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A MONTHLY JOURNAL OF EDUCATION IN PHYSICS & RELATED AREAS

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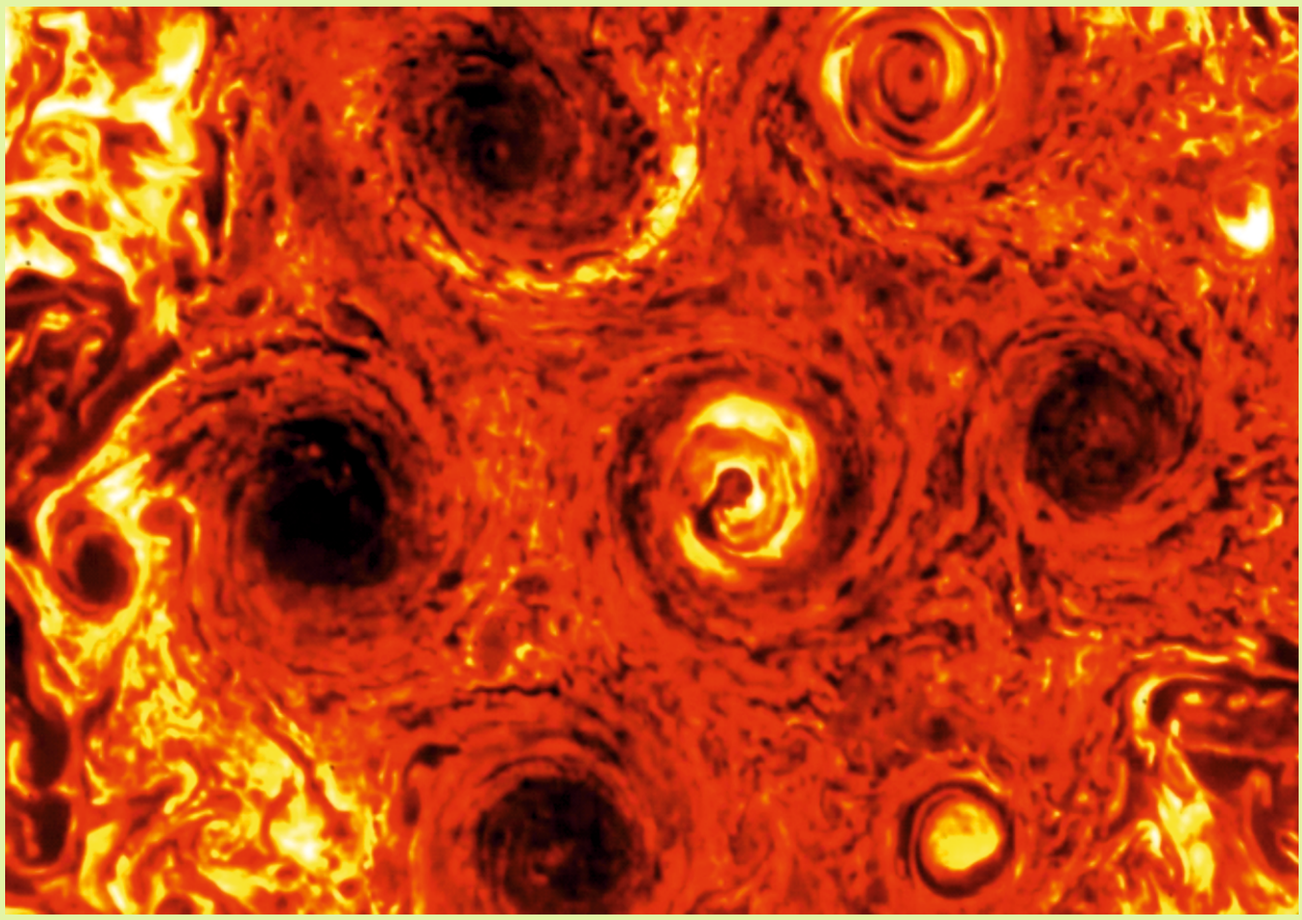

Why are there so many cyclones around the north pole of Jupiter? The topic is still being researched. NASA's robotic Juno mission orbiting Jupiter took data in 2018 that was used to construct this stunning view of the curious cyclones at Jupiter's north pole. Measuring the thermal emission from Jovian cloud tops, the infrared observations are not restricted to the hemisphere illuminated by sunlight. They reveal eight cyclonic features that surround a cyclone about 4,000 kilometers in diameter, just offset from the giant planet's geographic north pole. Similar data show a cyclone at the Jovian south pole with five circumpolar cyclones. The south pole cyclones are slightly larger than their northern cousins. Oddly, data from the once Saturn-orbiting Cassini mission has shown that Saturn's north and south poles each have only a single cyclonic storm system.
Link: https://apod.nasa.gov/apod/ap250309.html

Bulletin of The Indian Association of Physics Teachers

http://www.indapt.org.in

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

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Editorial

On Creating Internship Opportunities for Physics Undergraduates and Post-Graduates

Slowly and steadily the National Education Policy 2020 is being rolled out as per the guidelines of Dept of Higher Education, Govt. of India through All India Council of Technical Education (AICTE) and University Grants Commission (UGC) in the country. Policy documents are available on the UGC Website. Lot of changes are envisaged in the delivery of curriculum content with new windows for learners' engagement within the classroom and outside the classroom in the colleges of the country. One of such reforms is introduction of internship program at the undergraduate level as a compulsory element to enhance students learning with real life problems.

Can we envisage a role of Indian Association of Physics Teachers to function as a platform to offer guided internship activities? Following is a bullet list of dimensions of internship programs.

- Research experience
- Industry Academia Collaboration
- Skill Development
- International Opportunity
- Stipend and Funding.

A search on the web provides a comprehensive list of institutes offering internship for research experience in the country which includes IIT's, IISER's, National Science Academies, HBCSE and some other Institutes of national importance focussed on this aspect alone. For a country like India the seats available in these institutes are too small and require a scaling up of these initiatives. We must think of going beyond research experience programs. Comprehensive online mentorship program is the need of the hour and linking these programs with job opportunities is the expectation of the students coming out from higher education institutes.

Higher education qualification framework circulated by UGC lists a number of anticipated attributes of a learner after a level of study to improve the employability of the students passing out from higher education Institutes. The biggest challenge is how to align these internship programs to strengthen these attributes in a typical institutional setup.

Lately IAPT has conducted structured programmes online with successful completion to the satisfaction of the participants. IAPT RCs have been conducting summer workshops also whose experiences can help us charter a course to investigate this issue. When the 4-year UG program started a decade ago in Delhi University, it included internships that provided real-world experience both on and off-campus. No doubt, out of campus internships provide a diverse perspective, ideas, and approaches.

Among the physics faculty and students there is an opinion that physics undergraduates and postgraduates have extremely limited career opportunities. Can IAPT Community network together to create a reliable platform to be part of this effort? Capacity building is the key to this. Department of Higher Education, Ministry of Higher Education has launched a program on Capacity Building on Design and entrepreneurship for creative problem-solving capabilities through design thinking and entrepreneurial training particularly to foster a relation ship between industry and academia. Given to understand that a comprehensive model curriculum of Physics is on the anvil of UGC. Hope some of the issues related to internships get addressed there to create space for physics undergraduates and postgraduates beyond academics as well. Can Physics graduates and undergraduates find a share in the cake of quantum or space or Energy workforce of the country?

