KMVPHY-SPECTRUM

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A PHYSICS NEWS LINE

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"Energy is liberated matter, matter is energy waiting to happen." **- Bill Bryson**

Visionary Physicist

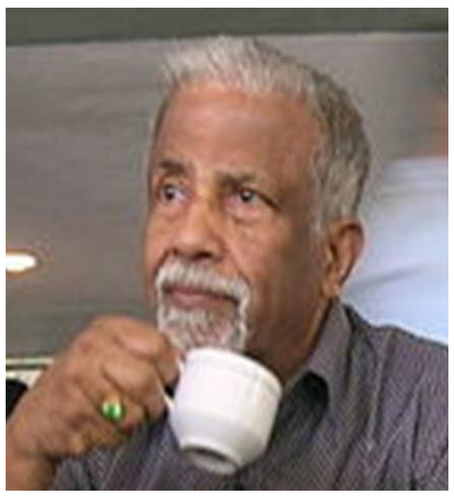
FIRST STREE SHAKTI SCIENCE SAMMAN AWARDEE: INDRANI BOSE

Indrani Bose born in Allahabad, U.P. and grew up in Calcutta, was fascinated by the subject of Physics from an early age. Her two elder brothers had excellent science teachers in school, who inculcated in them a sense of wonder about the natural world. The brothers after returning home from school would transmit their excitement to their younger sister by discussing animatedly Archimedes' principle, Newton's laws of motion, and law of gravity. Her uncle gifted her set of Feynman Lectures in Physics after she passed out from school, the tattered copies of which are still with her. Inculcated interest in Physics at home inspired her to complete her Ph. D. degree in Physics from the University of Calcutta in 1981.

After a stint of post-doctoral research at the Indian Association for the Cultivation of Science, Calcutta, Bose in 1987 obtained a faculty position in the Physics Department of Bose Institute, Calcutta, founded by Acharya Jagadish Chandra Bose. Post-retirement, she is currently a NASI Honorary Scientist at the Physics Department of Bose Institute.

Her areas of research included quantum many body systems, specifically, interacting spin systems and strongly correlated systems, quantum information theory and statistical mechanics. For the last several years her research focus has been on interdisciplinary physics, especially, biologically inspired physics. Approximate methods of study often fail to capture the reality, specially, if the interactions are strong. Bose developed a number of models of interacting spins and strong correlation for which some of the important physical properties could be determined exactly. The real excitement lay in the fact that experimental analogs of some of the toy models were later discovered. The Nobel Prize in Physics this year has been awarded to three physicists who carried out pioneering experiments demonstrating the existence of quantum entanglement and its application potential. Bose studied the entanglement properties of quantum spin systems extensively and showed how these properties change when the spin systems undergo quantum phase transitions, e.g., a jump in the magnitude of entanglement occurs at one such transition point. A spin-1/2 particle is a natural choice for a qubit, the fundamental unit of quantum information. She also showed how certain thermodynamic properties of molecular magnets can serve to detect the presence of entanglement in the spin clusters constituting the molecular magnets. She further determined some novel properties of a new type of quantum correlations called quantum discord. Bose has made significant research contributions in the areas of stochastic gene expression (a central activity in the living cell, in the final stage of which proteins are synthesized), bacterial strategies for survival under adverse circumstances involving a collaboration with two experimental biologists in Bose Institute, the role of fluctuations in key protein levels in cellular decision making processes, the early signatures of sudden regime shifts, e.g., in the transition from a normal to a cancerous cell, phase transitions and critical phenomena in living systems and the dynamics and function of motifs (substructures) which appear frequently in experimentally determined biological networks. Her theoretical studies have strong links to eperimental observations. In recognition of her scientific research, Bose has been elected to the Fellowship of the Indian Academy of Sciences, Bangalore, the National Academy of Sciences, Allahabad and the West Bengal Academy of Science and Technology. She was the first recipient, in 2000, of the Stree Shakti Science Samman Award. She is awarded for her exact solutions of model Hamiltonians in low dimensions, relevant to magnetism in Condensed Matter Physics. Her models and their solutions have not only mathematical rigour, but in recent years these models and their solutions have become important in view of their impact on the experimental community. Due to advancement of technology, it has become possible to reach an extremely low temperature to verify the predictions of the theory for low dimensional materials. Professor Bose got all her scientific training while working in Calcutta only, and she achieved both national and international recognition in rather difficult circumstances. She has single-handedly developed a strong solid-state theory group in the Bose Institute, devoted to the study of magnetism, strongly correlated systems and exactly soluble quantum models. She is a Fellow of the Indian Academy of Science, Bangalore. She is truly remarkable professional woman with a strong commitment for excellence in research, at both personal and at the institutional level. Her exuberant enthusiasm, abiding interest and leadership in the sustenance and growth of research in Calcutta and inspiring and training young physicists, make her an excellent role model for the younger generation. Her greatest reward, however, lies in the joy and satisfaction derived from a lifetime spent in physics research.

