President of this RC. After the unfortunate demise of Prof Majumdar, an outstanding condensed matter physicist in the country and the Founder -Director of SNBNCBS in 2000, the workshop has been dedicated to his memory. During the Covid period we had to skip the programme but later it is continuing with the support from SNBNCBS and we have been able to organise the 25th version of the programme. The participants belonged to the 6th Sem B.Sc. (Physics) and 2nd Sem M.Sc. (Physics) from the institutions located in NCR (Delhi), Jharkhand, West Bengal, Tripura and Odisha.

On the inaugural day, Prof. Anjan Barman, Dean (Academic) SNBNCBS, welcomed the participating students and teachers present. He spoke briefly about the institute and its research activities. Dr. Bhupati Chakrabarti, former General Secretary of IAPT, then introduced the students to IAPT and highlighted the multiple activities being undertaken by the organisation targeted towards betterment of physics education. He also highlighted the genesis of the Workshop and the support IAPT RC-15 is getting from the joint organiser of the programme SNBNCBS over the years.

The structure of the workshop includes normally three talks during the morning session and some laboratory sessions after the lunch. Participants are divided into two groups. One group undertakes laboratory sessions that include some hands-on experiments provided by the SNBNCBS PG lab and some experiments developed at the IAPT- Midnapore College Centre for Scientific Culture. The other group goes to visit different research labs of the Institute. They go to the labs where they are exposed to the functioning of high precision analytical instruments like TEM, AFM, XRDand a few more under the guidance of the Ph.D. students and the supporting staff of the laboratories of SNBNCBS. Dr Avijit Chaudhuri, a faculty member of SNBNCBS, arranged for all the different laboratory sessions. Apart from these a few of the sessions towards the end of the workshop are set aside for the students to present their ideas and analysis on some papers taken from different physics educational journals and given to the students for study.

On the opening day our first speaker was Prof Rupamanjari Ghosh, formerly of JNU and a former VC of Shiv Nadar University, New Delhi. She gave a very nice overview of the happenings in the forefront of quantum optics. Dr. Surajit Chakrabarti, a senior member of our RC, like many previous years, referred to some interesting papers of pedagogic value, carefully chosen from international educational journals. Students were asked to study at least one of the papers and try to understand them. They were encouraged to form small groups of participants (2-3 participants) who were interested in the same topic and make presentations at the students' sessions.

In this Workshop Prof Tanushree Saha Dasgupta, Director SNBNCBS and a leading condensed matter physicist talked on 2D magnets and outlined the research of her group in the institute. Prof Samit Kumar Ray of Department of Physics, IIT Kharagpur talked about 'Recent Trends in Semiconductor Devices' and the work of his group. Prof Ray is the President of the RC-15 and joint organizer of the Workshop. Prof. G.P Das from Research Institute for Sustainable Energy (RISE), TCG-CREST, Salt Lake, spoke on Physics and Chemistry of Energy storage: From Batteries to Hydrogen, from the point of view of a material scientist. Dr. Bhupati Chakrabarti gave a talk on the emergence of Bose statistics in its

centenary year.

Prof. Arnab Rai Chaudhuri of IISc, Bangalore, delivered talk on 'The Mysterious Magnetic Personality of Our Sun.' He talked about the magnetic fields of the sun which is the first astronomical object in which magnetic fields were discovered in sunspots in 1908 by using the Zeeman effect. It was known before this discovery that there is a 11-year cycle of sunspots, which could be identified as the magnetic cycle of the Sun. He explained these in terms of some major developments in plasma physics and magneto-hydro dynamics (MHD). Prof. Asoke Kumar Sen of Assam University, Silchar talked on 'recent space mission to comets and our present day understanding of the origin of the solar system.' He discussed how the comets were formed in the outer part of the solar system some 4.5 billion years ago and then were transported to their present location of Oort cloud by perturbation of giant planets. In a second lecture he discussed major telescopes in India and their polarimetric capabilities in the optical and near infrared (NIR) bands for studying different astronomical objects.

Title of the talk by Dr. Suman Chakraborty of SNBNCBS was 'Computational molecular biophysics: Using computer simulations to understand the thermodynamics and kinetics of biomolecular processes'. Dr. Chakraborty first explained the methods based on molecular dynamics that go into the simulation packages. Then he explained how these packages are used in simulating the energetics of molecular processes and protein folding phenomenon in trying to explain biophysical processes. Dr. Subhro Bhattacharjee of ICTS, Bangalore gave a talk on 'The material multiverse.' Many new material properties have been discovered recently. According to the speaker these are due to the development of entanglement in the quantum wave functions of the matter under consideration rather than the spontaneous symmetry breaking. He discussed the von Neumann entanglement entropy during his lecture. Dr. Saquib Shamim of SNBNCBS talked on 'Introduction to 2D topological insulators. In this talk Dr. Shamim explained first the classical Hall effect and then went on to explain the quantum Hall effect. He then discussed the dynamics of the 2D electrons in a quantizing magnetic field and finally explained the fractional quantum Hall effect and gave an example of a 2D topological insulator.

Dr.Sunandan Gangopadhyay of SNBNCBS who shared the responsibility of the joint convener of the programme delivered a talk on 'Uniformly accelerated observer, equivalence principle and clocks in gravitational field.' He described the general coordinate transformation between an inertial and a uniformly accelerated frame. From this he arrived at the Rindler coordinates and the gravitational time dilation. Dr. Ananda Dasgupta gave a talk on 'how birds flock: the physics of active matter.' Dr. Dasgupta explained flocking, a phenomenon we often see in nature, for example in a flock of bird, a school of fish etc. It is the collective, coherent motion of large number of self-propelled agents like birds that gives rise to this flocking effect. The model simulating this phenomenon has great significance for statistical mechanics. Prof. Palash Baran Pal, retired from SINP gave a talk on 'Neutrinos.' Prof. Pal started from the basic beta decay of nuclei and Pauli's first conjecture of a neutral spin half particle called neutrino. Then he introduced the idea of solar and atmospheric neutrino problem and its resolution in terms of neutrino oscillation. This is a purely quantum effect which needs for its explanation a small mass difference of two neutrino 2 varieties. Then he discussed the status of the baryon asymmetry problem of the universe.

There were altogether more than 25 talks which were delivered on diverse areas by the experts from various fields. There was a good mix of senior and not so senior faculty members and all of them motivated the students albeit at different degrees depending on the area they chose to speak on. Many of the students gave their presentations on the topics they chose from the papers provided to them. Most of the talks were quite lively indicating that the students went through the materials quite critically despite the paucity of time. In the valedictory sessions, while underlining their experience of the Workshop, the participating students appreciated most of the talks. However, a few students commented that they were not

comfortable with the timing of the programme as it clashed with their examination schedule.

