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# THE INDIAN ASSOCIATION OF PHYSICS TEACHERS

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This composite image shows the Christmas Tree Cluster. The blue and white lights (which blink in the animated version of this image) are young stars that give off X-rays detected by NASA's Chandra X-ray Observatory. Optical data from the National Science Foundation's WIYN 0.9-meter telescope on Kitt Peak shows gas in the nebula in green, corresponding to the "pine needles" of the tree, and infrared data from the Two Micron All Sky Survey shows foreground and background stars in white. This image has been rotated clockwise by about 160 degrees from the astronomer's standard of North pointing upward, so that it appears like the top of the tree is toward the top of the image.

Link: <https://www.nasa.gov/image-article/telescopes-illuminate-christmas-tree-cluster>

## The Story of Cosmology Through Post Stamps 65

### THE NEW ASTRONOMY

### GAMMA RAY ASTRONOMY

Gamma Rays are most energetic form of electromagnetic radiation. Since most of the radiation are absorbed by the atmosphere, so gamma ray astronomy depends upon instruments placed at high altitude. Most of the gamma ray radiations comes from Galactic plane because of the interaction between cosmic rays and interstellar gas. However, many discrete and enigmatic source like Pulsars, Hypemova and extra galactic source like Blazer produce strong gamma ray burst.



**Balloon astronomy** – Swedish PIROG, 1990, equipped with IR and sub mm instruments



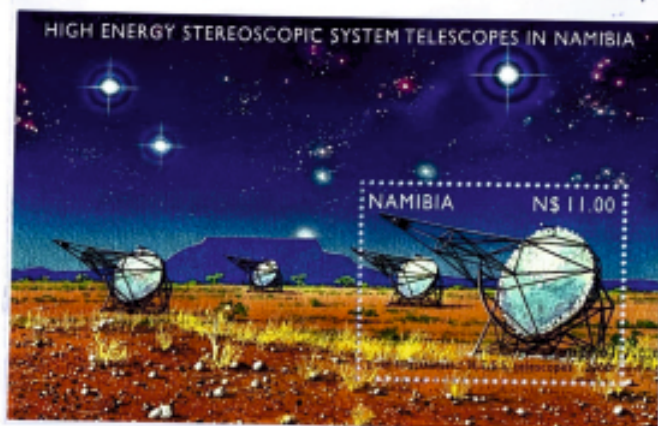
**A Pin Hole in Stamp** represent Gamma ray source in Crab Nebula as detected by Pointed Infrared Observation Gondola (PIROG)



AGILE satellite, launched by ISRO, 2007, first time provided the complete map of the sky as visible in Gamma Ray



**Stamp with hologram sticker**- depict gamma ray observatory Compton, with sensitive telescope EGRET first to provide complete view of sky in gamma ray of 100MeV (in3D sticker). Milky way in Background



**High Energy Stereoscopic System; HESS**, most sensitive telescope, to detect weak beam of Cherenkov Radiation generated by gamma- rays on entering in atmosphere.



**Triptych set of 8 stamps**- Depict space research program by NASA, in which a sensitive gamma ray was also on board on space shuttle



**BULLETIN OF  
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## An outlook beyond IAPT at 40

Indian Association of Physics Teachers has just completed forty years of its presence on the horizon of Physics Education, Research and Outreach activities in India. A moment to cherish, celebrate and reflect. Time to remember and thank visionaries who dreamt of it and made sure that it survives.

Achieving this milestone is a very interesting and inspiring story, of very humble collective efforts of its members, its stakeholders and vision of its founders. Founders had a plan, is evident from a very well-established working network of Regional Councils across the length and breadth of Bharat with an autonomy to work for the *love of Physics*, for dissemination of knowledge of physics to young impressionable minds and above all preparing and empowering teachers to give their best to their students.

Past is like a history book and future symbolizes new hopes, and new possibilities. It is indeed a work in progress always. We have to continuously evolve, reinvent and innovate to remain relevant for the causes dear to us. Change is the key to success and changing with times is the hall mark of a resilient organization.

We can see a transition of IAPT into an era of world without borders through the means of information technology. Virtual platforms are buzzing with IAPT activities and green shoots of young members joining us is a welcome sign.

IAPT has to rise to the challenges which NEP 2020 implementation is bringing on our tables. The answers to these challenges lie in collective and sincere efforts through teams working for well identified tasks and recognizing and roping in young leaders from among us and from outside.

We have to resolve and see to it that our resolutions do not fade away, putting us into a sense of complacency. When it comes to teachers, society is beholden to us to deliver quality education for nurturing capabilities,

competencies, creativities and inquisitiveness. Can each one of us put forward our takes for the next one year in the form of action plans?

Here are my mine outlook points which I would like to put before you to mark this occasion:

1. *Complete transition and alignment of IAPT's working to the best of harnessing information technology* for the spread of our outreach within India and outside India.
2. Time has come to start international chapters of IAPT and bond with international community of Physicists, physics lovers and physics teacher bodies.
3. A series of action plans to *model school and UG Physics Education* to improve physics curriculum both for theory and laboratory and to make it worth the needs and aspirations of the students, to make country a STEM power in the world. Physics and physicists are known for bringing paradigm shifts and to be part of this process IAPT must play a role. Bring out *model syllabi and supplementary material* in tune with National Higher Education Qualification Framework (NHEQF) and needs of Basic Science Education and research.
4. We need to get into *workshop modes* across the country to brainstorm, document, publicize and implement learning opportunities beyond the classroom.
5. Converting our journals (IAPT bulletin, IAPT Physics Education and IAPT Prays) into *open journal systems (OJS)* in next six months bringing them at par with the best in the world.
6. As they say *Money Matters*, and it matters more when we can see need of its investment for a positive change. This is desirable to make our activities both viable and sustainable. We have to come forward with ways and means to raise funds through all possible sources for the good of physics. Let us utilize various channels for this: *crowd funding, CSR funding, member endowments, MOUs with institutions to hand hold IAPT activities (ISRO, BARC, HBCSE, IISER's etc.)*. Our dynamic website is ready to initiate these.
7. Academic resource generation in the form of workshops, topical schools, book writing, PER practices, AI for physics .... And curating these for access to stake holders without barriers.
8. Strengthening the *network of IAPT within Regional Councils* by floating sub regional councils. Remember more the merrier works beautifully for a grassroot level organization like IAPT. The councils can create audio and video podcasts to network with the physicists and scientists and institutions of the region.
9. *Making election process of the IAPT online* for the coming elections of IAPT at different levels.

Dear members, I welcome you to share your outlook points for the future of IAPT beyond 40. Add your outlook points to mark your foot prints for raising the quality of Physics Education by posting these as IAPT feeds with suggestions to turn your outlook points into action plans.

All steps for improvement are easy to discern once they are identified. The moot point is to identify them, work on them to bring improvement and become part of an IAPT brigade who made impossible possible.

**Greetings and best wishes for a very happy and happening New Year 2024.**

**PK Ahluwalia**  
President

## PHYSICS NEWS

### **Ancient stars made extraordinarily heavy elements, researchers find**

An international team of researchers has found that ancient stars were capable of producing elements with atomic masses greater than 260, heavier than any element on the periodic table found naturally on Earth. Stars are element factories, where elements constantly fuse or break apart to create other lighter or heavier elements. The heaviest elements are only known to be created in neutron stars via the rapid neutron capture process, or r-process. The team at North Carolina State University took a fresh look at the amounts of heavy elements in 42 well-studied stars in the Milky Way. The stars were known to have heavy elements formed by the r-process in earlier generations of stars. By taking a broader view of the amounts of each heavy element found in these stars collectively, rather than individually as is more common, they identified previously unrecognized patterns. The team was able to determine that the r-process can produce atoms with an atomic mass of at least 260 before they fission which haven't been previously detected. This can give insight to rich diversity of elements came to be.