E. C. GEORGE SUDARSHAN: NINE TIMES NOBEL PRIZE NOMINATED PHYSICIST



Ennackal Chandy George Sudarshan is widely regarded as the most gifted theoretical physicist of Indian origin in the latter half of the 20th century. who did pioneering work in a variety of areas like elementary particle physics, quantum field theory, and quantum optics, between 1950s and 1970s, died on May 14 in Texas, the United States, where he was a professor since 1969. He was the one who challenged Albert Einstein's theory that nothing with mass can travel faster than light proposing the existence of the hypothetical particle called tachyon, which he purported could move faster than light. It was eventually proven that such a particle could not exist in reality as it would defy the laws of physics.

However, the term is still used today as a placeholder for an imaginary particle with a quantum field and plays a crucial role in theoretical physics. Dr. Sudarshan also proposed the paradox known as Quantum Zeno Effect — the more frequently we measure a system, the less it changes. His work had tremendous impact in several areas, though unfortunately he did not receive proper credit for all his achievements. He was initially asked to do experimental work in particle physics, using the photographic emulsion technique. In this phase he worked closely with Sukumar Biswas (1924–2009) and Ranjit Roy Daniel (1923–2005), as well as with Bernard Peters (1910–1993), all well-known cosmic-ray physicists. Later he was able to turn to theoretical work, developing his true interests and strengths. These years brought him close to two other senior physicists at TIFR – the condensed matter theorist Kundan Singh Singwi (1919–1990), and the experimental nuclear physicist Raja Ramanna (1925–2004).

"He was a scintillating person filled with ideas," Mukunda says of his former doctoral advisor. Born in Kerala, Sudarshan was famously influenced to become a physicist when he found his older brother's high school textbook at home. After reading the book end to end, he stumbled upon the sentence "the derivation of the formula for the period of a simple pendulum was beyond the scope of the book". Young Sudarshan set out to hunt for a book that actually would show the derivation of the formula, and found a life-long love in the process. He studied at CMS College in his hometown before attending the University of Madras and later the Tata Institute of Fundamental Research. He later studied and taught at the University of Rochester and then at the University of Texas at Austin, where he taught for over 40 years. At Harvard he did a well-known piece of work with K. Johnson, a student of Schwinger, on inconsistencies in higher spin field theories in external fields. Dr. Sudarshan set up the Centre for Theoretical Studies at the IISc in Bangalore in 1972. The weak interaction in elementary particles based on research that Sudarshan did in 1957 is one of his two contributions that Mukunda believes are most important. "Sudarshan and Robert Marshak made crucial step in this long story lasting from 1934 to 1967-68, when a final understanding on the question emerged," Mukunda said. In 1979, three scientists who brought the line of development to its conclusion were awarded the Nobel: Sheldon Lee Glashow, Abdus Salam and Steven Weinberg. It was in 1961 that his fundamental work with P. M. Mathews and J. Rau titled 'Stochastic dynamics of quantum mechanical systems' appeared. This was in a sense far ahead of the times, heralding the quantum theory of open systems which is today at the base of quantum information theory. His later work in quantum optics done around 1963 was another notable contribution seminal in many ways. It became the basis for the Glauber–Sudarshan representation. However, only Roy J. Glauber was awarded the Nobel in 2005 "for his contribution to the quantum theory of optical coherence." This was perhaps Sudarshan's greatest legacy: He was a living example of the Nobel committee's openly flawed bias towards European and American male scientists. Following Glauber's win, several physicists had written to the committee in criticism, noting that the bulk of the work on it had been done by Sudarshan and merely co-opted by Glauber. In 2007, speaking to the Hindustan Times, Dr. Sudarshan said: "The 2005 Nobel Prize for Physics was awarded for my work, but I wasn't the one to get it. Each one of the discoveries that this Nobel was given for work based on my research." He was honoured with several other prestigious awards like ICTP Dirac Medal, Padma Vibhushan (2007), Padma Bhushan, Majorana Prize, TWAS Prize, Bose Award (1977) and C V Raman Award (1970). He had been nominated for the Nobel Prize nine times. The disappointment over the Nobel didn't dim the eminent physicist's sense of humour.