It goes without saying that this programme could be done because of enormous efforts from a section of the members of IAPT RC-15. Keeping in mind that it was a wonderful team effort we should specially mention the names of Dr Saswati Dasgupta, who was a joint Convener of the programme, Prof Sukla Chakrabarti, Dr Surajit Chakrabarti, Prof Suman K Ray and Dr. Sunandan Gangopadhyay, also a joint convener from SNBNCBS. The support staff in the auditorium of SNBNCBS played a very effective role. We are expecting that videos of some of the talks will be available in a You Tube channel once the necessary technical work is complete. Finally, we must thank SNBNCBS, the joint organizer of the programme along with IAPT RC 15 for providing not only infrastructural support but also a significant financial support. The financial support also came from the IAPT Central office enabling the RC 15 to complete this task for the 25th time.

Group Photo of the participants, IAPT members & the faculty members from SNBNCBS

Bhupati Chakrabarti,
Surajit Chakrabarti,
Suman K Ray

Report (RC-04)

Faculty Development Programme (FDP)

A six-day Faculty Development Programme (FDP-2024) on "**Data Analysis and Instrumentation Techniques for Translational Research**" was successfully conducted from 15th to 20thJuly2024. The event was organized in collaboration with Invertis University, Bareilly, and the IAPT, RC-4 Uttar Pradesh under the aegis of the Faculty of Science.

The programme was designed to equip faculty members and researchers with advanced skills in data analysis and instrumentation techniques, crucial for translational research in the modern scientific landscape. During the six-day FDP-2024, the

organizers had the privilege of hosting eminent speakers: Dr. Amit Kumar Misra, Dr. Harsh Vardhan Mahara, and Dr. Upendra Kumar. Dr. Amit Kumar Misra, from the Department of Statistics, Babasaheb Bhimrao Ambedkar University, Lucknow, delivered an insightful lecture on scales of measurement and graphical representation. Dr. Harsh Vardhan Mahara, Associate Professor at Invertis University, Bareilly, provided comprehensive lectures on LaTeX, a typesetting system widely used in academia and publishing. Dr. Upendra Kumar, from Indian Institute of Information Technology, Allahabad, offered a thorough exploration of X-ray diffraction (XRD) and its crucial role in material characterization.

Prof. Sundar Singh, also addressed during the inaugural function of FDP and highlighted the academic activities undertaken by IAPT.He appreciated the efforts of Invertis University Officials, particularly honorable vice-chancellor Prof. Y.D.S. Arya and Prof. P. P. Singh, Dean, Faculty of Science, Invertis University for helping RC-04 in organizing such an informative program. Around 45 faculty members from various institutions participated in this FDP.

The successful completion of FDP-2024 marks a significant step towards enhancing the research and teaching capabilities of faculty members and strengthening the academic and research ecosystem at Invertis University. The feedback from participants was overwhelmingly positive, with many expressing their appreciation for the well- structured curriculum and the expertise of the resource persons.

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Sundar Singh
Executive Member

Report

National Conference on Functional Glasses and Ceramics: Impact on Health and Environment-2024 (NCFGCHE-2024) March 1-2, 2024 and Preconference on February 29, 2024

Materials Research Society of India (MRSI), Subject Group: Ceramics and Glasses including Building Materials (CG), MRSI Bangalore Chapter, Indian Association of Physics Teachers (IAPT), Regional Chapter and Visvesvaraya Technical University (VTU), Centre for PG studies, Kalaburagi, and Karnataka State Council for Science and Technology (KSCST) jointly organized a **two-day National Conference on Functional Glasses and Ceramics: Impact on Health and Environment (NCFGCHE-2024) at VTU, during March 1-2, 2024, along with a Preconference session for UG/PG students on 29-02-2024 at S. B College of Science, Gulbarga in hybrid mode.** The aims of the preconference were (i) to give exposure for the undergraduate and postgraduate students to some novel and exciting ideas related to physics, chemistry, and engineering; (ii) to equip them with basic concepts and

technological tools to ask and answer relevant research questions; and (iii) to inspire and motivate them to take up careers in the area of glass and glass-ceramics science. The prime beneficiaries of such gatherings are the students.

The conference was inaugurated by Prof (Dr) Ashoka Raichur of IISc Bangalore, Chairman KSCST. Prof G P Kothiyal, Former Head Glass and Advance Ceramics Division, MG, BARC and Chairman MRSI-Subject Group: Ceramics and Glasses including Building Materials, while welcoming the

Figure 1. NCFGCHE-2024 Inaugural Function

delegates on behalf of MRSI gave genesis of the conference. In the inaugural address, Prof, Raichur mentioned that conferences are key in disseminating knowledge about recent developments. Dr Basawaraj Gadgay, Director of Regional Center VTU, Kalburagi, presided over the function. In the beginning Dr Sambulingappa

(VTU). Welcomed the delegates and invitees, and Dr M S Jogad, Convener NCFGCHE-2024, briefed the participants about the details of the conference, including Invited talks, resource persons, Oral presentations, and Poster presentations.

On this occasion, an Abstract cum Souvenir Book was released, together by Prof Dr. Ashoka Raichur, Dr G P Kothiyal, Dr Bharat Kale, Former DG, CMET Pune, Dr M S Jogad and Dr Baswaraj Gadgay. It contained encouraging messages from Dr Vivek Bhasin, Director BARC Mumbai, Dr Raghvendra Tewari, Outstanding Scientist and Associate Director BARC Mumbai. Dr Balamuralikrishnan, DMRL Hydrabad, Dr N Raghu Director CMET, Pune, Dr (Mrs) Suman Kumari Mishra, Director CSIR-CGCR, Kolkata, Prof Dr VenkappayyA. R. DEsAi, Sri B N Narasimha Murthy, Chancellor, SSSUHE, Kalaburagi, Poojya Dr Sharnbaswappa Appa Chancellor Sharnabasava University and Dr P K Ahluwalia President IAPT.

