KMVPHY-SPECTRUM

WE LEAD OTHERS FOLLOW

A PHYSICS NEWS LINE

Vol. 10 (Issue 2) January to June-2025

"Not everything that counts can be counted, and not everything that can be counted counts." -A**lbert Einstein**

Visionary Physicist

The futurist Physicist Transforming Science Education: Chandralekha Singh

In the often complex and challenging world of physics, where equations stretch across blackboards and theories reach beyond galaxies, one name shines not just for her scientific insight but for her passion to illuminate the path for others—Dr. Chandralekha Singh. Born and raised in India, Singh grew up in a family that valued education and encouraged her intellectual curiosity. At a time when few women pursued advanced studies in physics, she dared to follow her fascination with the natural world and the fundamental questions science seeks to answer. Her academic brilliance carried her to the Indian Institute of Technology, Kharagpur, where she completed an integrated Bachelor's and Master's in Physics, graduating at the top of her class—a distinction that foreshadowed her trailblazing career.

Her journey continued in the United States, where she earned both an M.S. and a Ph.D. in Physics from the University of California, Santa Barbara, specializing in theoretical condensed matter physics. While she excelled in research, Singh also grew increasingly interested in the way physics was taught and the struggles students faced, particularly with abstract topics like quantum mechanics. This curiosity led her to pivot into the emerging field of physics education research, determined to make physics more accessible, engaging, and equitable.

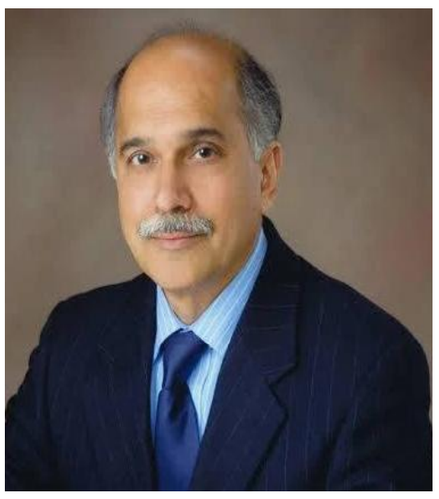
Since joining the University of Pittsburgh in 1995, Dr. Singh has become a leader in transforming science education. She founded the Discipline-Based Science Education Research Center (dB-SERC), a pioneering hub for evidence-based teaching methods that improve student learning across STEM fields. She also serves as Special Assistant to the Provost for Quantum Education, guiding national initiatives to bring quantum science to K–12 schools, universities, and underrepresented communities. By blending cutting-edge research with a deep commitment to inclusivity, Singh has redefined what it means to be both a scientist and an educator.

Her message to students reflects this dual mission: *"Science is not just about finding answers; it's about nurturing curiosity and courage. When you have mentors who believe in you and a community that supports you, there is no limit to what you can achieve."*

Dr. Singh's pioneering efforts have earned widespread recognition. In 2024, she received the **J.D. Jackson Award for Excellence in Graduate Physics Education** from the American Association of Physics Teachers, one of the highest honors in her field. She is a Fellow of the American Physical Society and several other leading scientific organizations. The University of Pittsburgh has named her a **Distinguished Professor**, honoring her national leadership in physics education and advocacy for equity in science.

Yet perhaps her greatest impact lies in mentorship. Singh has consistently worked to inspire women, first-generation students, and those from marginalized backgrounds to pursue physics with confidence. Through outreach programs, innovative curricula, and her ongoing research into digital learning tools and AI-driven teaching methods, she continues to open doors for the next generation of scientists. Dr. Chandralekha Singh's story is one of brilliance, resilience, and service. By advancing both the frontiers of physics and the way it is taught, she demonstrates how science can bridge divides, break barriers, and empower all who seek to understand the universe.

The Professor Who Taught the World to Think Differently: Ramamurti Shankar



In a world where physics is often perceived as intimidating, abstract, and reserved for the gifted few, Professor Ramamurti Shankar has made it not only understandable but joyful. As a distinguished professor at Yale University and one of the most beloved physics educators on the internet, Shankar has built a legacy that bridges the gap between the elegance of theoretical physics and the curiosity of everyday learners. Born on April 28, 1947, in New Delhi, India, Shankar's academic journey began in engineering. He earned his B.Tech in Electrical Engineering from the Indian Institute of Technology, Madras, in 1969. Physics was not his first pursuit—it was curiosity that eventually led him there.