Science News Section

The future of 3D display and the emergence of holographic television

The pioneers of holography predicted that the ultimate 3D display will be based on it, because it the only approach that can render all optical cues interpreted by the human visual system. In a new review paper published in Light: Science & Application, Prof. Blanche from the University of Arizona is reviewing the recent accomplishments made in the field of holographic 3D display; specifically, computer-generated holograms approach real-time processing. Holography is still considered as the ultimate technology that will enable rendering of all the optical cues needed for the human visual system to see projected images in 3D. All other technologies, such as (auto) stereoscopy, light-field, or volumetric displays suffer from trade-offs that limit 3D rendering. Nonetheless, these technologies will likely prove to be stepping stones leading to better visual comfort until holographic displays are achieved. However, some challenges remain to be solved. The two main obstacles at the time this manuscript was written are the computation of photorealistic 3D holograms in a reasonable amount of time, and a suitable electronic device for the reproduction of large holographic 3D images with high resolution.

Research team creates the world's lightest isotope of magnesium to date

In collaboration with an international team of researchers, Michigan State University (MSU) has helped create the world's lightest version—or isotope—of magnesium to date. Forged at the National Superconducting Cyclotron Laboratory at MSU, or NSCL, this isotope is so unstable that it falls apart before scientists can measure it directly. Yet this isotope that isn't keen on existing can help researchers better understand how the atoms that define our existence are made. Led by researchers from Peking University in China, the team included scientists from Washington University in St. Louis, MSU, and other institutions. The new isotope will help refine the theories and models scientists which can help them to understand the questions like "where do the universe's elements come from" and How are these elements made?. The new magnesium isotope, however, is far too unstable to be found in nature. But by using particle accelerators to make increasingly exotic isotopes like this one, scientists can push the limits of models that help explain how all nuclei are built and stay together. This, in turn, helps predict what happens in extreme cosmic environments that we may never be able to directly mimic on or measure from Earth.

The mystery of the small dimensionless number with a big effect

Non-dimensional numbers may sound like a scary, incomprehensible term reserved for scientists in a laboratory, but you have more experience with them than you know. Two competing effects determine the vertical motion and concentration of particles in this region—gravity pulling them down to the ground and turbulent air that generates drag forces that can lift them up. Researchers often quantify these competing effects by a non-dimensional settling number, Sv, which is the ratio between how fast the particles settle in the absence of turbulence and the characteristic speed of the turbulent air flow near the surface. The conventional wisdom is that when Sv is very large, the effects of turbulent winds on the particle motion can be ignored, while when Sv is very small, the effects of gravitational settling can be ignored. Studies have shown that in some cases, the use of non-dimensional numbers to quantify the importance of a particular effect in a system can be very misleading, and great care is required.