There were a total of 13 invited talks, including two from abroad (online), 14 Oral, and 20 Poster presentations. In all, 120 students, research scholars and young faculty from different colleges, Universities and premier research institutes attended the conference along with 10 supporting staff members. Among the Invited speakers for the conference we had; Prof. S Murugavel, Delhi University, Delhi: Dr V Sudarsan, Chemistry Division, BARC, Mumbai : Prof R S Gedam, VNIT, Nagpur, Dr Bharat Kale, Emeritus prof and Director Material Science CoE, MIT-WPU, Pune, Former DG, C-MET, Pune , Dr P S R Krishna, Solid State Physics, BARC, Mumbai: Prof Bernhard Roling, University of Margburg, Germany: Prof Mikhail Brik, University of Tartu, Estonia: Dr Gopinath T MIT-WPU, Pune: Prof Dr Gopi Sharma, Kanya Maha Vidyalaya, Jalnandhar: Prof Mahantappa S Jogad, Kalburagi : Dr P Nandi, Glass and Advanced Materials Div., BARC, Mumbai: and Prof C K Jayasankar, Ex-S V University, Tirupati.

The conference was supported by Materials Research Society of India (MRSI), Indian Association of Physics Teachers (IAPT), Karnataka, State Council for Science and Technology (KSCST), and Defense R & D Organization (DRDO) and M/s Borosil Scientific Limited.

A pre-conference on physics education was organized

Figure 2. Release of souvenir

on Feb 29, 2024, for the benefit of students and staff of different colleges. Four invited talks were presented, while three Simulation experiments were conducted.

Among the speakers we had: Shivaprasad Khened, Former Director VITM, Bangalore and Mumbai. (Keynote): Prof. M. S. Jogad, SSSUHE, Kalaburagi; Prof. C. K. Jayasankar SV University, Tirupati, and Prof P K Ahluwalia, President, IAPT. Simulation Experiments were conducted by Prof Sarmistha Sahu, Dr L A Udachan, Dr S M Khened and Dr M T Hosmani.

Figure 3. Some of the Team members of the Conference and preconference

A Valedictory function was organized at the end of the conference on March 2, 2024. In the valedictory address, Dr G P Kothiyal, brought out the need of such conferences and elaborated on the biomedical and environmental aspects of glasses, glass-ceramics and advanced ceramics. Further, feedback from participants and speakers provided very good input for future events. Students also found the conference quite beneficial to them. Prizes/awards were distributed to 3-posters and 3-oral presenters. The evaluation of the oral and poster presentations took place under the chairmanship of Dr. V Sudarshan. During the Valedictory program, Dr. Babu Reddy, Dr. Brijbhushan, Dr. M S Jogad (Convener), and Dr. Shambulingappa graced the occasion.

Overall, the conference and preconference were found useful in reviewing the present status of functional glasses and ceramics, particularly with regard to their impact on health and the environment.

The following invited talks were presented during the conference:

- Unravelling the Potential of Multifunctional Mesoporous Bioactive Glass Nanoparticles
- Mumbai Structure-property correlations in glasses and glass ceramics
- Semiconductor Glasses: Properties and Applications
- Beyond Glasses, Ceramics and glass ceramics
- Local Structure of glasses and glass ceramics
- AFM-based Techniques for the Electrochemical Characterization of Solid Electrolytes and Mixed Ion-Electron Conductors
- Impurity ions in optical materials: first principles and semi-empirical methods of calculations of their spectroscopic properties
- Cocreation for Problem-Solving in society
- Photoluminescence studies of rare earth doped oxide glass ceramics
- Dielectric and neutron diffraction Lithium Zinc Silicate (LZS) glass
- Studies of Radiation Shielding Window Glasses
- Rare earth doped functional glasses and glass-ceramics for societal applications

M.S. Jogad
Convener NCFGCHE 2024

Report

National University Celebrate Inaugural National Space Day IAPT, Centre for Excellence in Quantum Science, and Jaipur

Jaipur, August 23, 2024 — The Indian Association of Physics Teachers (IAPT), the Centre for Excellence in Quantum Science, and Jaipur National University (JNU) jointly celebrated the inaugural National Space Day, an event designed to inspire and engage the next generation of space enthusiasts and scientists. The event brought together students, faculty, and distinguished guests, creating a platform

for learning and inspiration.

The day's highlight was the participation of two renowned speakers who have made significant contributions to space science and education: Prof. (Dr.) P. M. Udani and Rashmi Sheoran.

Prof. (Dr.) P. M. Udani, Vice Chancellor of Sankalchand Patel University, Gujarat, and a distinguished ISRO veteran with 29 years of service, shared his vast experience in space applications and technology commercialization. His tenure at ISRO's Space Applications Centre in Ahmedabad was instrumental in advancing remote sensing, satellite navigation, and developing critical software such as IGiS GIS & Image Processing Software and QPAD Mobile GIS Software. Prof. Udani also played a crucial role in the National Database for Emergency Management, a collaborative effort between ISRO and the Ministry of Home Affairs, which significantly improved disaster management capabilities across the country.

In his address, Prof. Udani underscored the importance of ongoing innovation in space technology and encouraged students to pursu careers in this dynamic and rapidly evolving

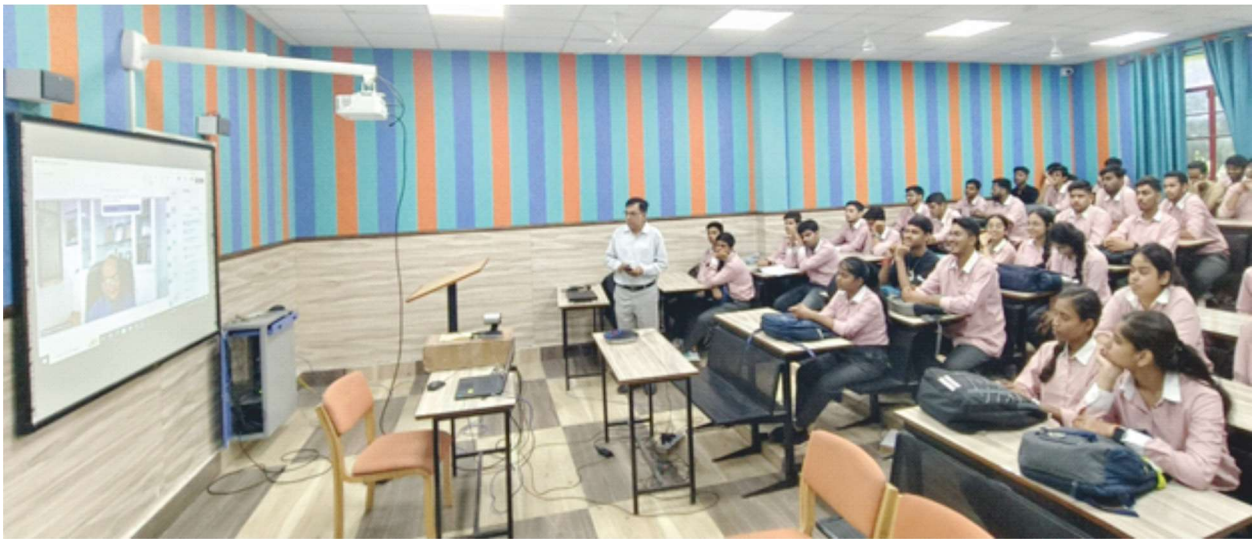
field. "Space science is not just about exploring the unknown; it's about harnessing that knowledge to enhance life on Earth," he remarked.