As a young engineering student, Ramamurti Shankar stumbled upon Richard Feynman's legendary lectures, and what began as casual reading soon became an intellectual awakening. Physics, with its elegant logic and beauty, revealed itself as his true calling. With encouragement from his father, he completed his engineering degree before making the bold shift to physics, a decision that would define his life's work.

Shankar went on to earn his Ph.D. in theoretical particle physics at the University of California, Berkeley, in 1974. Soon after, he was selected as a Junior Fellow at the Harvard Society of Fellows, becoming only the second Indian, after Nobel laureate Subrahmanyan Chandrasekhar, to receive this honor. In 1977, he joined Yale University, where he would spend his career, ultimately holding the prestigious title of Josiah Willard Gibbs Professor of Physics.

His research contributions span multiple domains—particle physics, quantum field theory, condensed matter physics, and statistical mechanics. He worked on exact solutions in disordered systems, the renormalization group approach to Fermi liquids, the Hamiltonian theory of the fractional quantum Hall effect, and the physics of topological insulators. These achievements alone would secure his legacy as a physicist of great influence.

Yet Shankar's impact extends far beyond his scholarship. What makes him unique is his rare ability to make the most complex ideas accessible. Through Yale's Open Yale Courses initiative, his introductory physics lectures—particularly *Physics 200*—were made freely available online. These lectures, now watched by millions on YouTube, have inspired students, hobbyists, and lifelong learners across the globe. His lectures are not just classes but performances, infused with humor, storytelling, and mathematical clarity. "Life-changing," one student called them. Another confessed, "I don't even go to Yale, but I've watched every lecture." Beyond the classroom, Shankar has authored some of the most widely used textbooks in physics. His *Principles of Quantum Mechanics*, *Basic Training in Mathematics*, and *Quantum Field Theory and Condensed Matter* are staples in universities worldwide. He also contributed to updated editions of *Fundamentals of Physics* by Halliday and Resnick, a standard for generations of students. Translated into many languages, his works continue to shape physics education internationally.

Shankar's contributions have been recognized with numerous honors. He received the Julius Edgar Lilienfeld Prize of the American Physical Society in 2009 for both his research and his exceptional gift for communicating physics. At Yale, he was awarded the Harwood F. Byrnes/Richard B. Sewall Teaching Prize for his transformative impact as a teacher. He is a fellow of both the American Physical Society and the American Academy of Arts and Sciences, and earlier in his career, he was awarded the Alfred P. Sloan Fellowship.

Despite these accolades, Shankar remains remarkably modest. In interviews, he emphasizes joy over achievement: "I just like my subject a lot. Any number of times, any number of people. And I think they can feel my enthusiasm." That enthusiasm radiates through his teaching, his mentorship, and even his family life—his daughter, Maya Shankar, a cognitive scientist and former White House adviser, has often spoken of his wisdom and calm guidance.

Today, Professor Shankar continues to teach, write, and inspire. His office hours are famously lively, filled with eager students who come not just for answers but to share in his passion for discovery. In an era dominated by metrics and digital noise, Ramamurti Shankar reminds us that physics is not merely a discipline but a conversation with the universe—a conversation he has invited millions to join.

For Shankar, teaching is not just a profession. It is an act of joy, clarity, and generosity. And in that spirit, he has made the vastness of physics feel like home to learners everywhere.

Science News Section

Aditya-L1 Solar Mission Releases Data

In **January and February 2025**, ISRO's **Aditya-L1**, India's first solar observatory in space, released its **first two sets of scientific data**. The mission recorded: A powerful **X6.3-class solar flare,** A rare **flareless coronal mass ejection (CME),** Insights into **solar wind dynamics and charged particles**. These observations were made using advanced instruments like **VELC, SUIT, PAPA**, and others. The data offers new clues about **solar activity** and its impact on space weather—vital for satellite safety and communications on Earth.