Your thoughts on this important issue are solicited. In the context of Physics, IAPT is the right place to initiate this debate and function as a network builder for the success of internship programs for the benefit of majority of students studying non-descript colleges around the country.

PK Ahluwalia
President-IAPT

Physics News

Symmetry between up and down quarks is more broken than expected

In late 2023, Wojciech Brylinski was analyzing data from the NA61/SHINE collaboration at CERN for his thesis when he noticed an unexpected anomaly—a strikingly large imbalance between charged and neutral kaons in argon–scandium collisions. This suggested that the so-called "isospin symmetry" between up and down quarks might be broken by more than expected due to the differences in their electric charges and masses. According to isospin symmetry, strong interactions in heavy-ion collisions should generate nearly equal amounts of charged kaons and neutral kaons. The collaboration is now planning additional studies on this new result, using different projectiles, targets and collision energies to determine whether this effect is unique to certain heavy-ion collisions or is a more general feature of high-energy interactions. It has also put out a call to theoretical physicists to help explain what might have caused such an unexpectedly large asymmetry.

Read more at: https://phys.org/news/2025-03-symmetry-quarks-broken.html

Original Paper: arXiv (2023). DOI: 10.48550/arxiv.2312.06572

Physicists discover a copper-free high-temperature superconducting oxide

Professor Ariando and Dr. Stephen Lin Er Chow from the National University of Singapore (NUS) Department of Physics have designed and synthesized a groundbreaking new material—a copper-free superconducting oxide—capable of superconducting at approximately 40 Kelvin (K) under ambient pressure. Modern electronics generate heat and consume energy during operation. Superconductors, however, possess a unique property known as the zero-resistance state, which eliminates energy loss due to electrical resistance. In theory, this makes them ideal for modern electronic applications, addressing the world's growing energy demands. This is the first time since the Nobel-winning discovery that a copper-free high-temperature superconducting oxide has been found to function under ambient pressure. Additionally, this new material is highly stable under ambient conditions, significantly improving its accessibility. This breakthrough represents a major step toward the development of next-generation superconducting materials, with practical applications in modern electronics and energy-efficient technologies.

Read more at: https://phys.org/news/2025-03-physicists-copper-free-high-temperature.html

Provided By: Nature (2025). DOI: 10.1038/s41586-025-08893-4

Newly developed waveguide device protects photonic quantum computers from errors

Researchers from the Universities of Southern California, Central Florida, Pennsylvania State and Saint Louis, physicists from the University of Rostock have developed a novel mechanism to safeguard a key resource in quantum photonics: optical entanglement. A key resource to quantum computation is so-called entanglement, which underpins the protocols and algorithms that make quantum computers exponentially more powerful than their classical predecessors. Moreover, entanglement allows for the secure distribution of encryption keys, and entangled photons provide increased sensitivity and noise resilience that dramatically exceed the classical limit. By fine-tuning this coupling to conform to so-called anti-parity-time symmetry, the researchers managed to selectively remove the non-entangled components of arbitrary input states. Implemented on a lossless photonic network, their newly-devised entanglement filter achieves near-unity fidelity under single and two-photon excitation and is scalable to higher photon levels, remaining robust against decoherence during propagation. This work sets the stage for advanced quantum technologies to be developed on integrated platforms.

Read more at: https://phys.org/news/2025-03-newly-waveguide-device-photonic-quantum.html

Original paper: Science (2025). DOI: 10.1126/science. adu3777

Soumya Sarkar
IISER PUNE

An Experiment on Measurement of Refractive Index of Liquids

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Abstract: An experiment basically aimed at measuring the refractive index of liquid for monochromatic light is proposed for teaching-laboratory. It basically involves measurement of bending-angle when a rod is dipped in liquid.

Introduction: There are several methods of measuring refractive index (R.I.) of liquids which eventually are based on Snell's law, critical angle, and planner-geometrical theorems [1,2]. In this article, a newer practical method is discussed where Snell's law, geometrical calculation along with the measured angle of bending are used to deduce R.I. if a given liquid. Prompted by answering a question of a class-IX student the author has recently performed the experiment that primarily helps measuring the refractive index of liquids in a simple way. But the process of observation has to be very specific and to undergo too much care and caution.

Experimental Details (Materials and Methods):

The material components one needs to perform this experiment are one rectangular box with open top ,rectangular cross-section being perpendicular to its vertical height all-through , a narrow soft bright straight metal stick or wire(say aluminum wire), and a liquid the *R.I.* of which is to be measured. The straight wire, a longer than the distance between two touching points, is first kept within the empty box with its lower end leaning to the bottom inner edge - line of wall and its upper end-point touches the upper edge- line of the opposite wall so that the wire-length be at right angle to both edges at both points (Fig.1). Now one fixes one's eye exactly on the upper end point of the wire in such a way so that the point becomes visible only, keeping all other part of the wire occulted behind it. If this happens to be observed correctly then that will prove that the wire is perfectly straight. Then keeping the whole set-up exactly the same liquid is poured (here in this experiment water is taken as the liquid) full to the brim. Then again to fix eye on the same upper end-point in a

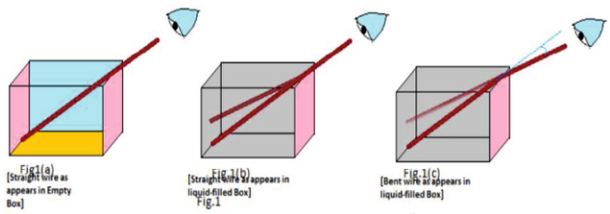


Fig.1

way so that the part of the wire outside the liquid in the container-box gets wholly occulted behind that point and the rest part within the water remains somewhat visible a little lifted from the line of sight. Then the wire is gently bent a little at that particular point where it is held with finger keeping the obtuse angle down- sided while opposite reflexive angle be upwardly faced. Again fixing the eye on the same upper end-point of the wire and to check if the end point gets the whole part of the wire (inside and outside water) occulted behind it or not. If not then this process of mild-bending of the wire at same place a little and placing similarly at the same position to observe whether the occultation of the whole length of the wire behind end-point is perfectly visible is continued until it happens to be so. When it is achieved the mildly bent wire is taken out of water and then gently swiped over with dry soft cloth to soak all the attached water-mass and make it dry. Then it is kept on a plane white clear paper and with the help of a sharpened-nib pencil the border line of the whole length of the wire is drawn and as it is a singly bent line having two straight arms one such arm is extrapolated a little extent with pencil so that the bending angle can be measured. Bending-angle 'θ' is determined using trigonometric relations, *i,e.*, tracing the metal wire on paper.

Elementary Theory: Two basic points of primary importance for understanding and obtaining result of this experiment are

(i) The bent should be with sharply particular such an angle so that all rays from all points along the submerged part of the straight body-length of the wire

go straight along the straight length of the wire to emerge out at liquid-air interface exactly along the bent upper part of the wire that is in air.