Rashmi Sheoran, a dynamic science communicator and ISRO space tutor representing The Center for Creative Learning at IIT Gandhinagar, delivered an equally captivating session. A physics graduate from Delhi University, Rashmi has been at the forefront of making science accessible and exciting for young minds. Her work in informal science education, coupled with her social media presence—especially her popular Instagram page, Astro Roxy, with over 50,000 followers—has inspired countless students to delve into the wonders of the universe.

During her session, Rashmi shared her experiences at the Indian Astronomical Observatory and her efforts to bring the stories of scientists to life, making science more relatable and engaging for students. "My mission is to spark curiosity and show students that science is not just confined to textbooks—it's all around us," she said.

The event also included an online quiz that attracted enthusiastic participation from students across JNU and other institutions. Out of 350 participants, 61 students were selected to attend the event in person, while others joined online, ensuring widespread engagement and participation.

National Space Day 2024 was a resounding success, setting a strong foundation for futurecelebrations and continuing the tradition of fostering a scientific temper among the youth.



Y C Sharma
Vice President, IAPT- RC06

Report (RC-12)

Lecture on

Overview of Nanoscience and Its Applications

On the occasion of Library Day, on 12-08-2024, Government First Grade College for Women, Raichur , Karnataka (RC-12) organized a Special Lecture by Dr. Meera R Gumaste, Assistant Professor, Dayananda Sagar College of Engineering, Bangalore. The event was co-ordinated by Dr. Jyoti C K , Coordinator IQAC, Department of Physics, Government First Grade College for Women Raichur, Karnataka. Principal Dr. Suguna Basavaraj gave the Presidential remarks. Chief Librarian Dr. Suresh Patil explained the importance of Books and Library to the students. Dr. Meera explained Nanoscience and elaborated on its applications to Bachelor of Science degree students of Physical Sciences stream.

The event was guided by Prof. Sharanabasava M. Khenedand, Prof M. S Jogad of IAPT RC-12.

Meera R Gumaste

Report (SRC-08E)

Virtual Talk: National Space Day

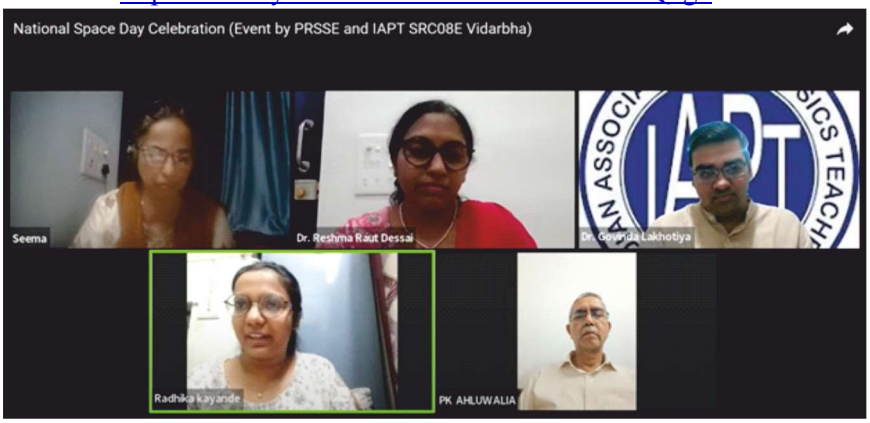
On 22nd August 2024, Prof. Rajendra Singh Science Exploratory (PRSSE), Nagpur, in association with IAPT SRC08E (Vidarbha), hosted a virtual talk to celebrate National Space Day. The engaging session, aimed at school students, featured Dr. Reshma Raut Dessai, from Goa University who delivered an insightful presentation on "Space and Effects of Microgravity."

Dr. Dessai captivated the audience by discussing the vastness of space and the fundamental concept of gravity. She elaborated on the physiological impacts of microgravity on the human body, including muscle atrophy and bone density loss, highlighting the challenges faced by astronauts during long missions. Additionally, she encouraged students to consider careers in astronomy, outlining various opportunities in the field.

The event was hosted by Miss Radhika Kayande, with Dr. Seema Ubale, Director of PRSSE, introducing the speaker. Prof. P.K. Ahluwalia, President of IAPT, provided concluding remarks, emphasizing the importance of space exploration. Dr. Govinda Lakhotiya, Vice-President of IAPT SRC08E, delivered the vote of thanks.

To further engage students, PRSSE organized a poster competition and quiz competition on 23rd August 2023. The virtual talk was a resounding success, inspiring young minds to explore the wonders of space science.

Youtube Live Link: https://www.youtube.com/watch?v=46z7uLoQsg0



Shyamkant W. Anwane
President, SRC-08E

Sub Regional Council Maharashtra 8D

Executive Council Jan 01. 2025 - Dec 31 2027

The election for the new EC for the term from **January 2025** to **December 2027** is scheduled to be held in November- December 2024 for the following posts:

1. President 1
2. Vice-president 1
3. Secretary 1
4. Treasurer 1
5. Members 5

Nomination papers for the above posts are invited so as to reach the undersigned on or before **20th SEPTEMBER,2024**.The proforma for the nomination is given below. Before filing nomination, the candidate is expected to ascertain that he/she satisfies the eligibility criteria as per the Constitution 7d(ii) and the Bye-Laws, Rules and Regulations12(a) of the IAPT Constitution.The nomination papers from the candidate duly filled in with all the details should reach the Returning Officer (RO) through

(1) Speed Post or courier.

(ii) by hand (in a sealed envelope) or

(iii) email (a neatly scanned copy/clear photo of duly filled in nomination paper).