India's First Full-Stack Quantum Computer "Indus" Launched

Bangaluru based QpiAI, one of the 8 startups selected under the National Quantum Mission, coordinated by the Department of Science and Technology (DST) announced the launch of one of India's most powerful quantum computers featuring 25 superconducting qubits, on the occasion of World Quantum Day . QpiAI-Indus, the quantum computer launched, is the first full-stack quantum computing system in the country and combines advanced quantum hardware, scalable control, and optimized software for transformative hybrid computing. It integrates advanced quantum processors, next-generation Quantum-HPC software platforms, and AI-enhanced quantum solutions. With this milestone, QpiAI is driving deep-science and deep-tech innovation across life sciences, drug discovery, materials sciences, mobility, logistics, sustainability, and climate action.

Breakthrough in Phonon Control via Twisted 2D Materials

A breakthrough method of controlling properties of phonons-- energy wave travelling through crystal lattice on vibration of atoms of the material, through twist angles between layers of two-dimensional materials, can help engineer materials with tailored thermal, optical, and electronic characteristics, vital for quantum technology. A phonon is a collective excitation in a periodic, elastic arrangement of atoms or molecules in condensed matter like a tiny wave of energy that travels through the crystal lattice when atoms in the material start to vibrate. They are similar to movement of ripples in a pond on dropping of a stone. Phonon properties and their interactions can play a crucial role in developing optoelectronics tunable photonic devices. Scientists are exploring different methods in controlling properties of phonons for the purpose. Researchers at the Indian Institute of Science (IISc), Bangalore, have uncovered a method to vary twist angles in WSe2 (Tungsten diselenide) homobilayers to influence phonon hybridization and other key properties. This study, published in ***ACS Nano*** highlights the intricate relationship between periodic structures that form when two or more two-dimensional (2D) lattices overlap (moiré superstructures) and their impact on phononic and electronic interactions.

Quantum-AI Curriculum in Andhra Pradesh

Visakhapatnam: In a bid to create the 'Amaravati Quantum Valley' and make the state a globally recognised hub for emerging technologies, the Andhra Pradesh State Council of Higher Education (APSCHE) is spearheading the development of a robust curriculum framework for quantum computing, quantum technologies, and artificial intelligence. APSCHE's vision aligns with the National Education Policy 2020 and AICTE. The program includes hands-on labs, training for 500 educators, and support from IITs, TCS, IBM, and DST

Discovery of Altermagnets in Chromium Antimonide

Scientists from the S N Bose National Centre for Basic Sciences (SNBNCBS), an autonomous institution of the Department of Science and Technology (DST), have spotted electrical and thermal transport phenomenon in the altermagnet CrSb. Scientists found new electrical and thermal transport in altermagnet CrSb. Altermagnets, a novel magnetic material class, combine ferromagnet and antiferromagnet properties with zero net magnetism but unique spin polarization. CrSb, an earth-abundant material, exhibits remarkable characteristics, making it highly promising for future spintronics and spin caloritronics, exploring the interplay of spin and heat flow for information technology.

Proposal for Sapphire Detector to Study Neutrino-Nucleus Scattering

Researchers at the **Bhabha Atomic Research Centre (BARC)** have proposed the **Indian Coherent Neutrino-nucleus Scattering Experiment (ICNSE)**, which aims to detect **coherent elastic neutrino–nucleus scattering (CEvNS)** using a **sapphire (Al_2O_3) detector** placed near reactor sources of antineutrinos. This proposal explores several key scientific goals: Measuring the **weak mixing angle** in a low-energy regime, Investigating the **electromagnetic properties of neutrinos**, such as their magnetic moment., Placing tighter constraints on **new light mediator particles** in scenarios beyond the Standard Model. The sapphire detector's one-year exposure shows strong promise in improving sensitivity to scalar and vector mediators, offering enhanced limits compared to other detectors.