(ii) The height (h) to length (l) ratio should be pretty greater than the particular value for which the angle of incidence inside the liquid, i,e., r must be less than critical angle of the liquid-air combine (Fig.2).
Moreover one should take care , while performing experiment so that wall of the box should neither be transparent nor reflecting because then all other unwanted images will interrupt with the main image making the perfect observation difficult.

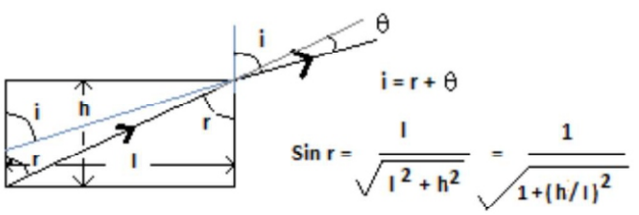


Fig.2
[Schematic Cross-section of Rectangular Box as seen laterally]

$$i = r + \theta = \sin^{-1}\left(\frac{1}{\sqrt{1+\left(\frac{h}{l}\right)^2}}\right) + \theta \quad ..(1)$$

{ h , l and θ are all measurable}

$$\text{Hence } \mu = \frac{Sin\, i}{Sin\, r} = \frac{\sin\left[\sin^{-1}\left(\frac{1}{\sqrt{1+\left(\frac{h}{l}\right)^2}}\right) + \theta\right]}{\frac{1}{\sqrt{1+\left(\frac{h}{l}\right)^2}}} \quad .....(2)$$

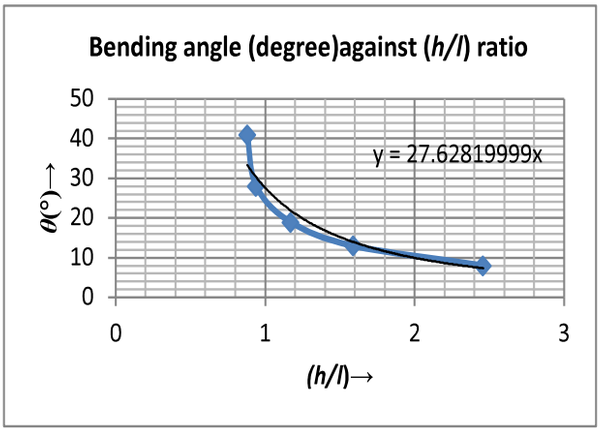
Results and Brief Discussion: Since angle 'r' is decided by the dimension of the box co-variations among 'i' , 'r', 'θ' and *(h/l)* from Eqns.(1) and (2) for a range of values of 'i' $0° < i \leq 90°$ and for μ = 1.33 are found out prior to experiment and are presented in Table-I.

Table-I.

Co-variations among i', 'r', 'θ' and *(h/l)* calculated from Eqns.(1) and (2) for water]

Variables	**Values**				
i	30°	45°	60°	75°	90°
r	22°	32°	41°	47°	49°
θ	8°	13°	19°	28°	41°
(h/l)	2.46	1.59	1.17	0.94	0.88

Fig. 3 Graphical plot showing calculated values of ***θ*** with ***(h/l)*** (Table-I)

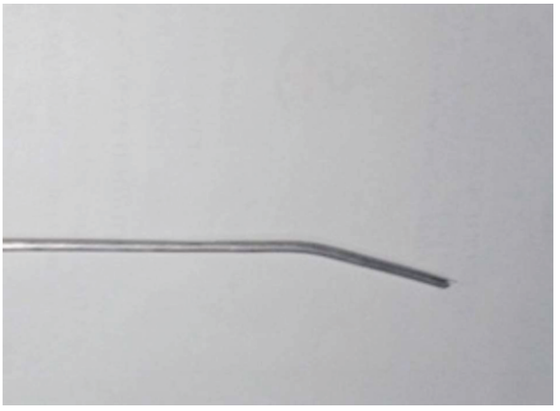


One can select the box with (*h/l*) value from a region, where θ values are comfortably measurable and values of deduced R.I. are reliable .

Table-II : Experimentally obtained values of (°) for some specific values of h and l of box and calculated value of r.i. thenceforth with the help of Eqn.(2)

	h(cms)	l (cms)	θ(°)	μ	$\bar{\mu}$
1	8.8	5.7	12	1.30	**1.31**
2	8.8	5.7	12.5	1.31	
3	5.3	3.2	11	1.29	
4	13.3	9.6	14.8	1.32	
5	13.3	9.6	14	1.31	

[A Few Pictorial Glimpses of the Performed Experiment]



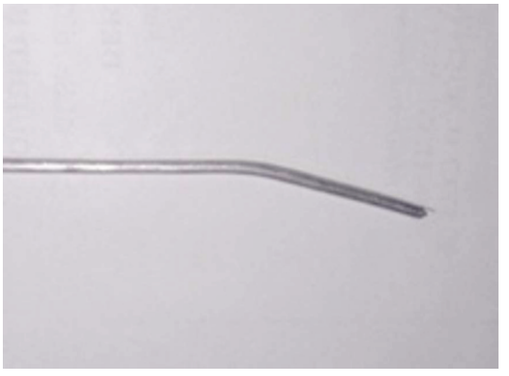


Fig.3 shows an ultimate variation of $\theta(^\circ)$ with the dimensional ratio (h/l) which is best fit with a polynomial with negative power and these two are thereby seen to be somewhat inversely related. Then the experiment have been performed correctly a few times and a table[Table-II] is prepared to present the obtained data and the corresponding calculations and hence result. For the specific length and height taken eventually in our experiment the different value of the ratio (h/l) and the corresponding value of $\theta(^\circ)$ obtained experimentally is seen to match extremely well with the theoretically calculated value as in Table-I. The results obtained is approximately satisfactory as it is seen to match with standard known value up to first decimal. It is well-known that the standard value of refractive index of pure water is 1.33 while the result obtained here is 1.31(approx.) deviating only about 1.5% of its standard value. The result is therefore pretty acceptable for demonstration. Performing this experiment requires two main precautions as follows;

(i) The height of the liquid-pot should be greater than its horizontal length (/width) in whatever direction it may be so as to ensure that the angle of incidence within liquid from inside at the liquid-air interface

must be less than the critical angle for the pair of optical media.

(ii) The stick or the wire, preferably made of soft bright metal (namely copper or aluminum)of narrow width/diameter(say within one millimeter) , should be perfectly straight while observation has to be rendered to attain level-best perfection. The necessary bending of the wire should be made at exactly the proper place where it just emerges out from liquid- surface. Alignment of the metal strip can be done by looking through a piece of cold-drink- straw (using as a collimator) before and after pouring liquid into the box.

(iii) Measurement can be repeated using the same and also different box with the metal wire placed along diagonal connecting opposite points at the end of the diagonal in the box.

Conclusion: This method of determining refractive index of liquid can be extended to other easily available liquids such as Glycerin, Alcohol, Turpentine oil, Coconut oil, Liquid paraffin, Castor oil. The method is of pedagogic value for the school students. Teachers should design such experiments for measurement of other physical parameters along with derivation of formula and inspire students to perform.