***IMPORTANT NOTE: if a nomination paper (scanned/photo) is sent by an email, the original nomination paper whose scanned copy has been sent earlier should be sent by speed post/courier or by hand so as to reach the RO within SEVEN days from the lastdate. Therefore, such an original nomination paper should reach the RO latest by* 20TH September, 2024.**

IMPORTANT DATES:

Last Date (for nomination papers to reach RO by speed post /by hand/ by email)**---**
27th September, 2024
Last Date (for original nomination papers to reach RO by speed post/courier by hand)---**27th September, 2024**
Scrutiny of nomination papers and intimation of valid nominations to the Candidates**---**
30th September, 2024
List of valid nominations will be communicated to the candidates:**1st October, 2024**
Last Date of withdrawal of nominations by email---**8th October, 2024**

List of unopposed Candidates, contesting Candidates and proforma of ballotpaper will be published in the **November, 2024** issue of the Bulletin.

Elections to the posts, if necessary, to be conducted through ballot papers to reach the RO **14th December, 2024.**
The results will be declared on 19th DECEMBER 2024. Please send the form on address,

RETURNING OFFICER (RO)
Dr. Prashant P. Chikode,
2574, Chintamani, Gothanbhag, Near Ram mandir, Miraj
Dist.- Sangli Pin-416410 (M)-9422408462
Email-prashantchikode@gmail.com

ELECTION NOTIFICATION

INDIAN ASSOCIATION OF PHYSICS TEACHERS-SUB REGIONAL COUNCIL PUNE (SRC-08C)

EXECUTIVE COUNCIL January 01, 2025-December 31, 2027

The Election for the new EC for the term from January 2025 to December 2027 is scheduled to be held in November-December 2024 for the following posts:

1. President-1
2. Vice President-1
3. Secretary 1
4. Treasurer-1
5. Members-5 (from life members in Pune, Ahmednagar & Nashik Districts)

Nomination papers for the above posts are invited so as to reach the undersigned on or before **20th September 2024.**

The proforma for nomination is given below. Before filing nomination, the candidate is expected to ascertain that he/she satisfies the eligibility criterion as per the constitution 7d (ii) and the Bye-Laws,

Rules and Regulations 12(a) of the IAPT constitution.

The nomination papers from the candidate duly filled in with all details should reach the Returning Officer (RO) through

1) Speed Post or Courier

2) By hand (in sealed envelope)

3) E-mail (a neatly scanned copy/ clear photo of duly filled in nomination paper)

Important Note: if the nomination paper (scanned/photo) is sent by an email, the original nomination paper whose scanned copy has been sent earlier should be sent by speed post/ courier or by hand so as to reach the RO latest by 27th September 2024.

Returning Officer:
Dr. Sundarrao F. Dhakane
Ex- Vice Principal & HOD Physics,
Annasaheb Waghire College Otur, Tal- Junnar, Dist -Pune. PIN- 412409.
IAPT Member 7646/4287
Phone: 09421038332/07020673157
Email: dhakanesf@gmail.com

I**MPORTANT DATES:**

LAST DATE (for nomination papers to reach RO by Speed Post/ by courier/ by hand/ by email)- **Friday, 20 September 2024**

LAST DATE (for original nomination papers to reach RO by Speed Post/ by courier/ by hand)- **Friday, 27 September 2024**

Scrutiny of nomination papers and intimation of valid nominations to the Candidate: **Monday, 30 September 2024**

List of valid nominations will be communicated to candidates: **Tuesday, 1 October 2024**

LAST DATE of withdrawal of nominations by email-**Tuesday, 8 October 2024**

List of unopposed Candidates, contesting candidates and proforma of ballot paper will be published in November 2024 issue IAPT Bulletin.

Election to the posts, if necessary, to be conducted through ballot papers to reach the RO-**Saturday, 14 December 2024**

Election Results will be declared on **Thursday 19 December 2024.**

Further, for any election related grievances, approach any of the following members of the grievance Redressal Committee:

1 . Prof. Bharat U. Kangude
Mobile no: 98901 06937 ● Email ID: bharatkangude@gmail.com
2. Dr. Sandip G. Kakade
Mobile No. 95614 09730 ● Email ID-sundipkakade@gmail.com
3. Dr. P. S. Tambade
Mobile No. 86055 29031 ● Email ID-pstam3@rediffmail.com

IAPT- Sub Regional Council Of Maharashtra (Sub RC-08F)

Executive Council January 01, 2025- December 31, 2027

The Election for the new EC of Sub RC-08F (Marathwada Region) for the term from **January 2025** to **December 2027** is scheduled to be held in **November-December 2024** for the following posts:

1. President-1
2. Vice President-1
3. Secretary-1
4. Treasurer-1
5. Members-5

Nomination papers for the above posts are invited so as to reach the undersigned on or before **20th September2024**.
The proforma for nomination is given below. Before filling nomination, the candidate is expected to ascertain that he/she satisfies the eligibility criterion as per the constitution 7d (ii) and the Bye-Laws, Rules and Regulations 12(a) of the IAPT constitution.
The nomination papers from the candidate duly filled in with all details should reach the Returning Officer (RO) through

1) Speed Post or Courier
2) E-mail (a neatly scanned copy/ clear photo of duly filled in nomination paper)
3) By hand (in sealed envelope)

Important Note: if the nomination paper (scanned/ photo) is sent by an e-mail, the original nomination paper whose scanned copy has been sent earlier should be sent by speed post/ courier or by hand so as to reach the RO latest by **27th September 2024**.

Returning Officer:
Prof. Vaibhav DevidasMurumkar, Dept of Physics, Vivekanand Arts, Sardar Dalip singh Commerce and Science College, Chhatrapati Sambhajinagar (Aurangabad), Maharashtra- 431001.
Contact No.: 9422686322
Email ID: vdmurumkar@gmail.com
Life Membership No.: L9393

IMPORTANT DATES:
LAST DATE (for nomination papers to reach RO by Speed Post/ by courier/ by hand/ by email)-
Friday, 20th September 2024.
LAST DATE (for original nomination papers to reach RO by Speed Post/ by courier/ by hand)-
Friday, 27th September 2024.
Scrutiny of nomination papers and intimation of valid nominations to the Candidate: **Monday, 30th September 2024**.
List of valid nominations will be communicated to candidates:
Tuesday, 1st October 2024
LAST DATE of withdrawal of nominations by e-mail-**Tuesday, 8th October 2024**.
List of unopposed Candidates, contesting candidates and proforma of ballot paper will be published in **November 2024** issue IAPT Bulletin.
Election to the posts, if necessary, to be conducted through ballot papers to reach the OR-**Saturday**, **14th December 2024**.
Election Result will be declared on **Thursday 19th December 2024**.