**Read more at:** <https://phys.org/news/2023-12-ancient-stars-extraordinarily-heavy-elements.html>

**Original paper:** Science (2023) DOI: 10.1126/science.adf1341

### **'Doughnut' beams help physicists see incredibly small objects**

In a new study published in *Optica*, researchers at the University of Colorado Boulder have used doughnut-shaped beams of light to take detailed images of objects too tiny to view with traditional microscopes. The research is the latest advance in the field of ptychography, a powerful technique for viewing very small things. Unlike traditional microscopes, ptychography tools don't directly view small objects. Instead, they shine lasers at a target and then measure how the light scatters away. In the new study, however, Murnane and her colleagues decided to try something different. They didn't make their shadow puppets using regular lasers. Instead, they generated beams of extreme ultraviolet light, then employed a device called a spiral phase plate to twist those beams into the shape of a corkscrew, or vortex. Moving forward, her team wants to make their doughnut strategy even more accurate, allowing them to view smaller and even more fragile objects—including, one day, the workings of living, biological cells.

**Read more at:** <https://phys.org/news/2023-12-doughnut-physicists-incredibly-small.html>

**Original paper:** *Optica* (2023) DOI: 10.1364/OPTICA.498619

### **How do quark-gluon-plasma fireballs explode into hadrons?**

Quark gluon plasma (QGP) is an exciting state of matter that scientists create in a laboratory by colliding two heavy nuclei. These collisions produce a QGP fireball. The fireball expands and cools following the laws of hydrodynamics, which govern how fluids behave in various conditions. Eventually, subatomic particles (protons, pions, and other hadrons, or particles made up of two or more quarks) emerge and are observed and counted by detectors surrounding the collision. The research provides a tool for using simulations to compute observable fluctuations in the QGP. This has allowed the researchers, from the University of Illinois, Chicago, to use freeze-out to identify hints of a critical point between a QGP fireball and a gaseous hadronized state. This critical point is one of scientists' unresolved questions about quantum chromodynamics, the theory of the strong gluon-driven interactions between quarks. The novel freeze-out procedure will find applications in the theoretical calculations of event-by-event fluctuations and correlations observed in experiments such as the Beam Energy Scan program at RHIC aimed at mapping the QCD phase diagram.

**Read more at:** <https://phys.org/news/2023-12-quark-gluon-plasma-fireballs-hadrons.html>

**Original paper:** *Physical Review Letters* (2023). DOI: 10.1103/PhysRevLett.130.162301

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INDIA

## **Abstracts of Oral Presentations at the National Symposium of Physics-2023 held at Panjab University, Chandigarh during October 27 – 30, 2023.**

### **O-1: AN ANALYSIS OF PLANETARY PARAMETERS OF EARTH, MARS, JUPITER AND SATURN**

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The axial tilt, semi-major axis, and rotational period of a planet are all known to be independent of each other. However, by analyzing the values of these parameters for Earth, Mars, Jupiter, and Saturn, it was discovered that all these quantities are directly related and their relation can be explained using one equation. This equation is explained below. Let  $\theta$  be the axial tilt,  $v$  be the equatorial rotational velocity,  $a$  be the semi-major axis,  $d$  be the diameter and  $n$  be the number of significant moons of a planet. This relation may seem like a conflicting idea however, on substituting the values in equation 1 its validity becomes explicit. Outer planets like Jupiter and Saturn have captured many moons, most of these moons are KBOs or asteroids. In this study, it is necessary to consider only those moons that have enough mass and proximity to their host such that they exert enough gravitational force to influence their planets. Such moons can be called Significant moons. The effect of smaller (and distant) moons can be ignored. These moons with the lowest gravitational force can be found using interesting patterns realized when the gravitational force of moons was plotted. The results of Equation 1 are fascinating because they show a direct relation between quantities that were previously considered independent. Equation 1 also shows (mathematically) how a moon affects its host planet. Given that the aforementioned values are utilized to explain seasons, surface temperature etc. of a planet; a direct relationship between these quantities will substantially increase our comprehension of distinct planets' events and the laws that govern them. Equation 1 and the techniques used for identifying lower magnitude moons are being discussed for the first time. The entire work is novel and with endless applications

### **O-2 GALAXY ROTATION CURVES USING DIFFERENT MODELS**

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This review work presents an in-depth examination of three theoretical models proposed to explain the phenomenon of flat rotation curves observed in galaxies. To examine different models, in our study we have taken the data of four galaxies, namely NGC 2403, NGC 3198, NGC 6503, and NGC 2903 from Begeman[1]. First, we have considered the Dark Matter Halo Model with an exponential disk[2] to study the role of non-baryonic dark matter as a potential explanation for the observed discrepancies, and then we delve into Modified Newtonian Dynamics (MOND)[3] where the model assumed a deviation from the Newton's second law for low acceleration. Additionally, we explored the Navarro-Frenk-White (NFW)[4] it is a mathematical model to describe the distribution of dark matter in the halos of galaxies, it only describes the dark matter component of the halos and does not account for the presence of baryonic matter, we computationally optimized different parameters to obtain the best fit corresponding to the observed rotation curve.

### **O-3: HIGHLY MAGNETISED MASSIVE WOLF-RAYET STAR FAVOURS A MAGNETAR FORMATION AFTER SUPERNOVA**

**Bhavya Jain and Vanshika Gupta**

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Massive star which exceeds Chandrasekhar mass limit (mass  $M \gtrsim 1.4$  solar masses ( $M_{\odot}$ )) end their lives as a supernova and as a result form neutron star. Magnetars are a type of neutron star which have extremely powerful magnetic fields of around 10 to Tesla. They have a magnetic field thousand times stronger than an ordinary neutron star. In this article, we briefly review an article which says that a massive helium star with a sufficiently strong magnetic field, i.e. HD 45166 will form a magnetar. Using Spectropolarimetry technique, Binary Star HD 45166 containing a rich helium quasi-wolf-rayet (qWR) star core which has already lost its outer hydrogen rich layer with mass of 2 solar masses and magnetic field of 43 kiloGauss, makes it the most magnetic massive star known and only qWR star in which such high magnetic field has been measured. It is a rare object which is difficult to explain. Since formation mechanisms of magnetars are unknown, they might explain how magnetars are formed.

### **O-4: TOUCHING THE SUN'S SECRET: THE PARKER SOLAR PROBE SPACECRAFT**

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The Parker Solar Probe (PSP) is a NASA spacecraft launched on 12th August, 2018. It was launched by NASA with the aim of studying the sun's corona and solar wind at close proximity. The PSP mission has been successful since its launch. It has provided valuable data and insights about the sun's corona, solar wind and various solar phenomena. The spacecraft has completed several close approaches to the sun and has been able to withstand the extreme heat and radiation in the solar environment, which shows the elegance of this spacecraft. The mission has contributed significantly to our understanding of the sun and its effect on space weather and earth environment. This very mission will act as a transition bridge between 1st type of civilization to 2nd type of civilization, the future of Dyson sphere might not be really that far away.

### **O-5: MARS EXPLORATION ROVER (MER): SEARCHING FOR RED GIANT**

**Rohit Jangid**

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Mars a giant red planet, celestial body which is next to the earth and a part of the solar system. So is exploration of Mars needed? First we have to talk about the single question that we are dealing with in space science- "Are we alone?", "Where do we come from", may be life evolved on Mars first, maybe we are Martian. In 1970's NASA Viking mission, a spacecraft safely landed on the surface of Mars and returned images of the surface. This search for life dominated all over in the public and governmental interest in the mission. And when life wasn't found by Viking then there was disappointment and we had no Mars mission for next 20 years as a consequence. Primary mission of the lander was to look for life on the surface and that searched to nothing- what Viking found was- unfriendly environment for life, 150° below 0° at midnight, very thin atmosphere, no protection from the solar radiation, no organic chemicals in the soil, no liquid water, the verdict at that time was that "Mars is dead". After few years



NASA came up with this idea and curiosity of human kind. NASA's current strategy is "search for life then go with water". Mars and Earth come closest every 780 days, called planetary opposites, it is the best time to observe the red planet. Then the rover has to be smart enough to make its own decisions (Earth is far away to operate it), should have high resolution stereovision to survey the landscapes, infrared camera to do many tests and more science instruments around robotic arm. And after successful mission conducted by humans. Future mission is focused on if the humans can go in deep space as well as on Mars. NASA, SPACE-X and other private companies are still working on it. "Mars exploration is the biggest and bravest step taken by humans."