Maybe 'boson clouds' could explain dark matter

The scientists argue that dark matter could be made of particles known as scalar bosons with a spin of 0 and are perfectly happy occupying the same state. So if they are supercooled a bunch of bosons (such as helium-4) can settle into a strange quantum object known as a Bose-Einstein condensate. The only known scalar boson is the Higgs boson. The Higgs can't be dark matter given its known properties, but some theories propose other scalar bosons. These would not interact strongly with light, only with gravity. Since light can't significantly heat them up, over time, these scalar bosons would cool and collapse into large clouds. So perhaps dark matter is made of large, diffuse clouds of scalar bosons. Since, scalar bosons interact gravitationally, they also interact with gravitational waves. Depending on their mass, scalar bosons might also decay by emitting gravitons. As a result, scalar bosons could create long-lasting gravitational waves that have a similar frequency. It's the gravitational equivalent of a faint hum. So the team looked at gravitational wave data from LIGO and Virgo.

Solution to Puzzle: 25F =-3C Implying ice, so coin will not touch the bottom

Science Crossword Puzzles Across: 2. Isolated 7. Boundary 9. Two 12. Open 13. one 15. Kilogram 16. Equilibrium

Down: 1. Surroundings 3. Thermodynamic 4. Gauge pressure 5. Independent 6. Statistical 8. Meter 11. Cyclic 14. Classical

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Mentoring Session on converting a prototype into a startup

Department is constantly working in the directions of imparting science education through innovative teaching methodologies. One of the innovative methodologies is to organize special mentoring sessions on Sep 9, 2021 for students with innovative minds. The Department arranged an advanced training session to design Innovative projects and organized a trip to Innovation Hub of Pushpa Gujral Science City, Kapurthala. Under the able guidance of Er. Vishal Sharma, Scientist cum Chief Mentor of Innovation Hub, Pushpa Gujral Science City, Kapurthala KMViets have developed an automatic machine of hand sanitizer, touch less switches and also constructed a project on stagnant waste water problem. In the on-going time of pandemic, students have realized the need of frequent sanitization. With this objective students have developed an toughness hand sanitizing machine which will be installed in the entrance of their class rooms. Further a prototype of touchless switches has been developed with an objective that students while entering or leaving the class room can turn lights and fans ON/OFF without even touching switches and can get themselves sanitized too. Also during rainy season cities faces waste water stagnation problem, which leads to several accidents. Keeping this in mind, students have developed an automatic sensor system which will work on three different modes depending on level of stagnated water..

Problem Solving and Ideation Workshop

Department of Physics organized a Problem Solving and Ideation Workshop on 20th Nov, 2021 for science students with an objective to develop creativity and skill amongst students to implement the scientific ideas of Basic Physics slowly but surely in their everyday life. Some experiments like circular pendulum, anharmonic oscillator, Transmission line, Black hole, Air cannon, Doppler Effect, rotational Motion, Motion in inclined plane, energy transfer in spring etc., were demonstrated to the students to make it easier for them to understand the concepts in a practical way. They were given left unattended in the hub to explore the instruments and setups.

Extension lecture on talk "Quarks to Quasars"

An extension lecture on "From Quarks to Quasars" was delivered by Dr. Rajesh on 25th November, 2021 entitled to the PG and UG science students. He started with connection between a microscopic particle quark and macroscopic entity star. During his lecture Dr. Rajesh discussed Big Bang theory, the evolution of the Universe, the life journey of a star and the stages it has to go through. He concluded his talk by explaining the students about the connection of human life with stars, where the fundamental blocks (the elements) for life were formed. The lecture ends with the answers to the queries of students as well as faculty members.