Please send the form on following address, Dr. Vaibhav Devidas Murumkar, Returning Officer IAPT Sub RC-08F EC Elections 2024:
Dr. Vaibhav DevidasMurumkar,
Professor, Dept of Physics,
Vivekanand Arts, Sardar Dalipsingh Commerce and Science College, Chhatrapati Sambhajinagar (Aurangabad), Maharashtra- 431001.
Residential address:Plot No. 75, Sector F, CIDCO, N-4, Chhatrapati Sambhajinagar (Aurangabad), Maharashtra- 431003.
Pin Code- 431003.
Contact No.: 9422686322 Email ID: vdmurumkar@gmail.com
Life Membership No.: L9393

Further, for any election related grievances, approach any of the following members of the Grievance Redressal Committee:

1. **Dr. Ramdas BhanudasKavade**
   Mobile No. 9421349143
   Life membership no: 4701
   Email ID: kavade.ramdas@gmail.com

2. **Dr. Ashok Pandit**
   Mobile No.: 9423452991
   Email ID- principalpandit@gmail.com
   Life membership no. L9383

3. **Mr. Harish Kulkarni**
   Mobile No. : 8308835433
   Email ID- harishkulkarnisbphy23@gmail.com
   Life membership no. L9348

Election Notification

IAPT Sub-regional council Mumbai (SRC08B)

Executive Council (January 01, 2025, to December 31, 2027)

The election of the new executive council for SRC08B will be held for the following posts:

1) President-1
2) Vice President-1
3) Secretary-1
4) Treasurer-1
5) Members- 5

Nominations for the above posts are invited to reach the undersigned on or before **20th September 2024**.

The nomination papers of the candidates duly filled in should reach the undersigned by

1) Speed post or courier
2) By hand delivery (sealed envelope)
3) By email: A neatly scanned copy

If the scanned copy is sent by email, then its original nomination paper should be sent by speed post or by courier to reach the undersigned by **27th Sept., 2024.**

Important dates:

Last date of nomination: **20th Sept. 2024.**

Scrutiny of nomination: **30th Sept. 2024.**

Date of intimation to valid nominations to candidates: **01 Oct. 2024.**

Last date of withdrawal of nominations by email: **8th Oct. 2024.**

The list of unopposed candidates, list of candidates for election and the Performa of ballot paper will be published in November 2024 IAPT bulletin issue.

Elections to the posts, if necessary to be conducted through the ballot papers to reach the RO: Saturday **14th Dec.2024.**

Election results will be declared on Thursday, 19th Dec. 2024.

Please send the form/communication to the following address of RO:

Prof. Kiran Murlidhar Kolwankar

Professor, Department of Physics, Ramniranjan Jhunjhunwala College, Ghatkopar (W) Mumbai 400 086

(M) : 9920381051 Email: kiran.kolwankar@rjcollege.edu.in

PROFORMA OF NOMINATION PAPER FOR

ELECTION TO THE EC / RC / SUB RC

FOR THE TERM JANUARY 01, 2025 TO DECEMBER 31, 2027

(PLEASE FILL IN CAPITAL LETTERS ONLY)

(A) 1. NAME OF THE POST :

2. NAME OF THE CANDIDATE IN FULL :

3. LIFE MEMBERSHIP NO. :

4. POSTAL ADDRESS :

5. MOBILE NO. :

6. EMAIL :

(B) 1. NAME OF THE PROPOSER :

2. LIFE MEMBERSHIP NO. :

3. POSTAL ADDRESS :

4. MOBILE NO. :

5. EMAIL :

6. SIGNATURE OF THE PROPOSER :

(C) 1. NAME OF THE SECONDER :

2. LIFE MEMBERSHIP NO. :

3. POSTAL ADDRESS :

4. MOBILE NO. :

5. EMAIL :

6. SIGNATURE OF THE SECONDER :

(D) DECLARATION BY THE CANDIDATE / NOMINEE :

I declare that I do not hold any of the elective posts to the Executive Council more than once immediately prior to this nomination. I give my consent to the above nomination.

Signature :
Date :
Place :

JAIPUR NATIONAL UNIVERSITY, JAIPUR

NAAC

in association with

Center for Excellence in Quantum Science (CEQS)

Indian Association of Physics Teachers (IAPT), RC-06, Rajasthan Chapter

&

National Academy of Sciences India (NASI), Rajasthan Chapter

organize

Seminar on "Discovery & Detection of Gravitational Waves"

September 14, 2024

CHIEF PATRONS

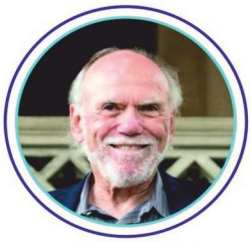
2017 Physics NOBEL Laureates

Massachusetts Institute of Technology

PROF. RAINER WEISS
Professor of Physics (Emeritus)

PROF. KIP S. THORNE
Richard P. Feynman Professor of Theoretical Physics (Emeritus)

Caltech



PROF. BARRY C. BARISH
Ronald and Maxine Linde Professor of Physics (Emeritus)

The Division of Physics, Mathematics and Astronomy

Register

Link: https://forms.gle/86eoK5W6bhNUS9ZQ6

JAIPUR NATIONAL UNIVERSITY, JAIPUR

NAAC

in association with

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Indian Association of Physics Teachers (IAPT), RC-06, Rajasthan Chapter

&

National Academy of Sciences India (NASI), Rajasthan Chapter

organize

Seminar on "Discovery & Detection of Gravitational Waves"

September 14, 2024

SPEAKERS

PROF. T. SOURADEEP
Director, Raman Research Institute, Bangalore

PROF. A. C. PANDEY
Director, IUAC, New Delhi

PROF. P. C. DESHMUKH
IIT, Tirupati &
RV University, Bengalore

PROF. PATRICK DAS GUPTA
University of Delhi, Delhi

PROF. SARAH SHANDERA
Director, Institute for Gravitation and the Cosmos
Davey Laboratory University Park, PennState, USA

PROF. GABRIELA GONZÁLEZ
LSU Boyd Professor, Physics and Astronomy
Louisiana State University, LA, USA

PROF. MANJARI BAGCHI
The Institute of Mathematical Sciences, Chennai

PROF. SUDIP BHATTACHARYYA
Payload Manager or PI,
Soft X-ray Telescope, AstroSat Space Mission,
Department of Astronomy and Astrophysics, TIFR, Mumbai

PROF. K. N. JOSHIPURA
Sardar Patel University, Anand

PROF. ARUNAVA MUKHERJEE
Saha Institute of Nuclear Physics, Kolkata

PROF. ANAND SENGUPTA
IIT, Gandhinagar

PROF. SUVODIP MUKHERJEE
Tata Institute of Fundamental Research, Mumbai

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Central University, Amarkantak

DR. SURESH DORAVARI
R&D Scientific & Technical Officer-F
IUCAA, Pune

SAURABH SALUNKHE
Senior Outreach Coordinator for LIGO-India
IUCAA, Pune

Chair

PROF. YOGESH CHANDRA SHARMA
Director, Research & Academic Development, Jaipur National University
Director, Center for Excellence in Quantum Science (CEQS)
Vice President, IAPT-RC6; Treasurer, MRSI-Rajasthan Chapter
Mobile: 9664075093; email: director.res.acad.dev@jnujaipur.ac.in

Register

Link: https://forms.gle/86eoK5W6bhNUS9ZQ6

FIRST ANNOUNCEMENT

XI IAPT National Student Symposium on Physics (NSSP) – 2024.