#### **O-6: A PYTHON-BASED NUMERICAL INVESTIGATION OF DEUTERON GROUND STATE USING SQUARE-WELL POTENTIAL.**

**Niyukti Patil**

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Deuteron is the only bound system of two nucleons in nature. Experimentally, the deuteron is a weakly bound nucleus with a binding energy of  $-2.224$  MeV. Theoretically, the deuteron binding potential is computed by solving a transcendental equation, which is hardly solvable analytically. In his work, using the available experimental information, the depth and range of a square-well-shaped binding potential are numerically computed by solving transcendental equation. Various numerical techniques are employed to solve transcendental equations through Python programming. The best numerical approach is identified by comparing the results from different numerical methods. Further, the wave function, effective range and root-mean-square radius corresponding to the deuteron ground state under the influence of the computed potential are also determined.

#### **O-7: THE SECRET SPIRAL MOTION OF THE EARTH: A PYTHON SIMULATION**

**Bhavninder Singh Viridi**

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Earth is our home planet, and we live on it. The Sun, our home star, is the main reason for life on Earth. The Sun's gravity causes Earth to revolve around it. Earth orbits the Sun in an elliptical orbit, but it can be assumed to be a circular orbit as Earth's orbit is pretty circular. However, it does not stop there. As we know, the Sun also orbits the center of the galaxy with all the planets, their satellites, and all the asteroids and other objects. If we now look at Earth's orbit, it is helical, not elliptical or circular. This is because as the Sun moves, Earth moves with it, causing Earth to show a helical motion instead of an elliptical or circular one. I will try to show this motion of Earth with the Sun using my Python simulation, which is based on Newton's laws of motion and the universal law of gravitation.

#### **O-8: NUMERICAL SIMULATION OF DEUTERON USING NUMEROV METHOD-A PEDAGOGIC**

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Time independent Schrodinger equation is solved numerically using Numerov method. Deuteron's bound state energy and corresponding wavefunction is obtained using Morse as an interaction function. The pedagogical study can be applied for various quantum mechanical problem and can be easily implemented by UGs and PGs students using freely available open-source software like Gnumeric.



## **O-9: MODELING CHAOTIC SYSTEMS WITH PYTHON LIBRARIES**

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Through this opportunity, I wish to throw light on some of the simulations which can be modeled using Python describing nonlinear physics phenomena observed commonly in nature. Using simulations, we can comprehensively study the complex systems. Python programming language is the tool employed for data visualization due to its simplicity, scalability, versatility, and extensive scientific libraries. I will present and review key ideas of chaotic systems through scientific modeling like the Butterfly effect, double pendulum motion, three-body problem, etc.

## **O-10: ESTIMATING PI USING MONTE CARLO METHOD AND PLATONIC SOLIDS**

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By harnessing the unique properties of regular symmetric polyhedra, often known as the Platonic solids, we demonstrate a novel approach for pi estimation using Monte Carlo Simulations. The utilization of Platonic solids allows for accurate approximations of pi, providing a fresh perspective on this mathematical constant. Through the Monte Carlo Method, random data is used to produce meaningful results. In this presentation, we demonstrate generation of random points inside five 3D platonic solids namely Cube, Tetrahedron, Octahedron, Dodecahedron and Icosahedron, all circumscribed inside a sphere. Using the ratio of the number of points lying inside the platonic solid and outside it, in each case, the value of pi is determined. The high end simulations to the tune of 10 million are implemented through python code and a comparative study is performed for different geometries. This work provides computational algorithms, and experimental results demonstrating the effectiveness of using Platonic solids for pi estimation. The findings reveal the potential of this method to contribute to both theoretical mathematics and practical applications requiring precise pi values and is a simple demonstration of the broad use of Monte Carlo method, whose applications extend to nuclear physics, astrophysics, chemistry, biology, economics, finance and much more.

## **O-11: APPLICATIONS OF QUANTUM COMPUTING IN INDUSTRIES IN GENERAL AND FINANCE IN PARTICULAR**

**Puneet Mishra**

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Quantum Computing is a fascinating and prospective industry of the future. It uses the abstract concepts of quantum superposition and quantum entanglement to build a physical computing device. These unique properties of a quantum computer enable it to perform several complex mathematical and statistical problems simultaneously, as well as conduct parallel processing of big data. This groundbreaking feature of quantum computers will disrupt several industries as we know them and revolutionize several major industries. Finance is one particular industry among them. Here, I will begin by touching on the basics of quantum computing and the principles of quantum mechanics that it is based on, and then discuss how a future quantum computer will solve financial problems such as portfolio optimization, market prediction, option and stock pricing, and risk minimization.

## **O-12: FROM QUBITS TO QUMODES: QUANTUM COMPUTATION IN PHYSICS SIMULATION**

**Anmol Setia**

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Quantum bits (Qubits) allow us to do quantum computation. In physics, Quantum Computers are used as a tool to simulate various quantum mechanical systems, hence trying to simulate nature at a micro-level. In this presentation of mine, I would like to present how qubits and qumodes are used to simulate various fermionic and bosonic systems with a brief overview of the Bosonic Qiskit and its applications.

## **O-13: TRAPPING OF PHOTONS TO PRESERVE ENTANGLEMENT IN A NOISY ENVIRONMENT AND PENETRATING STEALTH TECHNOLOGY USING QUANTUM ENCRYPTION**

**Vanshika Rana**

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The goal of advancing research in any quantum field is to be able to demonstrate its advantage over its classical analog. The ability to quantify microwave photons has led us to believe that entanglement of these photons would make detection of objects easier and in fact more the noise better the detection. The aim of the given paper is to analyse microwave photons trapping and simulating if higher frequency would preserve the entanglement better and also study the effect of radar absorbing material, and detection of such aircrafts coated with such materials using quantum encryption.

## **O-14: HOW QUANTUM PHYSICS CAN TRANSFORM OPERATIONS RESEARCH**

**Deepali Gupta**

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Human cognition has always been the key to survival against other species and technological advancements. Hence, the rate of development depends upon that of cognition. What if we can enhance human decision-making abilities by considering the betterments required, new possibilities (irrational and (or) intuitive thinking), and past experiences (rational thinking)? Quantum physics deals with giving a desired outcome based on a probabilistic model, which concerns every factor affecting (and how it is affecting through the superposition) and has the potential to introduce numerous variables (as multi-dimensions) into one function to give a distinct value, which classical probability and AI can't. Considering the concept of quantum collapse, it is relatable that the human mind has many thoughts at any given time. But when asked, all the outlooks get superimposed by one, yielding one as a result and others as zeros. Hence, a decision forms. If one can formulate all the fluctuating human emotions and factors affecting them (as variables) into one function that will give a definite value in the form of human decision, then a human decision-making algorithm can be devised.

## **O-15: MEASUREMENTS OF PROMPT NEUTRON EMISSION IN THE SPONTANEOUS FISSION OF $^{252}\text{Cf}$**

**Tanya**

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Measurements of prompt neutrons emitted from the spontaneous fission of  $^{252}\text{Cf}$  have been carried out. The energy spectrum of neutrons was obtained using Time-of-Flight (TOF) spectroscopy with the help of EJ301 detector and using a parallel plate air filled ionization chamber. The Pulse Shape Discrimination (PSD) was also performed to discriminate neutrons from  $\gamma$ -rays emitting from  $^{252}\text{Cf}$  radioisotope. The neutron spectrum was obtained at different source-to-detector distances, and a decrease in number of neutrons per fission was noticed while increasing the distance. Also, the effect of source-to-detector distance on TOF separation was observed. The neutron spectrum at a source-to-detector distance of 52.1 cm was measured at  $0^\circ$ ,  $45^\circ$  and  $90^\circ$  angle between source and detector axis, and isotropic emission of neutrons was observed. In addition to this, an estimate of average Maxwellian temperature of fission fragments was determined using the efficiency corrected experimental data of prompt fission neutron spectrum (PFNS) and was found out to be  $1.40 \pm 0.04$  MeV.