References:

[1] R. Chattopadhyay, 'Determination of Refractive Index of Liquid using Lens-makers' formula', Physics Education(IAPT-e-journal),Vol.33, No.1 (2017), pp.1-6

[2] Rabindranath Chattopadhyay, 'Refraction of light in Liquid-Prism and Determination of Refractive Index of Different Liquid, 'Indian Science Cruiser, Vol.33, No.5, (2019, September) pp.33-40.

Donation received in the account of IAPT@40 corpus Fund till 31st March 2025

Sr. No.	Date	Name	Place	Amount
1.	21.10.2024	Prof. P.D. Lele	Mumbai	250000.00
2	03.11.2024	Prof. P. C. Deshmukh	Bangalore	100000.00
3.	09.11.2024	Prof. P. K. Ahluwalia	Shimla	100000.00
4.	13.03.2025	Suraj J Shah	Rajkot	5000.00
5.	13.03.2025	Debapriya Syam	Kolkata	25000.00
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19.	27.03.2025	Dr. Kuldeep Kumar Sharma	Hamirpur	5000.00
20.	28.03.2025	Prof. K. N Joshipura	Anand	21000.00
21.	28.03.2025	Dr. R. R. Kothawale	Barshi	1000.00
			Total Rs.	**6,09,700.00**

For details to donate in IAPT@40 Corpus Fund please visit our website < indapt.org.in >

Celebration of National Science Day, 2025

This year the National Science Day was observed by RC-15 in dual mode -- offline and online. The first was a day-long programme, held on 28 th February, 2025 and the second one was an online programme on 2nd March, 2025.

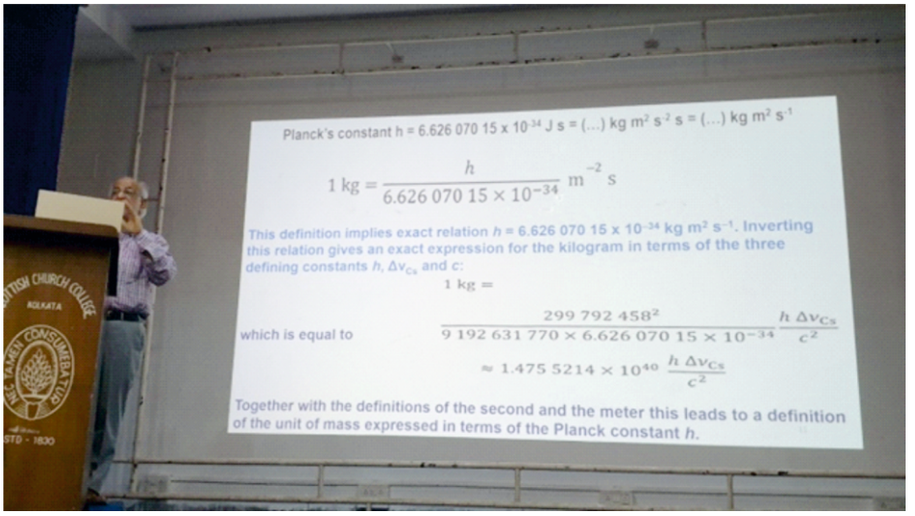
The offline programme which was conducted in collaboration with Scottish Church College, Kolkata was hosted by the said college at their M L Bhowmik Auditorium. The programme was divided into three phases – the Inaugural and the two Technical Sessions.

At the inaugural session, The Principal of the college, Dr. Madhumanjari Mandal delivered the Welcome Address, where she focussed primarily on the rich heritage of the institution. It was followed by two talks on 'The Life and Works of Sir C.V. Raman' and 'The Significance of the National Science Day'. The talks were delivered respectively by Prof. Aswini Ghosh a former Senior Professor from the Indian Association of the Cultivation of Science and Dr. Chinmoy Kumar Ghosh, a member of IAPT. Dr. C. K. Ghosh, in his talk, also highlighted about the aims, objectives and activities of IAPT in general and RC 15 in particular. Dr. Upendranath Nandi from the Physics Department of the college. who is also a member of IAPT and the co-coordinator of the program, offered the vote of thanks.

During the first technical session, the audience was apprised of the ongoing research activities in the science disciplines of the Scottish Church College. A teacher from each such discipline spoke on the thrust areas of their research. On behalf of IAPT-RC-15, Dr. Bhupati Chakrabarti delivered a lecture on the topic '150 Years of an International Body that Standardised the Measurement of Physical Quantities' and Dr. Surajit Chakrabarti talked on 'Physics Experiments with Smart Phone Photography and Other Sensors'. Both the lectures were very informative and they helped in opening new vistas of knowledge for the participants.

The main highlight of the second technical session was a Science Quiz Competition among the students, which was conducted by Dr. Joydeep Mitra of Physics Department of the college and again a member of the IAPT.

The online programme of 2nd March, 2025 started at 7 pm with the Welcome Address by Prof. Ananda Dasgupta, Vice President, IAPT-RC-15. Then there was a brief introduction of IAPT by Dr. Bhupati Chakrabarti. Thereafter the online platform got opened for Dr. Subhodeep De, Associate Professor, IUCAA, Pune, who delivered a talk on 'Accurate Timekeeping and its Necessity'. Dr. De took the entire audience through an exquisite journey of the evolution of time measurement from the sundial, sand clocks, candle clocks, etc. to the realm of atomic clocks. The speaker could very elegantly blend physics and technology in his talk, which aroused tremendous interest as could be gauged from the enthusiastic post-talk interactions. The gratification to the speaker and all concerned was offered by the Secretary, Dr. Shinjinee Dasgupta. The whole session was conducted by Dr. C. K. Ghosh.



Figs. Glimpses of National Science Day Celebration

Sukla Chakraborty
C.K. Ghosh

Report (RC-02)

Science Week Celebrations Electronics Workshop for UG Students

Activity: Science Week Celebrations: Electronics Workshop for UG Students

Date and Venue: 18-19, March 2025, INNOVATION-HUB, Physics Department, DAV College Bathinda

Sponsored: Punjab State Council for Science & Technology, National Council for Science & Technology, DST Govt. of India and IAPT-RC02

Beneficiaries: 44 students of B.Sc. I, II & III (NM)

Activity In charge: Dr Gurpreet Singh

As part of the weeklong celebrations marking National Science Day 2025, the Department of Physics at DAV College, Bathinda in association with Prof Yashpal Association of Physics Students successfully organized a two-day Electronics Workshop. The event, catalysed and supported by the Punjab State Council for Science & Technology, Chandigarh, the National Council for Science & Technology, the Department of Science and Technology, Govt. of India and IAPT RC-02 aimed to provide hands-on experience to students in designing and developing innovative electronic projects.

Workshop Highlights: The resource person for the workshop was Mr. Sukhwinder Singh, Coordinator, NIERT, Patiala. Having an extensive experience in teaching and technical expertise in electronics, Mr. Singh guided the UG students through various practical applications of electronics. Over the course of two days, students enthusiastically engaged in developing innovative projects, including automatic

tap using LDR sensor to avoid wastage of water, reed switch a magnetic sensor-based automatic switching system to save electric energy.Students creativity and technical acumen were commendable as they presented their projects to faculty members and peers.