IAPT has instituted the Annual National Student Symposium on Physics (NSSP) in order to foster a culture of innovation and creativity among the young students.

The yearly series started in 2013 in collaboration with the Department of Physics, Panjab University, Chandigarh. The first seven in the series NSSP 2013-2019 were successfully held at the Department of Physics, Panjab University, Chandigarh.

The 8th and 9th NSSP were held in Bengaluru during 2021-2022 and the 10th NSSP-2023 was held in Panjab University, Chandigarh.

The Symposium provided a national forum to young students to present their new ideas and innovation work at an early stage of academic career.

- We are glad to announce that 11th in the series, NSSP – 2024 will be held during November 12-14, 2024, at the Department of Physics, USTM (University of Science and Technology, Meghalaya) 9th Mile, Ri-Bhoi, Meghalaya (6 kms from Dispur, Guwahati).

SALIENT FEATURES OF THE PROGRAMME

- Oral/poster presentation by UG/PG students
- Invited talks by subject experts
- Visit to research laboratories/ campus visit
- Sky observation
- Local hospitality and accomodation to outstation students
- Registration fees for outstation participants Rs. 500/-

IMPORTANT DATES

Registration opens: 1st September, 2024.
LINK [https://docs.google.com/forms/d/e/1FAIpQLSfpcIqNsd1RoI8Eh-xr6oeQLp3JtSQZPyIOt8QBbzaaE3dFNg/viewform]
Last date of submission of Abstracts for poster and oral presentations: 30th September 2024.
[Abstracts are to be submitted through email: nsspiapt24@gmail.com]
Display of list of Selected Participants: 1st week of October, 2024.
Selected candidates must bring complete manuscript of their work in a proper template.

For information
nsspiapt24@gmail.com
Dr. Ranjita Deka
Co-ordinator, NSSP-2024
Guwahati, ASSAM.
Mobile No. 9864065585, 8135846535

- Please circulate this information to all interested undergraduate/postgraduate students of your college/university departments to encourage maximum participation.

Unveiling Excellence

XI-IAPT NATIONAL STUDENT SYMPOSIUM ON PHYSICS (NSSP-2024)

Organized by

Indian Association of Physics Teachers RC-17 & Department of Physics

UNIVERSITY OF SCIENCE & TECHNOLOGY MEGHALAYA

Accredited 'A' Grade by NAAC

About The Symposium

Indian Association of Physics Teachers (IAPT) has instituted the Annual National Student Symposium on Physics (NSSP) in order to foster innovation and creativity among young students. The yearly series, which started in 2013 in collaboration with the Department of Physics, Punjab University, Chandigarh, successfully held its first seven NSSPs at this venue from 2013 to 2019.The VIIIth and the IXth NSSPs were held in Bengaluru during 2021-2022 and the Xth NSSP-2023 was held at Punjab University, Chandigarh. The symposium provides a national forum for young students to present their new ideas and innovative work at an early stage of academic career.

We are glad to announce that the XI in the series NSSP will be held during November 12-14, 2024 at the Department of Physics, University of Science & Technology Meghalaya, 9th Mile, Khanapara, Ri-Bhoi, Meghalaya (6 km from Dispur, Guwahati).

Salient Features

1. Oral/Poster Presentation by UG/PG students on Physics and its related interdisciplinary subjects
2. Invited Talk by Subject experts
3. Visit to Research Laboratories/Campus Visit
4. Sky-Observation
5. Local Hospitality and Accommodation to Out-station Participants
6. Registration Fees: Rs. 500/- only

Important Deadlines

Registration Opens:
1st September 2024
Last date of Submission of Abstracts:
30th September, 2024
Display of List of selected Participants:
1st week of October, 2024
Registration Link:
https://forms.gle/KYs6u1xCo64bkgJn9

Registration Fee Payment

Registration Fee : **Rs. 500/- only** (Can be made in the Bank Details given below)
Bank Name : **UCO Bank**
Account Holder : **INDIAN ASSOCIATION OF PHYSICS TEACHERS (IAPT), REGIONAL COUNCIL XVII**
Account Number : **05720100013418**
Branch Name : **Dispur, Assam**
IFS Code : **UCBA0000572**
(Please SAVE a screenshot of the successful transaction to upload during registration process.)

Abstract Submission and Publication of Papers

Selected original unpublished papers presented in the symposium (Oral/Poster) will be published in IAPT students bulletin PRAYAS, after peer review. A template for the Abstract is available in the following link: **https://shorturl.at/8PcK0**
Abstracts are to be submitted through E-Mail: **nsspiapt24@gmail.com**

Accommodation for Outstation Participants

Budget-friendly accommodation will be provided near USTM campus on a first-come, first-served basis (Sharing). Please note that accompanying persons will need to arrange their own accommodation or pay for the provided accommodation.

Date : 12th–14th November, 2024
Venue: USTM Campus

Campus
Techno City, Khanapara, Kling Road, Baridua, 9th Mile, Ri-Bhoi,Meghalaya-793101
E-mail : ustm2011@gmail.com Web : www.ustm.ac.in

NATIONAL GRADUATE PHYSICS EXAMINATION (NGPE-2025)

Conducted by

INDIAN ASSOCIATION OF PHYSICS TEACHERS

Registered Office : 206, Adarsh Complex, OPR 4, Awas Vikas-1, Keshavpuram, Kalyanpur, Kanpur - 208017
Web: www.indapt.org (Regd. No. K 1448)

Day, Date & Time of Examination SUNDAY, January 19, 2025
TIME : 10.00 AM to 1.00 PM

Last Date for Enrolment : 17th November 2024

Eligibility for Appearing in NGPE-2025 : Students of B.Sc. I, II and III (Pass, Hons. or Integrated) are eligible. (Any one who has already passed B.Sc. is NOT eligible)

Exam Information :

Enrolment Fee : ₹ 300 (Rupees Three Hundred Only)
Language for NGPE : English, Hindi, Gujarati, Tamil, Telugu or any other language if 100 or more Students opt for it.