## **O-16: EFFECT OF DYSPROSIUM ON THE PHYSICAL AND OPTICAL PROPERTIES OF TELLOBORATE GLASSES**

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In the present work a series of  $\text{Dy}^{3+}$  doped zinc telloborate glasses were synthesized using conventional melt quenching technique at different concentration of  $\text{Dy}^{3+}$  having composition  $(70-x)\text{B}_2\text{O}_3 - 20\text{TeO}_2 - 10\text{ZnO} - x\text{Dy}_2\text{O}_3$  (where  $x=0, 0.1, 0.2$  mol%). The physical and structural properties were studied through density calculations and refractive index measurements. The optical absorption spectra of the glasses were recorded with UV-Vis Spectroscopy. It is found that there is an increase in density and band gap with increase in  $\text{Dy}^{3+}$  ion concentration. There is decrease in refractive index with increase in concentration of  $\text{Dy}^{3+}$  ion. Due to such properties, the  $\text{Dy}^{3+}$  doped zinc telloborate glasses find their application in photonic devices and white light LEDs.

## **O-17: AB – INITIO INVESTIGATIONS OF STRUCTURAL AND MAGNETIC PROPERTIES OF PRASEODYMIUM-MAGNESIUM ALLOY**

**Toshargarg, Shweta, Aditi Rani & Sanjay Kumar Singh**

Class of authors: TG, S, AR (B.Sc. NON MEDICAL III) & SKS (PhD)

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Structural and magnetic characteristics of the Praseodymium Magnesium Compound ( $\text{PrMg}$ ) have been computed using the Density functional theory (DFT) as implemented in the WIEN2k code with generalized gradient approximation (GGA). DFT is used to determine the electronic structure of atoms, molecules and solids.  $\text{PrMg}$  is stable in the cubic CsCl (B2) phase and belongs to the Pm-3m space group (No. 221). Experimentally found that it is anti-ferromagnetic with a dipole moment of  $2.7 \mu\text{B}$ . Structural parameters viz. Lattice constant, bulk modulus, its pressure derivative and total energy have been calculated in B2 phase. Our computed lattice constant is  $3.7968 \text{ \AA}$  agrees well with the experimentally obtained value  $3.821 \text{ \AA}$ . In the CsCl phase,  $\text{PrMg}$  alloy has a minimum energy

of -18886.156829 Ry in CsCl phase.

### **O-18: OPTICAL AND PHYSICAL CHARACTERIZATION OF ERBIUM DOPED ZINC BOROTELLURITE GLASSES FOR PHOTONIC APPLICATIONS**

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The Er<sup>3+</sup>-doped zinc borotellurite glasses with composition (70-x) TeO<sub>2</sub> -20B<sub>2</sub>O<sub>3</sub> -10ZnO-xEr<sub>2</sub>O<sub>3</sub> (where x=0, 0.1, 0.2 mol%) were fabricated using melt-quenching technique. The effect of Er<sub>2</sub>O<sub>3</sub> doping on the physical and optical properties of the glasses was studied using density and absorption spectroscopy. It was found that the secondary transmission has increased in glasses due to the presence of rare earth ion. The UV-VIS spectroscopy results also show that Er<sup>3+</sup> ions enter the glass matrix showing absorption peaks corresponding to its 4f-4f transitions. Density and energy band gap was found to decrease with an increase in rare earth ion concentration due to conversion of TeO<sub>4</sub> units to TeO<sub>3</sub> units. The high refractive index of the glass samples recommends its use in LEDs and image sensors.

### **O-19: STRUCTURAL AND MAGNETIC PROPERTIES OF NEODYMIUM MAGNESIUM ALLOY: A FULL POTENTIAL STUDY**

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**Abstract:** We have computed structural and magnetic properties of Neodymium Magnesium (NdMg) compound with the help of full potential approach of linearized augmented plane wave and local orbitals in the Density Functional Theory which is implemented in Wien2k Code. Structural properties viz, lattice constant, bulk modulus, pressure derivative of bulk modulus and total energy of NdMg have been calculated in CsCl (B2 Phase). Calculated lattice constant is 3.7952 Å, which agrees well with experimentally measured value 3.860 Å. NdMg alloy has minimum energy -19660.630139 Ry in CsCl phase. NdMg Alloy which exists in Cubic CsCl structure at room temperature having magnetic moment 2.09 μB orders antiferromagnetically experimentally. The obtained results are compared with available experimental and theoretical data.

### **O-20: FIRST-PRINCIPLES STUDY OF STRUCTURAL AND ELECTRONIC PROPERTIES OF AuAl<sub>2</sub>, AuGa<sub>2</sub> AND AuIn<sub>2</sub> UNDER HIGH PRESSURE**

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**Abstract:** The successful study of the structural and electronic properties of AuAl<sub>2</sub>, AuGa<sub>2</sub> and AuIn<sub>2</sub> compounds under high pressure have been done using Quantum Espresso code within Density Functional Theory. We have employed the first-principles scheme, based on the projector augmented wave (PAW) pseudopotentials method and used Generalized Gradient Approximation of Perdew Burke-Ernzerhof (GGA-PBE) to solve the exchange correlation. Our calculated structural parameters like equilibrium lattice constant, bulk modulus and its first order



pressure derivative are in well agreement with the previously reported experimental values as well as theoretical ones. Electronic properties are explained using the band-structures, density of states (DOS) & partial density of states (PDOS) calculations. Our calculated equilibrium lattice constants for AuAl<sub>2</sub>, AuGa<sub>2</sub> and AuIn<sub>2</sub> within acceptable estimation error range 0.5%, 1.87% and 1.85% respectively are much near to the experimental values than previous theoretical results. The considerable overlap between the valence and conduction bands in the calculated electronic structures of the three materials shows their metallic character. According to our electronic density of states analysis, the primary contributions to the density of states at the Fermi level comes from Al 3p states in AuAl<sub>2</sub>, Au 6p and Ga 4p states in AuGa<sub>2</sub>, and In 5p states in AuIn<sub>2</sub>. Meanwhile, the Au 5d bands are noticeably positioned well below the Fermi level in all three materials. These findings strongly suggest that the p bands of these atoms play a vital role in influencing the properties of these materials. Keywords: Structural and electronic properties, DFT, Quantum espresso, AuAl<sub>2</sub>, AuGa<sub>2</sub> and AuIn<sub>2</sub>.

## **O-21: MEASURING BIREFRINGENCE AND ITS FLUCTUATIONS IN CRYSTALLINE SILICON**

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**Abstract:** Gravitational wave detectors, like LIGO, require high-quality test mass mirrors to measure the minute changes caused by gravitational waves accurately. While fused silica has been the preferred material for test masses, the upcoming cryogenic upgrades of gravitational wave detectors require materials with exceptional properties at low temperatures and compatibility with a 1550-nm laser. Crystalline silicon has emerged as a potential alternative to fused silica due to its mechanical, optical, and thermal characteristics. However, birefringence in silicon and its fluctuations can negatively impact detector performance by reducing the signal-to-noise ratio. The LIGO-Voyager requirement for birefringence and its fluctuations are  $10^{-7}$  and  $10^{-15}$  /rtHz at 100 Hz. This project aims to investigate birefringence and its fluctuations in crystalline silicon using the phase difference introduced by the silicon sample as a probe. The experimental setup involves a 1550 nm laser, polarizers, a half-wave plate, and photodiodes. Signal amplifiers and high-pass filters are employed to enhance sensitivity and reduce noise in the measurement system. The birefringence value obtained is  $10^{-5}$ , and its fluctuations are of the order  $10^{-11}$  /rtHz at 100 Hz. The project is still in progress, and further analysis may yield more precise results. The results will provide valuable insights into the suitability of crystalline silicon for the future upgrades of gravitational-wave detectors and contribute to our understanding of material properties at extreme conditions.