Competition and Recognition: Among the numerous projects, three outstanding teams were awarded for their exceptional and innovative work: 1st Prize: Amandeep Kaur (B.Sc. III), Jiya, Navdeep, and Husanpreet (B.Sc. II), 2nd Prize: Sarita, Vanita, Akanksha, and Muskaan (B.Sc. III), 3rd Prize: Pushwinder, Karamvir, and Ashu (B.Sc. I). The winning teams demonstrated remarkable problem-solving skills and creativity.

Interaction with Distinguished Alumnus: A significant highlight of the event was an interactive session with an esteemed alumnus of 2013-14 B.Sc. batch, Mr. Govind, who earned his M.Sc. in Physics from IIT Madras and currently involved in an international research project on Gravitational Waves. He provided students with valuable insights into research opportunities in Physics, inspiring them to explore advanced scientific endeavours.

Conclusion and Future Prospects: The workshop concluded with a formal prize distribution ceremony,

where Principal Dr. Rajeev Kumar Sharma, along with Dr. Gurpreet Singh (HoD Physics) and other faculty members, felicitated the participants and honoured the resource person. Principal Dr. Sharma commended the department for organizing such an impactful workshop, appreciated the dedication of the students, and encouraged them to pursue careers in scientific research and development. He further thanked the sponsored and funding agencies for the workshop. The success of this workshop has further strengthened the department's resolve to conduct more such events in future, fostering innovation and practical learning among students in the field of electronics.

K.S. Mann

Report (RC-03)

National Science day Celebrations

On 19 March 2025, Guru Gobind Singh Khalsa College, Sector-26 Chandigarh in association with IAPT RC3 celebrated National Science day by organising a one day workshop on hands on training on electronic circuits. Dr. Balwinder Singh Dhaliwal, Associate professor, Electronics and communication Engg. NITTTR, Chandigarh was resource person. Students enjoyed the practical sessions and sharpened their skills. Indian Association of Physics Teachers RC3 in association with Centre for nanoscience and nanotechnology, Panjab University Chandigarh organised a two-days symposium on Advanced Materials for Device Applications,18-19 March, 2025. About 160 participants registered in this event and benefitted with 22 invited talks on various aspects of materials and their applications to realize devices.

Ranjan Kumar
Secretary RC-03

Report (RC-03)

Symposium on Advanced Materials for Device Application (AMDA-2025)

The Centre for Nanoscience and Nanotechnology, Panjab University in association with IAPT, Chandigarh Chapter and MCM DAV College, Sector-36, Chandigarh successfully hosted a two-day national symposium on *Advanced Materials for Device Application (AMDA-2025)* on March 18–19, 2025. The event brought together leading researchers, academicians, and industry experts to discuss advancements in the field.

Dr. Jadab Sharma, Chairperson of the Centre for Nanoscience and Nanotechnology, PU and convener of the symposium welcomed the chief guest, Prof. Y. P. Verma, Registrar of PU-Chandigarh, guest of honor Prof. Yojna Rawat, Director of the Research and Development Cell, PU-Chandigarh, and Prof. S. K. Tripathi, Chairperson, Department of Physics, PU and President-IAPT, RC-03, keynote speaker Prof. Shantanu Bhattacharya, Director of CSIR-CSIO, Chandigarh, and other distinguished guests & participants. Emphasizing the need to strengthen research infrastructure in universities, Dr. Sharma highlighted its role in positioning India as a manufacturing hub for advanced materials.

In his inaugural address, Prof. Y. P. Verma underscored the significance of materials in the renewable energy sector, while Prof. Yojna Rawat emphasized the impact of scientific research on societal development. Prof. S. K. Tripathi lauded the joint effort in organizing the symposium. Prof. Shantanu Bhattacharya, in his keynote address, shed light on advancements in materials for printable electronics. The plenary talk was delivered by Prof. Akash Deep, Director (additional-charge), INST-Mohali on 19.03.2025.

The symposium featured 20 invited talks from premier institutions such as IIT, IISER, INST, and PEC, fostering insightful discussions among experts. With over 150 participants, the event served as a dynamic platform for knowledge exchange on advanced materials for device applications and future technologies.

The symposium received partial sponsorship from the Science & Technology and Renewable Energy Department, Chandigarh Administration, as well as Infinity Biosciences, Avishkar Life Sciences, Trust for Education and Training in Cytometry (TETC), Flowcytometry Solutions, Toshniwal Brothers Pvt. Ltd., and ThermoFisher Scientific.

Ranjan Kumar
Secretary RC-03

Workshop on
Quantum Revolution –A Journey Across Orbits

Convener and Mentor : **Dr Abha Khandelwal**
Coordinator: Prof. Sarmistha Sahu

No of Participants: 60 teachers and 25 students
Dated: 4th to 13th February 2025

A remarkable educational journey, jointly organized by IAPT-RC12A and AACST (Association of All Computer Science Teachers)

As the proverb goes, *"Coming together is a beginning; keeping together is progress; working together is success."* This workshop was the epitome of successful collaboration and mutual learning.

Highlights of the Workshop

Every day, sessions began on time—allowing a modest grace period of five minutes—reflecting our collective discipline and commitment.

The course contents were meticulously curated by **Dr Abha Khandelwal**, aligning perfectly with the workshop's objective of introducing and deepening participants' understanding of quantum science, computing, research, and applications.

All resource persons, each having mastery in their domain, effectively delivered their sessions.

Everyone's unique teaching style made every session engaging and impactful.

A variety of tools, from **Python programs and Qiskit Quantum Computing Framework, short YouTube videos**, **Quantum simulation for Quantum principles**,

LottieFiles,: For lightweight animations (GIF-like), Notes in PDF files were employed to bring complex quantum concepts to life.

The resource persons collectively simplified even the most challenging quantum concepts, ensuring participants are left with clarity and confidence. Indeed, each session sparked a new flame of curiosity and discovery.

Daily assessment links posted in Google Classroom ensured continuous judgement of participants learning during sessions.

Sessions were **highly interactive**, with robust Q&A segments following each lecture.

Additional Assignments were given in two sessions.

Recorded Lectures were made available on Google Class room for revision before assessment

The Workshop Journey

The workshop began with **Session 1, on 4th February**, delivered by **Dr. Jyoti Ghushe**, on *Introduction to Quantum Computing, Key Quantum Principles, and the Beam Splitter Simulator Experiment*. She brilliantly explained core principles like superposition, entanglement, and interference, along with a comparison between classical bits and qubits. This session was chaired by **Prof. P C Deshmukh**, Mentor of CAMOST and Professor at IIT Tirupati and IISER Tirupati, who captivated everyone with his visuals illustrating the intriguing relationship between determinism and probability in quantum phenomena.In **Session 2 on 5th February**, **Dr. Ojas Garg** rocked the session with his excellent explanation of *Famous Experiments in Quantum Mechanics*, such as the *Stern-Gerlach Experiment, Quantum Dots, and Quantum Tunneling*. **Prof. K N Joshipura**, a retired professor from Sardar Patel University,Anand, Gujrat added an engaging touch with a video of a live black body changing colors at different temperatures.