Format for NGPE :

Part A : 25 MCQs with any number of options (1,2,3 or all 4) may be correct. Credit is given only if all the correct options are marked (6 marks each; Total 150 marks)
Part B1 : 10 Short Answer (5 to 6 Lines) Questions (5 marks each ; Total 50 marks)
Part B2 : Ten Problems (10 marks each ; Total 100 marks)

Unique Features of this Examination :

- Fully voluntary examination in a stress free environment.
- Carry away the question paper both part A and part B.
- It provides Individual's own assessment at all India level.
- Same paper for all BSc I, II and III Year Students with separate national merit.
- Solutions in printed form are provided to Centre In-Charge for each participant.
- The only national level examination testing students in both theory & experiment.
- Previous Year (2024) Question Paper & Solution for every centre registered for NGPE - 2025.

CERTIFICATES AND AWARDS IN NGPE - 2025

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

NGPE-2025 Awards

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

- Top 25 will be eligible for appearing in NGPE Part-C Examination - 2025 (an examination in experimental skill) for final selection for GOLD MEDAL and one time Scholarship (Max. 5 in Number) worth ₹ 20,000/- for pursuing higher studies in Physics. TA is paid and free lodging arranged.
- Top 25 will have eligiblity for an interview for Admission in Post - B.Sc. Integrated Ph.D. Programme in Physical Sciences 2025 of S N BOSE NATIONAL CENTRE FOR BASIC SCIENCES. KOLKATA, (Only BSc III year students with more than 60% Marks)
  For more details must see website: http://bose.res.in/admission.htm or write email to admission@bose.res.in
- May get opportunity to attend one week EXPERIMENTAL PHYSICS WORKSHOP organized by IAPT AT KOLKATA (Regional Council - 15). TA is paid.
- Top 5 to 10 students of B.Sc. First year (of University 3Yr System) shall be eligible to participate in prestigious NATIONAL INITIATIVE FOR UNDERGRADUATE SCIENCE [NIUS] program of Homi Bhabha Center for Science Education, TIFR, Mumbai. [This is A Govt. of India, DAE Program organized at Mumbai].
- Top 20 students of B.Sc. I appearing in NGPE-2025 may get an opportunity for two weeks Academic Workshop on Basic Physics at IIT Guwahati (Preferably for those from University 3-yr B.Sc. System)
- Some more programmes for toppers may be declared later.

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

FOR FURTHER INFORMATION : CONTACT

Dr Pradip Kumar Dubey
Coordinator NGPE
75, Bhagat Singh Marg, Opp. Shani Mandir
Dewas - 455 001 (M.P.)
Ph: 9425059796
Email: pradipkdubey@gmail.com

Prof B P Tyagi
Chief Coordinator (Examination)
23 Adarsh Vihar, Raipur Road,
Dehradun - 248001 (Uttarakhand)
Tel : +91 135 4050260, 9837123716, 9632221945
Email: iaptddn@gmail.com

Local Contact
Tel : _____

Why does our `problem solving' fail in solving novel, real-world problems ?

Solving textbook problems is a core, routine part of physics education in our classrooms. The eventual objective of this practice is to train students to acquire skills that will enable them to solve novel, open ended or real word problems. However, this goal is rarely achieved! In this column we review some research that sheds light on this problematic issue. Physics education research has dealt with it rather extensively, generating a vast amount of literature on different dimensions pertaining to problem solving (see the resource letter below for an overview).

Hsu, L., Brewe, E., Foster, T. M., & Harper, K. A. (2004). Resource letter RPS-1: Research in problem solving. *American journal of physics*, *72*(9), 1147-1156.

Many have noted that textbook problems have certain inherent limitations in imparting genuine, authentic problem-solving skills. They are often highly sanitized and structured, in contrast to complex, novel or real world problems, which are mired in uncertainties and embedded in vast amount of undelineated information. The assumption is that, despite these limitations, solving textbook problems will nurture skills that are transferable and useful when a novel or a real world problem is encountered. However, this transfer is contingent on many factors. One major stifling factor is the prevalence of unproductive problem-solving approaches among students such as the plug-n-chug approach. The paper below, which characterizes the approaches to problem-solving by students into a set of hierarchical categories, discusses this point further. The researchers interviewed 23 undergraduate physics students on how they go about solving problems as part of their courses. They then analyzed the key characteristics and focus of approaches employed by these different students. A lack of qualitative analysis, identification or recall of memorized equations, plugging in variables in these equations rather mechanically etc. were identified as some of the features of the plug-n-chug approach.

Walsh, L. N., Howard, R. G., & Bowe, B. (2007). Phenomenographic study of students problem solving approaches in physics. *Physical Review Special Topics—Physics Education Research*, *3*(2), 020108.

Pattern matching is another widely prevalent and problematic approach employed by students, especially those preparing for high-stakes competitive examinations. In this approach, students solve hundreds of problems thereby building a library of `problem patterns'. When encountering a new problem during the exam, the strategy is to revert to this library and employ a kind of template matching so as to swiftly generate the required answer. It may be noted that my point is not to dismiss these strategies as totally useless or to portray a deficit account of the students, but rather to highlight their limitations. The below article by Nobel laureate-turned science education researcher - Carl Wieman, provides a contrast case to understand these limitations in a very compelling way. He elucidates features of problem solving employed by scientists and engineers when solving complex problems. The article lists out a set of 29 decision making questions or steps commonly employed in research settings, but largely absent from the problem solving instruction imparted to students during their courses. These steps or strategies involve complex mental processes, imaginative work, and decision-making requirements. The author provides insights into how existing education practices prevalent in classrooms can be tweaked or modified to incorporate them.

Wieman, C. (2022). How to become a successful physicist. *Physics Today*, *75*(9), 46-52.

With a heavy emphasis on Olympiads and exams like IIT JEE, our context is a fertile ground for physics education research focused on problem solving. The prevalence of unproductive learning strategies, problem solving approaches and their subsequent impact on creativity are all discussed based on anecdotal evidence but are rarely subjected to systematic investigation. With generative AI becoming popular, and tools like ChatGPT being able to solve textbook-like problems, these issues are likely to become more stark in near future necessitating a renewed commitment to studying them.

K K Mashood
HBCSE - TIFR, Mumbai

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

VOLUME 16 NUMBER 9 SEPTEMBER 2024

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Dr. Sanjay Kr. Sharma

Managing Editor

Flat No. 206, Adarsh Complex,

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

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