## **O-22: EXPLORATION CENTRES**

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Even after a long time of independence, students face problems like lack of resources, mentorship and opportunities to engage them in hands on research. More of the intellectual brains are engaged in preparation of engineering and medical exams from a very early age. As at the initial level of science education, very few have knowledge about the experimental sciences because most of them are only getting theoretical knowledge in their institute and are lacking interest in experimental sciences. As a result very few students opt for researcher field in comparison to engineering and medical fields. It is evident from the list of Nobel prize winners that very few Indian got Nobel prize in Science. Opening an exploration center for school students would provide a dedicated space for them to

explore and learn science through innovative experiments. It would offer opportunities for hands-on experience, scientific

exploration, and developing research skills in students having intellectual brains. In this project, we will provide research activities related to their designed syllabus. In addition, we will introduce them with new technology methods and equipment. For students of higher classes, we can introduce them to various instruments used in labs for research purposes. Students will be familiarized with the research methodology and will not have to wait till their Masters to work on any research project. Young brains when engaged in such projects, will bring new innovations and make our India proud and achieve heights by winning Nobel Prizes in Sciences.

### **O-23: ROAD EX-TRELLIS (WASTE WATER STAGNATION)**

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Water Stagnation is a major problem in big cities of India. Stagnated water can cause outbreak of several diseases and often leads to accidents. It is the breeding ground for disease-carrying mosquitoes. Several parts of the country and major cities experienced moderate to heavy rain, which causes prolongation of water on the roads. To solve this problem, we have developed an automatic sensor system and three different devices (Inverted Pipe, Automatic Sliders, Pumping motor) which will start operating on different water levels. Water indication level will be helpful for drivers to examine the water level. So far, in developing countries, an effective remedy for the ejection of stagnated water has not been commercially available. We have come up with a unique and practical solution to the problem. Till date, stagnated water is only disseminated through the sewerage fields etc, which is just a wastage of water. Our water stagnated ejector project not only removes water but also stores water for further use. It can help to eject water even at low heights. It is mostly automatic, thus there is no need to put high manpower on clearing the water from roads. The objective behind proposing the idea is for the benefit of our society. Effectively removing water is the need of society. Proposed idea is sensor based, which can avoid numerous road accidents. Reuse of waste water can solve the water crisis too.

### **O-24: ELECTROSTATIC ACCELERATORS**

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**Abstract:** Accelerators are the instruments that accelerate ions and electrons to very high velocities. Based on the field that accelerates the particles, they can be classified into two fundamental types, Electrostatic (static electric field) and Electromagnetic (oscillating electromagnetic field) accelerators. Electrostatic were the first particle accelerators. The basic principle is to develop very high potential differences of the order of millions of volts to accelerate ions. Van de Graff (single-ended) and Pelletron (tandem) are the widely used electrostatic accelerators. The instrumentation mainly consists of an ion source, accelerating tank, focusing elements, vacuum gauges, Faraday cups and beamlines leading to experimental chamber. The accelerating voltages can go from 0.1 to 25 MV (Million Volts). One of their major applications is to study projectile-target interactions and perform analysis for diverse fields such as nuclear physics, material science, radiation biology et cetera.

## **O-25: DHWANI: THE SEVENTH SENSE (AN IOT BASEDWEARABLE SOLUTION FOR BLIND, DEAF AND MUTE PEOPLE)**

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This paper introduces "Dhwani: The Seventh Sense," an ingenious assistive technology that amalgamates physics, electronics, and machine learning methodologies to empower individuals with visual, hearing, and speech impairments. The system integrates advanced LiDAR sensors for obstacle detection, leveraging intricate photonics principles to create a comprehensive spatial map that enables safe navigation. Real-time audio-to-text conversion employs deep learning techniques, harnessing recurrent neural networks (RNNs) and convolutional neural networks (CNNs) to accurately transcribe spoken language, ensuring effective communication for the deaf. Gesture recognition further enhances user interaction, utilizing a combination of inertial measurement units (IMUs) and convolutional neural networks to interpret intricate hand movements, enabling expressive non-verbal communication for mute individuals. The interdisciplinary fusion of photonics, signal processing, and machine learning presented here not only showcases remarkable technical innovation but also underscores the immense potential of physics-based solutions in fostering inclusivity and societal advancement. This integration of advanced technologies into a user-friendly and practical solution reflects the commitment to enhancing the lives of people with disabilities. Extensive testing involving individuals from the categories has validated the technology's effectiveness and utility.

## **O-26: MAKING WASTE A SOURCE OF ENERGY**

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In today's world the biggest problem is of waste management –generating millions of tons of waste every day. From dustbins to garbage heaps that we see on the outskirts of every civilized city we can see how much waste is produced. With billions of tons of waste generation, the need is to emphasize on proper Waste management techniques involving every individual. With time humans have evolved some techniques and machinery to resolve this issue. we haven't only littered in lakes, oceans and grasslands but also in space.

## **O-27: EMERGING FRONTIERS OF CRYOGENIC TECHNOLOGY**

**Nazam**

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The cryogenic industry deals with the science of extremely low temperatures ranging from 125K to 0K. The change in properties of the material at such low temperatures is studied and its versatile applications in the fields of superconductivity, rocket engines, cryopreservation, cryo-electronics, and cryo-storage are discussed in detail. The techniques used to achieve these ultra low temperatures are analyzed and the process of liquefaction of helium, nitrogen, and hydrogen is discussed. Applications in the field of superconducting magnets like the ones used in LHC at CERN which operates at nearly 0K temperatures are discussed. Furthermore, the cryogenic stage in rocket engines is discussed in detail with an emphasis on India's indigenous cryogenic engine (CE-20) used in GSLV during the Chandrayan-3 mission. More worldwide applications like human organ preservation, MRI technology, food preservation, fuel storage and transportation, using low temperature technology are also briefly touched upon. Beyond that, the future scope of the cryogenic industry in the fields of quantum computing, fusion energy systems, carbon capture and storage systems, and cryogenic propulsion systems are discussed, thus describing the broad spectrum of research in this emerging field.

## BENEFICIAL EFFECTS OF RADIATION TECHNOLOGY AND INDIAN ENERGY PROGRAMME

**INNERVATE-2023** was organized in the Gandhi Memorial Hall of Bajaj College of Science, Wardha, under which, One Day National workshop was conducted on the topic “**Beneficial Effects of Radiation Technology and Indian Energy Programme**” on 12<sup>th</sup> September 2023. The workshop was organized by the Department of Physics, Bajaj College of Science in association with Indian Association of Radiation Protection (IARP) a unit of Bhabha Atomic Research Centre (BARC), Mumbai. The One Day National Workshop was supported by IAPT RC-08), Lucknow.

The participants for this national workshop included faculties and students from three different universities in the region: The Rashtra Sant Tukadoji Maharaj University Nagpur, The Sant Gadge Baba Amaravati University and The Gondwana University Gadchiroli. A total of 118 Participants from these three universities registered for the workshop. About 47 faculties of Bajaj College of Science also actively participated in the workshop. Hence nearly 165 participants were enlightened on the topic and benefitted from it.

### Chronology of the Events:

- **Registration and Breakfast: 8.00 am to 9.00 am**
- **Inauguration of the National Workshop: 9.00 am to 9.30 am**

The workshop was inaugurated at the hands of Shri. Sanjay Bhargava, Chairman Shiksha Mandal, the parent organization of Bajaj College of Science. The Subject Experts and Resource Persons Dr. S Murali, Senior Scientist BARC and Secretary IARP, Dr. V Natrajan, Scientist IARP, Shri S.Patil, member IARP and Convener of the National Workshop Dr. Sanjay H Bagade occupied the dais. Importance and relevance of the topic was highlighted during the session.