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P.G. Department of Physics Organizes Insightful Event "Research Rendezvous: Think Tank Meet"

Upholding its global vision, the Postgraduate Department of Physics recently organized an enriching session featuring Prof. John S. McLoy (Washington State University) and Dr. Ashutosh Goel (Rutgers University). The speakers offered valuable insights into research and internship opportunities in the U.S., guiding students on applications, eligibility, and essential skills. Appreciating the initiative, Madam Principal highlighted KMV's commitment to global exposure and student empowerment.

World Renowned Glass Guru Visited KMV: Glass Science for Tomorrow and Breaking Barriers

The Postgraduate Department of Physics recently hosted an enlightening lecture titled "Breaking Barriers: Glass Science for Tomorrow" by Prof. Arun Varshneya, President of The Society of Glass Technology, UK. Known as the Glass Guru, Prof. Varshneya captivated the audience with insights on the role of glass in modern technology, sustainability, and healthcare—including its use in EpiPens through chemical strengthening.The session sparked engaging discussions and inspired students to think innovatively. Organized under the visionary leadership of the Principal, the event reflected KMV's commitment to connecting students with global experts and fostering academic excellence.

Beyond the Equations: The Thrills of Physics with Prof. HC Verma

Padma Shri awardee **Prof. H.C. Verma** conducted an engaging physics workshop titled "Beyond the Equations"at Kanya Maha Vidyalaya (KMV), Punjab's only Anveshika Centre under the NANI initiative. Over 500 students participated in hands-on experiments, gaining a deeper understanding of physics through live demonstrations. The event also featured the LEPTON quiz and a talk on quantum networks. KMV Principal Dr. Atima Sharma Dwivedi praised the workshop for promoting scientific thinking and interactive learning.

Celebration of Science Day at Kanya Maha Vidyalaya, Jalandhar

The Faculty of Sciences in collaboration with the Punjab Academy of Sciences, organized a vibrant National Science Day celebration to honor the legacy of Dr. C.V. Raman. The event aimed to spark curiosity and promote scientific thinking through interactive activities and expert lectures.Graced by Principal Prof. Atima Sharma Dwivedi and esteemed guests from Panjab University and the Punjab Academy of Sciences, the celebration featured engaging competitions and two thought-provoking lectures. Prof. A.S. Ahluwalia spoke on biodiversity conservation, while Prof. M.C. Sidhu shared fascinating insights into the hidden world of plants. The event successfully inspired students to explore science with creativity, curiosity, and a sense of purpose.

Mentoring Session on Inno-Physics Demonstrations at GGSSS, Nehru Garden

On January 20, 2025, Dr. Surbhi from the P.G. Department of Physics, conducted an engaging mentoring session on Inno-Physics Demonstrations at GGSSS, Nehru Garden, Jalandhar. Through live demonstrations such as Newton's Cradle and wave motion with a string, she explained core concepts like conservation of momentum, energy transfer, and properties of waves. The interactive session sparked curiosity among students, who actively participated and connected the experiments to real-life applications, making the learning experience both insightful and inspiring.

KMV Student Secures Prestigious International Travel Grant, Underscoring Institution's Legacy of Scientific Excellence

PG Department of Physics proudly announces that Haramanpreet Kaur, research scholar from the P.G. Department of Physics, has received a \$2,500 travel grant to present her work at the ACerS Glass and Optical Materials Division Meeting (GOMD 2025) in Vancouver, Canada. Her achievement highlights KMV's strong research culture and commitment to empowering women in science.

KMV Professors Shine at International Congress on Glasses (ICG 2025), Present Groundbreaking Research in Optics and Photonics

Highlighting KMV's commitment to scientific research and women's empowerment,Dr. Neetu Verma and Dr. Gopi Sharma, Associate Professors of Physics, were invited to present their research at the prestigious International Congress on Glasses (ICG 2025), organized by CSIR-CGCRI. Their work on optical materials received wide appreciation, reinforcing KMV's status as a leading institution promoting innovation and global collaboration in science.