On **6th February**, **Session 3**, **Dr. Bhakti Patankar Rajvaidya** delivered a self-explanatory presentation on *Bell's Inequality Tests, Quantum Entanglement, and Quantum Teleportation*. which left participants spellbound. She mesmerised everyone with her beautifully designed presentation and explanation.

The chairperson of the session Dr. M K Raghavendra, Program Manager at Axis Bank Centre, IISc, highlighted the growing importance of

computing skills for physics students.

Dr. Sumit Pakhare led **Session 4 on 7th February**, explaining *The Need for Quantum Computers and Research Opportunities for Physicists*. He outlined global milestones, India's initiatives, and provided a structured approach to quantum research in terms of the growing global demand for quantum scientists. He provided a structured roadmap for quantum research and highlighted opportunities for physicists. He also effectively conveyed the diverse research areas in quantum computing for other domains, from quantum hardware to quantum algorithms, inspiring participants to explore interdisciplinary opportunities.

This session was chaired by Dr. Y C Sharma, Director, Research and Development, Jaipur National University. He emphasized the immense research potential in Quantum Computing, encouraging physics students to seize the opportunities in this rapidly evolving area.

10th February, **Dr Abha Khandelwal** delivered **Session 5 on Quantum Cryptography and One-Time Pad Encryption**, covering the **BB84 Protocol** and simulating **Quantum Key Distribution (QKD)** using Qiskit. Participants engaged in exercises to generate shared keys, which helped them grasp the practical aspects of quantum cryptography. The session also included solving an exercise on transmitting crucial messages using the secret key generated through QKD and one-time pad encryption, ensuring secure communication. This hands-on approach made the session an enriching and insightful experience for all participants, bridging theory with practical implementation.

The Chairperson, **Dr. Chetan M,** Assistant Professor at Jain University with his remarkable communication skills, beautifully concluded a thought-provoking lecture on QKD and simulation of quantum cryptography.

In **Session 6 on 11th February**, one of the most exciting features was our session with an **international speaker** showcasing the power of the digital world to connect minds across continents. **Dr. Shadab Hussain from Texas**, US introduced *Post-Quantum Cryptography, Lattice-based, Code-Based, Hash-Based PQCs, AI-Based Attacks, and Real-World Applications*. He elaborated on NIST-recommended algorithms and how AI can strengthen cryptographic resilience. The session was extensively informative.

The chairperson, **Dr. Shivalinga swamy** T, Prof of Physics, Maharani Science College, Mysuru, and President RC12A. He praised the topic that resonates perfectly with our increasingly digital lives.

We paused on **12th February** to remember **Prof. D P Khandelwal**, founder of IAPT. **Prof. P K Ahluwalia** walked us through his life and contributions, offering a heartfelt tribute to this visionary leader. Prof Ahluwalia highlighted his teachings, and his ideas, which are remarkably relevant even today, inspiring us to adopt and embody them in our lives.

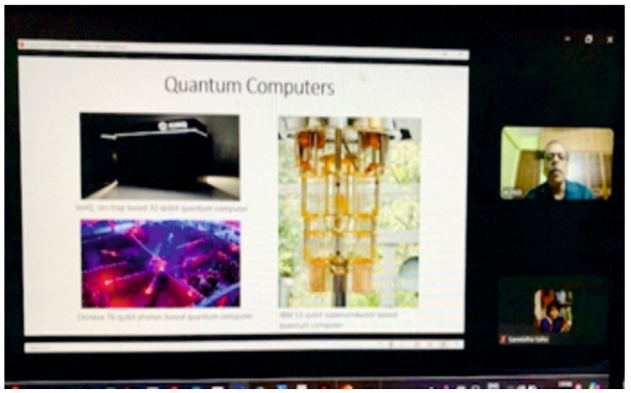
Session 7 was delivered by **Dr. Kishor Chandra Pati** on *Quantum Gates and Circuits*. He explained various quantum gates, Pauli gates X, Y, and Z and Hadamard Gate, S gate, T gate, Inner, Outer, and tensor products, and matrix representations, Normalization of Vectors, Orthonormal vectors covering every minute detail in a clearly understandable way. **Prof. K S Mallesh** chaired the session, simplified the session further for UG students, translating quantum language into plain English.

Finally, **Session 8 on 13th February**, also conducted by **Dr. Kishor Chandra Pati**, focused on C NOT Gate, Swap gate, *Quantum Circuits and Deutsch's algorithm*. He beautifully explained Deutsch's algorithm, a fascinating quantum breakthrough that elegantly demonstrates how a single quantum query can reveal the hidden nature of a function, far surpassing classical limits and paving the way for future computational possibilities.

This session was chaired by **Prof. P K Ahluwalia**, making it a perfect conclusion to the workshop by showcasing quantum advantage in solving complex problems.

A Note of Gratitude

A heartfelt thanks to the esteemed mentor and Convener **Dr Abha Khandelwal and her resource persons** team for their dedication and brilliance.



"Each teacher ignited a flame, and together, they created a bonfire of knowledge."

To the participants, a big thank you for their enthusiasm and perseverance. Their questions, reflections, and feedback added immeasurable value to this workshop.

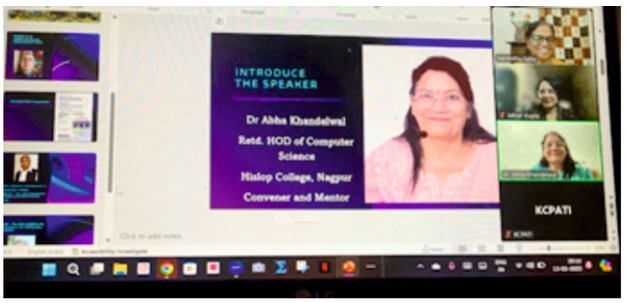


Figure 2 Participants' feedback, Abha mam's design!

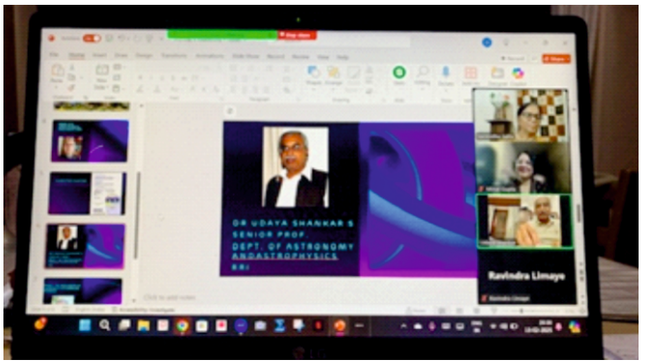


Figure 3 'Double-Slit conditions used in Radiotelescopes", Dr Udaya Shankar, RRI, guest for the evening

As we close this chapter, let us remember that *"The end of a journey is always the beginning of a new one."*

May the lessons learned here inspire all of us to explore new frontiers in quantum research and beyond.

Abha Khandelwal
Convener

Sarmistha Sahu

Secretary SRC 12 - A

Report (Ammani Anveshika)

Hands on Experiments

Date: 11.01.2025

Time: 1.30 pm to 3.30 pm

Venue: SadvidyaSemi Residential PU College &School, Vijayanagar, Mysuru, Karnataka

Number of students: - 50 students of Class 10

Resource person: Ms. M. K. Uma. **It was a very wise Sage who said, I hear and I forget, I see and I remember, I do and I understand.**

The Session started with a warming up activity.