- **Lecture Sessions: 10.00am to 1.30 pm**

A series of lecture sessions were held by the resource persons and subject experts from BARC and IARP. The basics of Nuclear Physics, benefits and hazards of nuclear radiations, detection of nuclear radiation, different methods for protection from nuclear radiations were discussed in the lecture sessions. Information regarding the Indian Nuclear Energy Programme and beneficial effects of radiation technology was also given to the participants in the workshop. Dr. G V Lakhotiya and Dr. S R Tiple coordinated different lecture sessions during the National Workshop which were as follows.

- L1: 'Radiation Quantities, Units and Effects' – Dr. Natrajan, IARP
- L2: 'Principle of Radiation Detection' – Dr. Natrajan, IARP
- L3: 'Radiation Protection & Monitoring' – Shri. Sanjay Patil, IARP
- L4: Nuclear Energy Programme, Application of Radiation Technology – Dr. S. Murali, IARP
- L5: Beneficial Effects of Radiation Technology - Dr. S. Murali, IARP
- Practical Sessions: 2.45 pm to 3.45 pm  
Practical & Demonstrations – Cyclic Manner (4): 30 min Sessions  
A: Activity estimation  
B: Radiation Monitoring kits, Personnel Protective Gears  
A practical and demonstration session was organized for the participants where the knowledge of commonly used equipment and instruments in the field of Nuclear Physics was given. Radiation Monitoring kits, Personnel Protective Gears were also displayed for the participants.



- **Special Lecture: 4.00 pm to 4.30 pm**  
A Special Lecture on Scientific Career Opportunities was delivered by Dr. S. Murali, IARP
- **Valedictory Function: 4.30pm to 5.00 pm**  
The valedictory function was attended by the participants where they expressed their views

about the workshop. Feedback forms about the workshop were collected from the students. Dr. G V Lakhotiya conducted the valedictory function while Dr. M. M. Yerpude proposed the vote of thanks. The workshop ended with National Anthem.

- **Financial Assistance Received:**

Sr.No	Organization	Amount(Rs.)
1.	Indian Association of Radiation Protection (IARP)	20000
2.	Indian Association of Physics Teachers (IAPT)	15000

Department of Physics, Bajaj College of Science, Wardha gracefully acknowledges the financial assistance received from IARP

and IAPT for the workshop and is grateful to them for their support and guidance.

Convener  
INNERVATE-2023  
(National Workshop)

Principal

## REPORT (RC-15)

### ONE-DAY SEMINAR FOR SCIENCE TEACHERS

This Seminar for orientation of science teachers at the school level was organized by the IAPT Midnapore College Centre for Scientific Culture (CSC) & Science Centre, Midnapore, in collaboration with IAPT RC-15 on December 15, 2023 (9.30 am - 4.30 pm) in the Seminar Hall, Midnapore College (Autonomous). One hundred ten teacher participants from 36 schools situated in the districts of Paschim Medinipur, Jhargram, Purulia, Bankura, and Hooghly in West Bengal, along with some individuals, attended the Seminar. Dr. M. N. Goswami, Associate Professor, Dept of Physics, Midnapore College and member of the Executive Council, IAPT, anchored the Seminar. Prof. S. R. Ghosh, Teacher-in-Charge, welcomed the participants. Mr. S. K. Pan, Secretary, Science Centre Midnapore, narrated the problems of Science Education in schools. Dr. S. C. Samanta shed light on the background of the Seminar. He pointed out the context mentioned in the NCF 2023: In schools, science classes are not supplemented with

experiments, and there is no correlation between what the students learn in classrooms and experiences outside. Against this backdrop, as a remedial measure, it was decided that some students from different classes - from VII to IX, in willing schools- be trained in the experiments in their science texts to form an advanced group of students (AGS). Finally, the schools may entrust the AGS to organize exhibitions in basic science (EBS). This approach may open up a possible way for the entire school community to learn science through experiments.

As part of this Seminar, an exhibition of relevant school science experiments was held, and the participants could discuss the merits of those experiments in classroom transactions of scientific concepts while moving around the exhibition halls. In fact, it is possible to continue the EBS in the subsequent years, because the structure of AGS would almost remain unchanged, class IX students may leave, but the same number of students would enter the group from old class six to form the new AGS. The

seniors may help the new entrants academically so that they together are empowered to organize the EBS for the second year. This way EBS would continue with the involvement of less human and material resources. Again, as an outcome of this project, IAPT can have more enrolment for NSEJS.

So, after a brief inaugural programme, the teachers were encouraged 'to see and try' the experiments of their direct concern and to visit the other experiments afterward. Finally, at 3 pm, everyone assembled to attend the feedback session.

In the given feedback form, the participants were asked to respond:

1. Is it possible to train a selected group of your students in those exhibits/ similar ones and organize EBS?
2. If yes, is it possible to find a room for the installation of those experiments and/or their variants there?
3. Can you help your neighbouring schools in this regard?

The response to the first question was an emphatic 'Yes'. As regards the availability of room for lab, almost all the responses were affirmative but subject to discussion with the school authorities. Again, participants were unanimous that once stable in their place, each could help the neighbourhood schools in similar activities; in fact, many have emphasized that they are used to inviting the neighbourhood schools whenever some exhibitions are organized in their

schools.

In this self-orientation programme, a group of teachers assembled the exhibits and explained related working principles to the rest of the participants. This was a programme for the teachers and by the teachers only, so it was indeed for their self-orientation. Activists of the CSC and Science Centre, Midnapore, only provided the right environment and platform. The participants were informed that IAPT and Midnapore College (Autonomous) established CSC labs for such purposes only, and those would always be available for such works. Faculty members of the different science streams present in the meeting corroborated this view.

'Bring a Smile', a social organization especially engaged in education-related works and other social activities, helped in different ways to make this Seminar successful. Its representative, Mr Rupayon Mandal, and his team were present throughout the Seminar for videography of the exhibits and promised to help organize EBS in different schools.

The organizers were informed of the formation of a WhatsApp group involving the teacher participants, the concerned heads of the institutions, and the organizers for facilitating online meetings.

Mr Pradip Mahanti, a retired HM of a school in Midnapore, took note of the proceedings of the meeting. Finally, Dr. S K Shee, Head, Dept of Physics, Midnapore College (Autonomous), thanked the participants and the others for making this event successful.





Pradipta Panchadhyayee  
Secretary, RC-15

## REPORT (RC-02)

### ROBOTICS DEMONSTRATIONS

**Topic:** Arduino for Robotics

**Organized by:** Department of Physics, DAV College Bathinda

**Schedule:** 05, October 2023 **Venue:** Innovation-Hub and

Car-Parking Area

**Sponsored by:** IAPT-RC02 and DBT-Star College Scheme-BT/HRD/11/019/2020

**Activity In-charge:** Dr Gurpreet Singh (HoD)



**Participants:** 48UG- Science students

**Coordinator:** Dr. KulwinderSingh Mann, Coordinator DBT-SCS.

The workshop titled "Demonstrations: Arduino for Robotics" was conducted on October 5, 2023, at DAV College Bathinda. The event was organized by Mr. Satvik, Shaksham, and Ayaan, final year B.Tech-ECE students from Punjab Engineering College, Chandigarh. It aimed to provide hands-on training to 34 B.Sc. students on various aspects of Arduino, electronics components, and related topics.

**Topics covered:**

**Arduino Programming:**Participants were introduced to Arduino, an open-source electronics platform, and given practical insights into programming it for robotics applications.

**Diode Circuits:**Understanding the fundamentals of diode circuits and their applications in electronic

capacitors, LEDs, potentiometers, and more.

**PCB (Printed Circuit Board):**Insight into the design and fabrication of PCBs, a crucial element in electronic systems.