Student-Student Mentoring Workshop- "ANUBHOOTI-2021"

Anubhuti is an annual event organised by the PG department of Physics and was celebrated on Dec 1, 2021 this year. Under this program undergraduate science students were given a platform to present their concept based innovative experiments and projects that they have designed under DBT star college scheme. This year the projects showcased in the event were air cooler, Laser show, matchbox microphone, Rocket water bottle, touchless hand sanitizing machine, a prototype of touchless switches and touchless attendance system, etc. Students also showcased Bluetooth Controlled Car to be operated by mobile phone. The workshop exposed the creativity amongst the students and developed a scientific spirit.

Innovative Idea got selected in INNOVESTA -2021

Recently six students of department have participated in INNOVESTA- 2021 organised by Dr. B.R Ambedkar National Institute of Technology in the online mode. Young innovators from different countries like France, Austria, South Korea, Utah, Bangladesh, Nepal and India participated in the event. KMV Students have developed touchless hand sanitizing machine which will be installed in the entrance of their class rooms. Further a prototype of touchless switches and touchless attendance system has been developed with an objective that students while entering or leaving the class room can turn lights and fans ON/OFF without even touching switches and can get themselves sanitized too. Cash prize of Rs. 1000/- was awarded to our students.

Social Outreach Program on Popularizing Science among school Students

P.G. Department of Physics organized a Social Outreach Program on "Popularizing Science among school students" to inculcate scientific temperament among General people in the month of December at Government Sec. School, Nurpur and Government Sen. Sec. School, Nurpur. Faculty of P.G. Department of Physics has developed some unique and innovative techniques, such as setups for longitudinal and transverse waves, magnetic lines, Lenz law, different types of mirrors etc to make the students understand science involved in our daily life easily.

These techniques not only make sciences an interesting subject but also inspire students to opt research as their career. Students learnt difference between sound and light waves and observed the behaviour of waves while propagating through different mediums. KMV's Mentors Program "Popularizing Sciences among School Students" has proved to be a great success as students have learnt basic concepts of sciences with the fun activities.

Orientation Session for students of P.G. Department of Physics

Orientation session was organized on 27th sept,2021 to introducethe students with the faculty and infrastructure available in the Physics Department for overall development and career building of our students. The students were benighted about the establishment year of the department and the programmes offered and were enlightened that it is the only college under GNDU whose faculty is guiding students for their Ph.D in collaboration with various institutions. Department of Physics is FIST Supported by Department of Science & Technology and first women college offering M.sc. physics under GNDU. Overall the session proved to be interesting and successful in creating awareness about P.G. Department of Physics among its students.

An event was organized to Know your Alumina

To motivate and encourage students to opt for research as career, Physics department has organized Know your alumina on Oct 1, 2021 and approximately 50 undergraduate and post graduate students participated in the event. The alumni shared their experiences regarding the department and their learning strategies with students. They also encouraged the students to opt research as their career. Students felt aroused by listening to their seniors success stories. Overall the session proved to be interesting and successful in creating awareness.

Innovation Day Celebrations: Birth Anniversary of Dr. APJ Abdul Kalam

To remember noble contribution of our former president Dr. Kalam, in the field of Sciences Department organized Innovation Day Celebrations. These celebrations include two online quiz titled Physics Bowl and Innovation Day- Celebrating Birth Anniversary of Dr. APJ Abdul Kalam, in which more than 400 students as well as faculty members participated from the entire nation. Main objective behind organizing this activity was to remember Dr. APJ Abdul Kalam, a great scientist, people's President, and a phenomenal teacher. He has been the driving force behind many cutting-edge technologies in India, from satellites to local healthcare, from missiles to nuclear tests. Etc. Principal Prof. (Dr.) Atima Sharma Dwivedi congratulated and appreciated the department for organizing such events.