The highlight of the session was that students were made to perform the activities and then the explanations followed. The Curious students were very enthusiastic and went back with Clarity in concepts.

The topics covered with demonstration using working models were: -

Electric charges – types and properties, Methods of Charging a body

Conductors and non-conductors

Electric current, Potential, Potential difference

Ohm's law, resistance and its dependence on length and area of a conductor

Resistances in series and parallel connections

Electric Power, Bulbs in series and parallel

Force on a current carrying conductor, Electromagnetic Induction

Rectilinear Propagation of light,

Refection in plane and curved mirrors,
Refraction and Total internal reflection.

Relevance and use of the above concepts in daily life were discussed.

M.K. Uma
Ammanni IAPT Anveshika

Announcement

EC Meeting of RC-03

A meeting of the office bearers / executive council (EC) members of IAPT RC-03 was held on Feb 18, 2025 in the Department of Physics, Panjab University, Chandigarh. The EC members nominated the following members for various vacant posts in EC.

Sr. No.	Name of the Post	Member Name	Life membership No.	Mobile Number	Address
1	Vice President	Dr. Rama Arora	L7177	8146511773	PG Govt. College, Sector 11, Chandigarh
2	E.C. Member	Dr. Mumtaz Oswal	L8193	9988708584	DAV College, Sector 10, Chandigarh
3	E.C. Member	Dr. Ranber Singh	L7560	7087401222	SGGS College, Sector 26, Chandigarh

Ranjan Kumar
Secretary, IAPT RC-03
Department of Physics
Panjab University, Chandigarh

National Competition in Computational Physics – 2025 (NCICP-2025)

(Physics Simulations & Software-Based Physics Experiments)

The **Annual IAPT Competition, NCICP-2025**, will be conducted **online** before the **Annual IAPT Convention 2025**. The venue and exact dates for the convention will be announced later.

Key Dates

Event	Date
Registration Deadline **(with submission of Title & One-Page Abstract)**	**31st May 2025**
Online Interaction with Experts	**15th – 21st June 2025**
Final Submission Deadline	**31st July 2025**
Final Presentation & Interaction for Evaluation (Online)	**20th – 31st August 2025**
Project Demonstration by Award Winners & Special Invitees	**During IAPT Convention 2025**

About NCICP-2025

Objectives

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

✅ **Promote** computational thinking, simulation-based analysis, and AI-driven problem-solving in physics.

✅ **Encourage** students and researchers to develop innovative solutions for real-world physics challenges.

✅ **Foster** deeper engagement with computational physics through hands-on simulations and software-based experiments.

✅ **Empower** educators to integrate generative AI and advanced computational teaching tools.

✅ **Enhance** modern scientific exploration by leveraging technology-driven methodologies.

This competition serves as a platform for participants to explore cutting-edge computational techniques, drive innovation, and contribute to the future of physics research and education.

Competition Categories

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

1 **Undergraduate (UG)**

2 **Postgraduate (PG) & Research Scholars**

3 **Educators**

- 🔹 **All work presented must be original.**
- 🔹 The **top three presentations in each category** will receive **prizes and certificates**.
- 🔹 All participants will receive an **e-certificate**.
- 🔹 **Judges' decisions will be final**.

Competition Theme

🔷 **Innovation in Physics Experiments and Simulations**

(Exploring new ideas, new methods, new devices, or algorithms in physics.)

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

Evaluation Criteria

Participants will be assessed based on the following metrics:

Sr. No	Criteria
1	Literature Survey
2	Software/Methodology & Implementation
3	Analysis of Results & Interpretation
4	Discussion & Critical Insights
5	Conclusions & Impact
6	Scope for Future Work
7	Bibliography & Quality of Resources
8	Novelty & Innovativeness
9	Presentation & Engagement in Interaction
10	Documentation

Competition Categories and Challenges

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

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

✓ **Computational Methods in Introductory Physics** *(Basic numerical techniques & programming applications in physics)*

✓ **Sensor-Based Data Acquisition & Analysis** *(Using Arduino/Raspberry Pi for data collection & processing)*

✓ **Simulations & Visualization in Physics** *(Graphical representations using Python, MATLAB, etc.)*

✓ **Basic AI & Data Science Applications** *(Applying AI for experimental data analysis in physics)*

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

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

✓ **Advanced Computational Techniques in Physics** *(Solving real-world physics problems with computational methods)*

✓ **Quantum Computing for Physical Simulations** *(Hands-on IBM Quantum, Qiskit & quantum algorithms)*

✓ **Machine Learning for Physics-Based Predictions** *(AI for pattern recognition, simulations & optimization)*

✓ **Multiscale Modeling & Complex System Simulations** *(Addressing interdisciplinary physics challenges)*

Category 3: Educators – Computational Physics in Classroom Teaching

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

✓ Open-Source Computational Lesson Plan Challenge

Task: Create a **lesson plan** that uses **only open-source** or freely available computational tools (e.g., PhET, Python, GeoGebra, Desmos) to teach a physics concept. The plan should include **home-based activities** to allow students to practice independently.

Evaluation Criteria:

- Use of freely available computational tools
- Clarity and effectiveness in conveying physics concepts
- Inclusion of home-based practice activities

✓ Virtual Lab & Simulation Development for Home Learning

Task: Design an **interactive virtual experiment** that students can conduct on their own, using **readily available software or simple coding platforms** like Jupyter Notebooks, Glowscript, or VPython.

Evaluation Criteria:

- Accessibility and ease of use at home
- Engagement and interactivity of the simulation
- Educational impact on understanding physics

✓ Computational Physics for Interdisciplinary Home Projects

Task: Develop a **project-based learning activity** that integrates **computational physics** with another subject (e.g., biology, environmental science, engineering) and can be **completed at home** using publicly available datasets, simulations, or coding exercises.

Evaluation Criteria:

- Creativity in interdisciplinary application
- Use of computational techniques with minimal resources
- Feasibility for students to complete independently at home

✓ Data-Driven Physics Education for Real-World Problems

Task: Create a **student-friendly module** where learners **collect, analyze, and visualize real-world physics data** using open-source software (e.g., Python, LibreOffice Calc, Jupyter). Example: Analyzing motion using a mobile phone's accelerometer or tracking planetary motion using online datasets.

Evaluation Criteria:

- Feasibility for students using home-based tools
- Depth and accuracy of data analysis
- Ability to enhance computational thinking skills

How to register and What to do next

Follow the website: https://www.indapt.org.in
The detailed entry should be submitted via the Google Form:
https://forms.gle/G8xGeA7yE7jNDJeq6

An individual / the team leader in case of a group (*Max. three members*) must submit the required information, including the One-page Abstract with Title in pdf format, within May 31, 2025.

What to do next

(i) After the interaction meeting with participants, the team leader, incase of a group, or an individual must submit the **Final pdf file** within July 31, 2025, as is described in the following points, to the Google Classroom (Class Code to be sent to the individual mailbox after June 21, 2025) as an attachment.

(ii) The file must be named as '1/2/3-*First name of the team leader /single participant*'.pdf. 1/2/3 is to be used to mention the category. At the end, please append: _G (for Group Category) / _S (for Single).