**Butter Board:**Practical knowledge about butter boards and their role in prototyping electronic circuits.**Hands-on Activities:**Engaging practical sessions where participants worked on assembling circuits, soldering components, and programming Arduino boards.**Capacitors, LEDs, Resistances, Potentiometers, etc.:**

In-depth discussions and demonstrations on the practical applications of these components in electronic systems and robotics.This workshop not only equipped the participants with theoretical knowledge but also provided them with valuable hands-on experience. The initiative aimed to foster interest and competence in the field of robotics and electronics among the students, preparing them for future endeavours in these domains. The event was made possible through the support of



systems.**Soldering Techniques:**Comprehensive training on soldering techniques, emphasizing the proper use of soldering irons, soldering materials, and safety measures.**Electronics Components and Their Handling:**Identification and hands-on experience with various electronics components, including resistors,

DBT-Star College Scheme and IAPT (RC02), showcasing the collaborative effort to promote education and practical skills development in the field of science and technology.

**KS Mann**



## WORKSHOP ON PERFORMANCE BASED OLYMPIAD EXPERIMENTS (POLLEX-X)

The IAPT-APhO Cell lead by Dr Vijay Kumar organized a 3-day workshop on “Performance Based Olympiad Experiments-X (POLLEX-X)” from Nov. 30 to Dec. 2, 2023 in the Department of Physics, Graphic Era Hill University Dehradun (Uttarakhand). The workshop aimed to create an independent, joyful, and highly learning environment for senior secondary school students to prepare them for participation in the Asian Physics Olympiad (APhO) examination. A

remarkable attendance of the students from DAV Public School, Defence Colony, Dehradun, Vivekanand Public School, Jogiwala, Dehradun and SGRR Inter College, Nehru Gram, Dehradun was registered. The students actively participated in a workshop on hand-on experiments.

The students performed unique Physics experiments designed for the prestigious and highly competitive APhO examination. Prof. P. K. Ahluwalia, President,

Prof. Rekha Ghorpade, General Secretary, Prof. B. P. Tyagi, Chief Coordinator (Examination), Dr. Ravi Bhattacharji, Ex-Coordinator IAPT-APhO cell, the Hon'ble Vice chancellor, Graphic Era Hill University, Prof. (Dr.) Sanjay Jasola graced the event with their esteemed presence and exchanged words with the students. Prof. Ahluwalia and Prof Rekha Ghorpade could join the event only virtually and addressed the students online.

A number of research scholars of the Department of Physics and final year students of B.Sc.(H) Physics were trained specifically to work as extended resource persons for different groups of school students. Prof. Sanjay Jasola interacted with Students. The school Students were overwhelmed with the experience they could share and with the team efforts of all members of the IAPT-APhO Cell.

**Vijay Kumar**

Co-ordinator IAPT APhO - cell



Inauguration of POLLEX-X on Nov. 30, 2023



Vivekanand Public School Jogiwala Dehradun

## POLLEX-XI WORKSHOP IN RURAL BIHAR

A three day POLLEX workshop from Dec 1 -3 2023 was held in Asoyan School in rural Chapra. Topics covered were mainly in the area of Thermodynamics. Shri Mithilesh Kumar secondary school teacher and IAPT member was the principal organizer and spoke on the laws of thermodynamics. Shri Deepak Kumar covered ideal gas law and the mole concept and helped students throughout several simple problems. Prof. Vijay Singh dealt with common misconceptions in this area. Very interestingly Shri S. N. Charurvedi was asked

by students to explain "English terms" which they find very difficult to understand in textbooks. This underscores the need to develop good teaching material in local languages. About 250 students attended and half were enthusiastic female students. POLLEX stands for Phenomena based Olympiad Level Experiment. Pollex also refers to the "thumb" and it is the evolution of our "opposable" thumb which complements the other four fingers and bestows tool handling.



Vijay A. Singh

REPORT (RC-06)

## DEMONSTRATION OF PHYSICS EXPERIMENTS

A Science Expert talk and demonstration of Physics Experiments was organized in PM SHRI School, JNV Patan, Neem ka Thana on 18.12.23. Prof. Y. K. Vijay (Retd. Prof., University of Rajasthan, Jaipur, Director CIST, IIS, President, RC-06,) was the resource person.

Prof. Vijay was welcomed by Principal with a bouquet., Mr. Dinesh PGT Hindi, co-ordinated the program in MP Hall and Mr. Satyaveer, TGT English introduced the resource person to the students.



Prof. Vijay started his session by showing an activity of air blower and balloon. He involved students in performing activities and discussed with students why the air goes up. He presented many activities related to science using daily life examples. He also explained crystal structure in a very simple way and how defects arise in crystal structures with the help of magnet and balls.

Prof. Vijay continuing in second session, explained variation of pressure with depth of liquid, Bernoulli's theorem, charging and discharging of metallic spheres, molecular structure and stability of atomic structure, effect of heat on density, Archimedes principle, Balancing of magnetic dipole, Electrical resonance, Total internal reflection of light, diffraction and interference, brightness of electric bulb with respect to heat to explain effect of

temperature on brightness and other activities related to daily life.

Students could understand how submarine can stay on water and underwater both places even after heaviness. The experiments, related to light to understand refraction and diffraction, internal reflection using laser light and minute pore size filter with LED lights were amazing which made the topic simpler for understanding by students.

All students and staff were overwhelmed by the session and enjoyed this knowledgeable and fruitful session. Mr. Mahipal Singh (PGT Physics) proposed the vote of thanks.

**Mahipal Singh**



## National Standard Examination - 2023

### Enrolment NSE - 2023

Sr No.	Enrolment	NSEP	NSEC	NSEB	NSEA	NSEJS	Total
1	ONLINE	49280	44180	29701	16793	32541	172495
2	OFFLINE	161	165	72	74	72	544
3	OVER SEAS	19	18	22	2	16	77
	Total	49460	44363	29795	16869	32629	173116

### State-wise Enrolment of NSE - 2023

Sr. No.	State	No. of Centre	NSEP	NSEC	NSEB	NSEA	NSEJS	Total
			Enl	Enl	Enl	Enl	Enl	
1	ANDAMAN & NICOBAR	4	46	36	77	4	39	202
2	ANDHRA PRADESH	40	1798	1847	635	634	2157	7071
3	ARUNACHAL PRADESH	10	121	105	131	28	145	530
4	ASSAM	34	745	632	582	175	330	2464
5	BIHAR	38	1657	1351	875	611	1040	5534
6	CHHATTISGARH	34	543	451	475	234	465	2168
7	CHANDIGARH	7	632	598	230	304	124	1888
8	DADRA & NAGAR HAVELI	3	103	108	137	13	56	417
9	DELHI	15	3236	2894	1466	1227	1048	9871
10	GOA	6	137	127	97	31	50	442
11	GUJRAT	55	2475	2400	1844	960	1127	8806



Sr. No.	State	No. of Centre	NSEP	NSEC	NSEB	NSEA	NSEJS	Total
			Enl	Enl	Enl	Enl	Enl	
12	HIMACHAL PRADESH	23	399	360	275	117	300	1451
13	HARYANA	56	2182	2028	1290	674	1768	7942
14	JHARKHAND	40	1164	857	528	413	851	3813
15	JAMMU & KASHMIR	23	348	314	243	97	442	1444
16	KARNATAKA	60	3134	2882	1936	971	2174	11097
17	KERALA	39	1275	1093	882	413	653	4316
18	LADDAKH	2	8	13	10	7	23	61
19	LAKSHADWEEP	1	3	3	5	3	6	20
20	MAHARASHTRA	122	6559	6076	4321	2036	3009	22001
21	MEGHALAYA	7	54	51	59	28	104	296
22	MANIPUR	6	36	33	66		69	204
23	MADHYA PRADESH	72	2074	1857	1667	663	1127	7388
24	MIZORAM	4	12	9	19		36	76
25	NAGALAND	6	10	23	41	1	101	176
26	ODISHA	49	1240	911	870	524	1027	4572
27	OVERSEAS	3	19	18	22	2	16	77
28	PUNJAB	36	1272	1218	753	442	488	4173
29	PUDUCHERRY	4	94	97	130	37	104	462
30	RAJASTHAN	89	4004	3551	2695	1381	2366	13997
31	SIKKIM	4	47	50	80	21	63	261
32	TELANGANA	39	3700	3723	838	1468	3751	13480
33	TAMIL NADU	76	3641	3212	2565	925	3361	13704
34	TRIPURA	11	127	97	139	39	128	530
35	UTTARAKHAND	24	638	603	410	228	325	2204
36	UTTAR PRADESH	107	4083	3413	2511	1488	2771	14266
37	WEST BENGAL	42	1844	1322	891	670	985	5712
	<b>Total</b>	<b>1191</b>	<b>49460</b>	<b>44363</b>	<b>29795</b>	<b>16869</b>	<b>32629</b>	<b>173116</b>