Post-graduate Physics students of KMV visited USIC centre, Delhi University

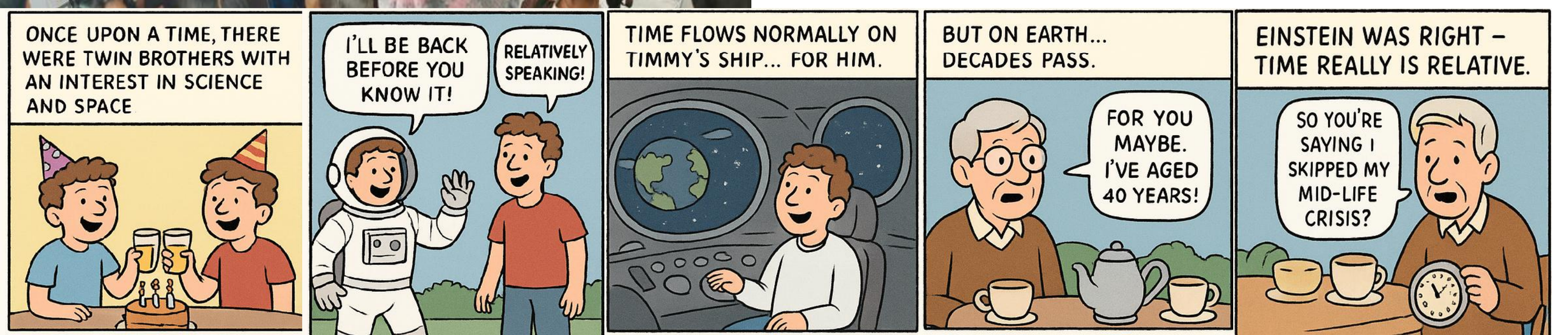
M.Sc (Physics) Semester-IV students, Nandita Thakur, Harmeet Kaur, Priya, and Simranjeet Kaur attended a two-day advanced instrumentation training at USIC, Delhi University. The program provided in-depth exposure to cutting-edge techniques like SEM, XRD, DSC, ICP-MS, TEM, NMR, and Dielectric Spectroscopy, bridging the gap between theory and practice in Material Science. Guided by leading experts, students gained valuable insights into scientific instrumentation, reaffirming KMV's dedication to empowering students through real-world learning experiences and research excellence.

Mentoring program to explore Innovative Experiments at KMV Innovation Hub

A group of enthusiastic students from Government Girls School, Bhogpur recently visited the Innovation Hub with the aim of fostering creativity, innovation, and entrepreneurial thinking. Guided by KMV faculty, the students explored hands-on projects and ongoing innovations in science and technology, gaining practical insights into real-world applications. The interactive sessions emphasized the importance of curiosity and problem-solving skills in today's world. The visit was well received, leaving students inspired and motivated, while the school's principal and teachers expressed heartfelt thanks to KMV for this enriching experience.

World Quantum Day celebrated with enthusiasm by PG Department of Physics,

Department of Physics observed World Quantum Day on 15 April 2025 under the National Quantum Mission. Nearly 100 science students participated in discussions and presentations highlighting the relevance of quantum mechanics in modern technology. Dr. Neetu Verma, Head, PG Department of Physics, inspired students to adopt research-oriented thinking, while Harmeet Kaur (M.Sc. IV Sem.) presented on Quantum Transport. B.Sc. students showcased projects on tunneling, cryptography, and lasers. Dr. Sangeeta Prasher spoke on electron spin. Principal Prof. Atima Sharma appreciated the initiative and encouraged students to explore opportunities in the quantum future.



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World Creativity and Innovation Day celebrated with enthusiasm by Department of Physics, Kanya Maha Vidyalaya Jalandhar

On April 21, 2025, the P.G. Department of Physics celebrated World Creativity and Innovation Day with great enthusiasm. The event was aimed at encouraging students to unleash their creativity and showcase innovative ideas through various scientific and technological projects. The celebration aligned with the institution's commitment to fostering creativity and innovation among students, as well as supporting the MIC (MHRD Innovation Cell) driven activities of the Institution's Innovation Council.