KMV Physics Students participated in Physics Quiz organized by Kanoria P.G. Mahila Maha Vidyalya, Jaipur

An intercollege online quiz in the subject of Physics was organized by Kanoria P.G. Mahila Maha Vidyalya, Jaipur on Oct 15, 2021 to provide an opportunity to the students to test their knowledge and engage in a friendly competition. Haramanpreet (B.Sc Physics Non. Medical Sem 5), Lavleen (B.Sc Non Medical Sem 5), Barjinder (B.Sc Non Medical Sem 5), and Manjusha (B.Sc Physics (Hons.) Sem 1) from our department eagerly participated in the event and one of the student won 7th rank in this quiz. They exhibited exceptional dedication and preparation to participate in the event, showcasing their commitment to academic excellence. Principal Prof. (Dr.) Atima Sharma Dwivedi extend heart felt congratulations to the students for their impressive performance and commendable efforts.She also appreciated the faculty of the P.G. Department of Physics for encouraging the students to participate in such national and Inter-national events.

Story time

Travel at a speed of Light

In the bustling city of New York, there lived a young brilliant physics student named Alex. He had always been fascinated by the mysteries of the universe, constantly seeking to uncover its hidden secrets. His room was adorned with posters of galaxies, planets and equations and models that ignited his imagination. With a mind brimming with ideas, he aspired to become a renowned scientist. One day, while attending Glenville University, Alex stumbled upon an idea that seemed both outrageous and groundbreaking: a machine capable of traveling faster than light.

With unwavering determination, Alex spent countless hours in the university's library, poring over complex theories, formulas, and scientific papers. Combining the knowledge gained from textbooks and the musings of great minds, Alex sketched out the design of a revolutionary device that could potentially unlock the secrets of interstellar travel. Weeks turned into months, and months into years and Alex's sketches and notes grew in complexity. The design began to take shape on paper, revealing a machine fueled by the manipulation of space-time itself. With each passing day, Alex's excitement grew, but so did the weight of responsibility. The discovery of such technology could change the course of human civilization, opening up new possibilities for exploration and understanding. One summer day, Alex had the important presentation at his lab and this presentation could be his ticket to success. He had carefully prepared his notes, sketches, and calculations, and he was determined to ace the presentation. But fate had other plans. As Alex left his house to make his way to the lab, he felt a sudden gust of wind. The papers in his hand were swept away, fluttering helplessly in the air. He chased after them, but it was too late. The papers were gone, lost in the chaos of the bustling city streets. Panicked, Alex rushed to save the important files containing the meticulously crafted design in his desktop. But alas, the computer had crashed, and the files were lost. Heartbroken and devastated, Alex desperately tried to recover the data, seeking help from tech-savvy friends and experts. But the damage was irreparable. The notes, the sketches, the blueprint of Alex's groundbreaking invention had vanished into the digital abyss. Days turned into weeks, and Alex's dream of unveiling a revolutionary technology seemed like a distant memory. Doubts crept into Alex's mind, questioning whether recreating the lost design was even possible. Despite the setback, the passion for unraveling the mysteries of the universe burned within. Determined to not let adversity dampen his spirit, Alex decided to start anew. Armed with the knowledge etched in their mind, Alex began to recreate the machine's design from scratch. Every evening, he would sit in the university's lab, tirelessly sketching, calculating, and running simulations. He spent every waking hour redoing his calculations, reproducing his notes, and sketching out his ideas and he became known as the young prodigy who refused to let adversity hinder his scientific pursuit.

Months passed, and as the design slowly took shape once again, Alex couldn't help but marvel at the resilience of the human spirit. The setbacks, the lost notes, and the countless hours of toil had only strengthened their resolve. Alex had not only recreated the original design but also made several improvements along the way. Finally, the day arrived when Alex stood before a sleek, metallic contraption, their masterpiece and the product of unwavering determination. The machine was a testament to Alex's perseverance and the unrelenting pursuit of knowledge. It had the potential to rewrite the laws of physics and revolutionize space travel as we know it. As the world marveled at Alex's incredible creation, the story of the lost notes became a symbol of human resilience and the indomitable spirit of scientific discovery. Alex's journey reminded everyone that setbacks and failures are an integral part of the path to success. It reminded the world that true knowledge resides within the minds and hearts of passionate individuals, and no setback, no matter how devastating, can extinguish the fire of determination.