(iii) It should contain a detailed write-up of their work (along with the computer program, if any), i.e. detailed theory with diagrams, procedure, observations, calculations, graphs, results, and references.

In the case of physics simulations, the report should include a statement of the problem, formulation of the problem, flowchart, code/worksheet, test cases, and visualization of results using Gnuplot or such Open Source software. There is no limit on the number of pages. The participant(s) should write his/her (their) name(s), affiliation(s), and email(s) at the end of this file. Please mention the innovation you have incorporated with its importance regarding applications.

(iv) Please use Times New Roman (font size 12, spacing 1.5), and marginsshould be appropriate (1 inch on each side).

Selected entries (Award winners and special invitees, if any) from each category will be invited for demonstration at the upcoming IAPT convention. The dates and venue will be notified in due course of time. The convention will likely be held during October 2025. The invited participants will be paid railway fare from the workplace to the convention place as per IAPT rules. In the case of joint authors, only one of the participants is eligible to receive TA (as per IAPT rules). The selected participant must come with his/her experimental setup for the final demonstration.

Your cooperation in abiding by the last date will be highly appreciated.

For any query:

Dr. Pradipta Panchadhyayee, Coordinator, NCICP-2025
Associate Professor, Department of Physics (UG & PG)
Prabhat Kumar College, Contai;
PO: Karkuli DSO, Dist-Purba Medinipur, WB,721404
Mail id: ppcontai@gmail.com
WhatsApp:(+91) 9476161100

39th Annual convention of IAPT

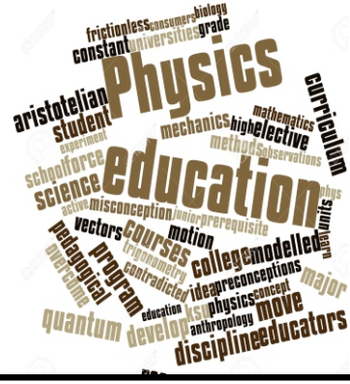
Goa University

FIRST ANOUNCEMENT

We are pleased to inform that 39th Annual convention of IAPT will be held at Goa University, Goa from 4th to 7th October 2025. Convention is open to teachers, researchers, Physics enthusiast and students at all levels- from schools to Universities. There are opportunities in abundance in the form of Pre Convention workshops, Plenary Lectures, Invited talks, paper presentations (Oral/Poster), physics stage shows, competitions, celebrations of teachers and students achievements and conversations on the side walks of the conference. Broad Themes are as follows:

Artificial Intelligence (AI)

Physics education Research



NEP: Challenges in Physics education

Quantum Science & Technology

Details will be provided in the due course

EC IAPT Goa RC-21

Space Research: Indias Achievements

Announcement

Following are declared as the office bearers, elected unopposed to IAPT RC-17 for the term January 2025 to December 2027

Sl. No.	Designation	Name	Life Membership Number	Address • Address • E-mail • Mobile Number
1	President	Dr. Runima Baishya	L-5288	runimabaishya@gmail.com 8135847815
2	Vice-President	Mr. Saumar Rajkhowa	L-5492	saumarrajkhowa@pragjyotishcollege.ac.in 8638228270
3	Secretary	Dr. Devabrat Mahanta	L-9433	devabrat.phy@gmail.com 9387875785
4	Treasurer	Ms. Bandita Deka	L-9430	banditadeka222@gmail.com 8638288915
		Members		
1	Member	Dr. Pranabjyoti Bhuyan	L-8968	pranabjbhuyan@cottonuniversity.co.in 9483832185
2	Member	Dr. Gauri Gautam Borthakur	L-5389	ggb.jist@gmail.com 9864308097
3	Member	Dr. Biplob Sarkar	L-8129	biplobsiut@gmail.com 9101614336
4	Member	Dr. Ananya Phukan	L-9247	Ananya.phukan26@gmail.com 8761048022
5	Member	Dr. Dipak Majumdar	L-9018	Dipak.mazumdar@avcollege.ac.in 7596986050

Co-Opted Members:

1. Dr. Ranjita Deka (L-4345)
2. Dr. Bandana Das (L-5489)

EC representative

1. Mr. Manab Deka (L-3110)

Pranab Kumar Das (RO)

Mobile Number: 9864061308

Cognitive Science: Another close kin of PER

We have discussed earlier how disciplines like history and philosophy of science contribute to research in physics education. In this column, we briefly review the role of cognitive science in PER. Since education fundamentally involves changing the human mind, in a sense, one can intuitively guess the strong interrelation between the two disciplines. Many studies are available along these lines and here we review some notable examples. The first one is the work of Frederick Reif, who is well known in the physics community because of his widely popular book on statistical and thermal physics. Specifically, Reif has employed insights from cognitive science to conduct research and improve aspects pertaining to teaching and learning of physics. A consolidation of his lifelong work in PER can be found in the following book:

Reif, F. (2008). *Applying cognitive science to education: Thinking and learning in scientific and other complex domains*. MIT press.

He stresses that a major source of student difficulties has its roots in the knowledge structure of physics. As, physics in particular and science in general, are designed deliberately to ensure maximum generality, the standards for precision, coherence, etc., are stringent. Consequently, beginning students stand in need of cognitive skills previously unlearned to handle these complexities. To facilitate the learning of these basic cognitive skills he designed a textbook and an associated workbook on mechanics, covering topics dealt with at the grade 11 level in our context (Reif, F. *Understanding basic mechanics*, John Wiley and Sons, 1995).

The second work which we discuss goes into deeper aspects of cognitive science and explores the evolution of abstract mathematical ideas:

Lakoff, G., & Núñez, R. (2000). *Where mathematics comes from* (Vol. 6, p. 489). New York: Basic Books.

It draws on the embodied cognition perspective and the authors maintain that human ideas are fundamentally grounded in our sensory motor experiences. Initial ideas and entities in any field (including physics) are generated from perceptual categories. More sophisticated and abstract entities, say for example electron, would be a higher order construct, a theoretical entity postulated to account for data, not based on direct bodily experiences. Cognitive mechanisms such as conceptual metaphors help erect such abstract ideas on the foundations provided by sensory motor experiences. Once a set of abstract and formal ideas gets generated, further storeys in the tower of abstraction can be built by manipulations and recombinations of them.

The book has an interesting chapter analyzing the development of Euler's equation ($e^{i\theta} = \cos\theta + i\sin\theta$) . It is stated that `knowing how to prove something does not necessarily mean that one understands the deep meaning of what has been proved'. The understanding that emerge from the manipulation of symbols or formalism is contrasted with that which is framed in terms of cognitive mechanisms such as conceptual blending (CB). It may be noted that CB describes how novels ideas are created by incorporating ideas, concepts and association from prior existing, disparate domains. It is now a commonly employed theoretical framework in PER. As an illustrative example, consider the following study involving heat equation:

Eynde *et. al.,* (2020). Dynamic conceptual blending analysis to model student reasoning processes while integrating mathematics and physics: A case study in the context of the heat equation. *Physical Review Physics Education Research*, *16*(1), 010114.

K K Mashood
HBCSE - TIFR, Mumbai

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