From Jalandhar to Tirupati: KMV Young Scientists Steals the Spotlight at Global Science Meet

Department of Physics, brought laurels to the institution at the "**International Conference on Science, Technology and Applications of Rare Earth Elements (ICSTAR-2025)"** held in Tirupati from April 21–23, 2025. Dr. Neetu Verma, Associate Professor in Physics, was invited as a Guest Speaker—one of the few women scientists honored at the event—while research scholar Ms. Anchal Pathania (BRNS Project) won the 3rd Best Oral Presentation Award. KMV was the only institution from North India represented at the prestigious conference, earning wide appreciation for its advanced research and commitment to empowering women in science.

NATIONAL TECHNOLOGY DAY CELEBRATIONS

National Technology Day was celebrated on May 15, 2025, with great enthusiasm to commemorate India's technological achievements and inspire budding scientists. Over 55 students participated in the event, which featured an insightful presentation by Dr. Neetu Verma, Head of the Department, on India's journey from traditional science to modern advancements in nuclear, space, and digital technologies. Live demonstrations of innovative physics experiments and a guided visit to the Departmental Innovation Hub further enriched the students' learning, sparking curiosity and motivating them toward research and innovation.

Fun Times with Physics

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wheel and axel
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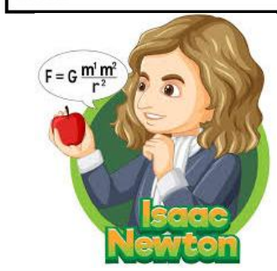

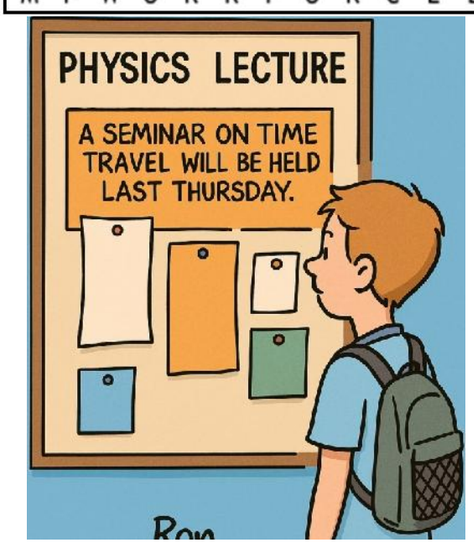

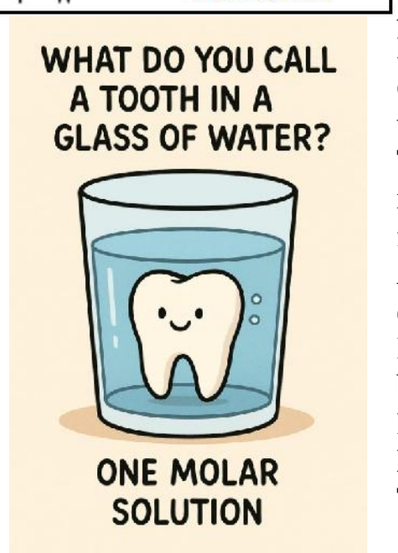

KMV Physics Students bag prestigious Internships at Borosil

Department of Physics, proudly announces that Simranjeet Kaur (M.Sc. Physics final year) and Gurleen Kaur (B.Sc. Non-Medical Sem IV) have secured a prestigious six-month paid internship at Borosil, Pune, starting June 15, 2025. Selected for the company's Research & Development Division, both students will receive a stipend of 20,000 per month while gaining hands-on experience in advanced glass research and technological innovations.

KMV's Kamaldeep Kaur Secures Prestigious Internship at Asahi India Glass Ltd., Bawal, Haryana

Department of Physics, proudly celebrates the achievement of Kamaldeep Kaur, B.Sc. Computer Science (2nd Year), who has secured a prestigious paid internship at Asahi India Glass Ltd. (AIS), Haryana, starting June 20, 2025. This opportunity will provide her with valuable hands-on industrial experience, bridging academics with real-world applications in technology and innovation.