**Prof B P Tyagi**

Chief Coordinator (Examination)

Indian Association of Physics Teachers

**To our readers**

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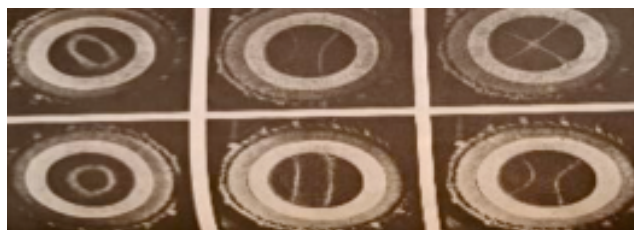
## IAPT National Competition on Essay Writing in Physics (NCEWP - 2024)

*Writing makes one perfect, essay writing more so.....*

### **Broad Topic: - PHYSICS OF MUSIC and MUSICAL INSTRUMENTS**

**Sound, in the form of music, gives me more pleasure than anything else in life** Albert Einstein

Physics of music and musical instruments is an interesting topic which fascinated the curious minds of stalwarts in physics like Helmholtz and Raman. The sounds made by musical instruments are a result of superposition of waves made by deft hands of the artists by plucking strings, blowing air in pipes or by vibrations of membranes by hitting them, leading to constructive interference and formation of standing waves travelling in opposite directions.



Standing wave patterns using sand on mridangam clicked by CV Raman

Sir C V Raman also studied exhaustively **the physics of the music of violin** which eventually became a book in itself. Raman also studied the uniqueness of Indian percussion instruments like mridangam. Far more than a diversion or hobby, music played a very significant part in his scientific journey. CV Raman wrote 53 papers on acoustics with 21 on musical instruments, between 1907 and 1918. He was an accomplished violist with a musical ear. Hall mark of his papers is its structured content, which included theoretical analyses, instruments designed and built, nature of vibrations and physical causes of vibrations etc.

NCEWP is one of the four national competitions being held by IAPT every year. The competition is open to participants in two categories viz., students and teachers (including Science Communicators).

**Category A** - *Students* of (i) Higher Secondary /Jr. College, (ii) UG and (iii) PG level;

**Category B** - *Teachers* of (i) Higher Secondary/Jr. College, (ii) UG and (iii) PG institutions, also Science Communicators working in recognized institutions.

**Broad suggested elements of the topic for both the categories are:**

You may write your entry for the essay competition keeping following points as broad guidelines to make your entry stand out.

- (i) Physics of Music-Characteristics of Musical sound
- (ii) How ear perceives music
- (iii) Various musical scales
- (iv) Classification of musical instruments
- (v) Principle and working of any **TWO** of the following instruments and their physics
  - a. Violin            b. Sarangi            c. Dilruba            d. Sitar            e. Veena
  - f. Pianoforte        g. Harmonium        h. Flute            i. Tabla            j. Tambura            k. Jal Tarang.
- (vi) Brief information of the musical instruments other than the above, available in your area (urban/ rural)
- (vii) Brief mention of the studies done by Sir C V Raman on Indian musical instruments or any other expert of science of musical instruments
- (viii) Music therapy and its benefits
- (ix) Conclusion

Note: It is only a guideline and not a structure for your essay. Be creative, scientific and innovative.

### **General Instructions:**

The essay will be limited to A4 size 10 pages including figures/tables etc. type-written in the Times New Roman 11-point fonts, with 1.15 spacing. Please do not exceed the page limit.

A format for the essay is given below:

## **IAPT National Competition on Essay Writing in Physics: 2024 (NCEWP – 2024)**

### **Broad Topic: - PHYSICS OF MUSIC and MUSICAL INSTRUMENTS**

**Category: A or B (Tick your category)**

**Title of the Essay (Font Size 14) (Choose a suitable title of your essay)**

Count of Words:

**Author's Details** (with Affiliation & Signature) (Font size 12)

**Abstract: in 150 words (Font Size 10)**

Key Words (Maximum Five)

Body of the Essay: not more than 10 A4 size papers, you can include pictures, graphs, tables, infograph and other structures in your paper. (Font size 11)

### **Important Instructions for conduct and participation in IAPT Essay Competition NCEWP-2024**

#### **Who will conduct the Competition?**

**All the Regional and Sub Regional Councils (RC's and SRC's) will conduct the regional level essay competition *digitally* by announcing the last date of submission of paper by 15th July.**

#### **Who can receive the essays digitally?**

Higher Secondary/UG/PG can submit their essays through e-mails to President/Secretary/EC member of the respective regional council. Only two entries per institution may be submitted in a category.

- (1) **How to send essay?** Students will send their entries duly forwarded through respective school/college/institute to the appropriate Regional Council (RC) with all contact details of the competitor (Name, email, mobile number etc. clearly).
- (2) **How the scrutiny and selection of essays will be done at RC level?** The RC's will have the initial scrutiny at their level. They will select 2 best essays from each level. Thus, each RC will submit 6 best entries to the national competition. RCs may award certificate etc., for their participants. Even the RCs may issue a certification of Participation to those whose Essays are sent to the National Competition.
- (3) **Language for writing the essay?** For the regional competition, students may write their Essays in Hindi or their regional languages. *If such entries are forwarded for the National Competition, then the concerned RCs will translate the Essay in English (with the help of Google translator etc.)* Only English Version of the submitted essay has to be submitted/forwarded for National Level Competition.
- (4) Similarly, Teachers & Science Communicators will send their entries through e-mails duly forwarded directly to the Coordinator/Members of team NCEWP. Retired teachers can self-attest their entry. All entries will be assessed by three evaluators. All entries (in English only) will be scrutinized reviewed and ranked.
- (5) **All entries will be subjected to an online plagiarism test.** Essays found failing in test will be rejected i.

#### **The last date for essay submission is 30th July, 2024.**

Final entries for the national competition must be submitted in PDF format by e-mail to any one of the following:

- i. Prof. S. K. Joshi, Coordinator, NCEWP, joshisantoshk@yahoo.com
- ii. Dr. Himanshu Pandey, Member, NCEWP, himanshukrpandey@gmail.com
- iii. Dr. Shivanand Masti, Member, NCEWP, shivanandmasti@yahoo.co.in

**Prof. S. K. JOSHI**  
(Coordinator, NCEWP-2024)

**THE NEW ASTRONOMY**

**DECIPHERING THE UNIVERSE**

**Stephen William Hawking** (1942-2018) was theoretical physicist & cosmologist. He was first to set out revolutionary theory of cosmology by union of general Theory of Relativity and Quantum Mechanics



**Stephen Hawking & Hawking Radiation-**

Hawking theoretically predicted that a Black Hole also emit radiation due to the Quantum Effect near its Event Horizon



**Triptych triplet with line perforation**

Illustrate the proof of Einstein's concept of bending of light due to space time curvature, which was experimentally verified during total Solar eclipse (1919)

The concept of *Gravitational Lensing* was also confirmed when Viking Probe transmitted the signal from Surface of Mars to The Earth



**Die Card-** illustrating -landing of *Viking Probe* on Mars



**Gravitational Waves**-these are the disturbance in the curvature of Space-time, generated by accelerated mass. Their existence was predicted by Einstein in 1916, by *General Theory of Relativity*. In 2016 the LIGO collaboration announced first observation of Gravitational Wave. In 2017,



**Space-time Curvature near the Black Hole**

**BULLETIN OF INDIAN ASSOCIATION OF PHYSICS TEACHERS**

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

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*If underlivered please return to :*

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