Annual National Meet of Anveshika Coordinators 2025

Department of Physics KMV is proud to be the only Anveshika Centre in Punjab under the NANI initiative of IAPT, mentored by Prof. H.C. Verma. The Annual National Meet of Anveshika Coordinators 2025 was hosted by DBS Global University, Dehradun, from 18–21 June 2025. Dr. Neetu Verma, Associate Professor, KMV, represented Punjab at the convention where her contributions to physics education were appreciated. The meet featured workshops, recognition of eminent contributors, and discussions on MOOCs and electronic kits, reinforcing IAPT's mission to promote innovation in physics education.

Story time

The Particle's Journey

It began as a fluctuation.

In the seething heart of a star, buried beneath layers of crushing plasma, a proton shivered, collided, and transformed. Out of that violent fusion, a photon was born—a tiny particle of light, carrying energy, carrying memory.

The photon's journey began not with freedom, but with struggle. For a hundred thousand years it was trapped in the star's core, bouncing from proton to electron to nucleus, scattering endlessly like a prisoner in a maze. To the universe outside, a hundred millennia was eternity; to the photon, it was the blink of an eye.

Finally, through countless ricochets, it escaped the burning interior and burst into space, free at last.

For the first time, the photon raced unimpeded, its path unbent, its speed absolute. Unlike any other traveler, it knew no acceleration or fatigue. It simply *was*—a constant, a messenger of light.

The void of space stretched before it: black, cold, infinite. But the photon was not alone. Around it swirled the great dance of creation—nebulae glowing like cosmic flowers, galaxies wheeling in silent spirals, planets cloaked in storms.

The photon did not think as humans do, but it carried impressions. It had witnessed the boiling chaos of a stellar heart, felt the pull of gravity's endless hand, brushed the curved fabric of spacetime. Each encounter added to its story, etched into the quantum tremble of its being.

It crossed light-years, then centuries. Stars were born, lived, and died as it traveled. Civilizations rose and fell on worlds it never touched. It was a witness, silent and tireless, to the unfolding of time.

One day, its path curved near the edge of a great black hole. Space itself bent around the darkness, and the photon's journey was pulled into an arc. It skimmed the event horizon, so close that time stretched into infinity, then flung outward again, carrying with it the story of the void's hunger. To human eyes, if they ever caught it, it would be a faint whisper of gravity's song—*lensing*, they would call it.

The photon pressed on.

After billions of years, it neared a small, yellow star, surrounded by rocky worlds and gas giants. Around the third planet, something strange stirred. Unlike stars or dust, this world hummed with signals, with structures that bent the surface into patterns unseen elsewhere. The photon, indifferent but persistent, fell toward it.

It sliced through the blue atmosphere, scattering among molecules of nitrogen and oxygen. Its wavelength shifted in the air's embrace, painting the sky as azure to the creatures below.

And then—contact.

It struck the back of an eye, an organ evolved precisely to catch such messengers. The photon's ancient journey ended as a spark on a retina, a signal transmitted into the electric dance of neurons.

A child on a hill looked up at the night sky, wide-eyed. To her, the photon was simply starlight, twinkling and pure. She gasped in wonder, her imagination ignited by the faint shimmer carried across cosmic gulfs.

The photon was gone, absorbed, but its story was not lost. It lived on in the child's widening thoughts, in her curiosity, in the questions she whispered into the darkness.

"What's out there?" she asked. "Where did that light come from?"

The answer lay in the photon's journey, a tale that had stretched across the universe to end in her gaze.

And so, from the heart of a star to the eyes of a child, the particle's path was complete.

But its story was not unique. Trillions of photons streamed endlessly across the cosmos, each carrying its own memory of creation, destruction, and survival. Together they wove the tapestry of the universe, a living record written in light.

The child would grow, study, and perhaps one day learn to name them—photon, particle, wave, messenger. She would realize that the spark in her eyes was the very same light born in the furnaces of distant suns. She would dream of following them, of touching the places they had seen.

And perhaps, because of that single photon's journey, she would become a scientist, reaching deeper into the mystery of existence.

In that way, the photon's voyage never truly ended. It became thought. It became wonder. It became the first step of another journey—humanity's unending quest to understand the cosmos.

For what are we, if not the children of particles, woven from their energy, illuminated by their light, forever chasing the secrets they carry?

The photon's story is the universe's story. It is our story too.