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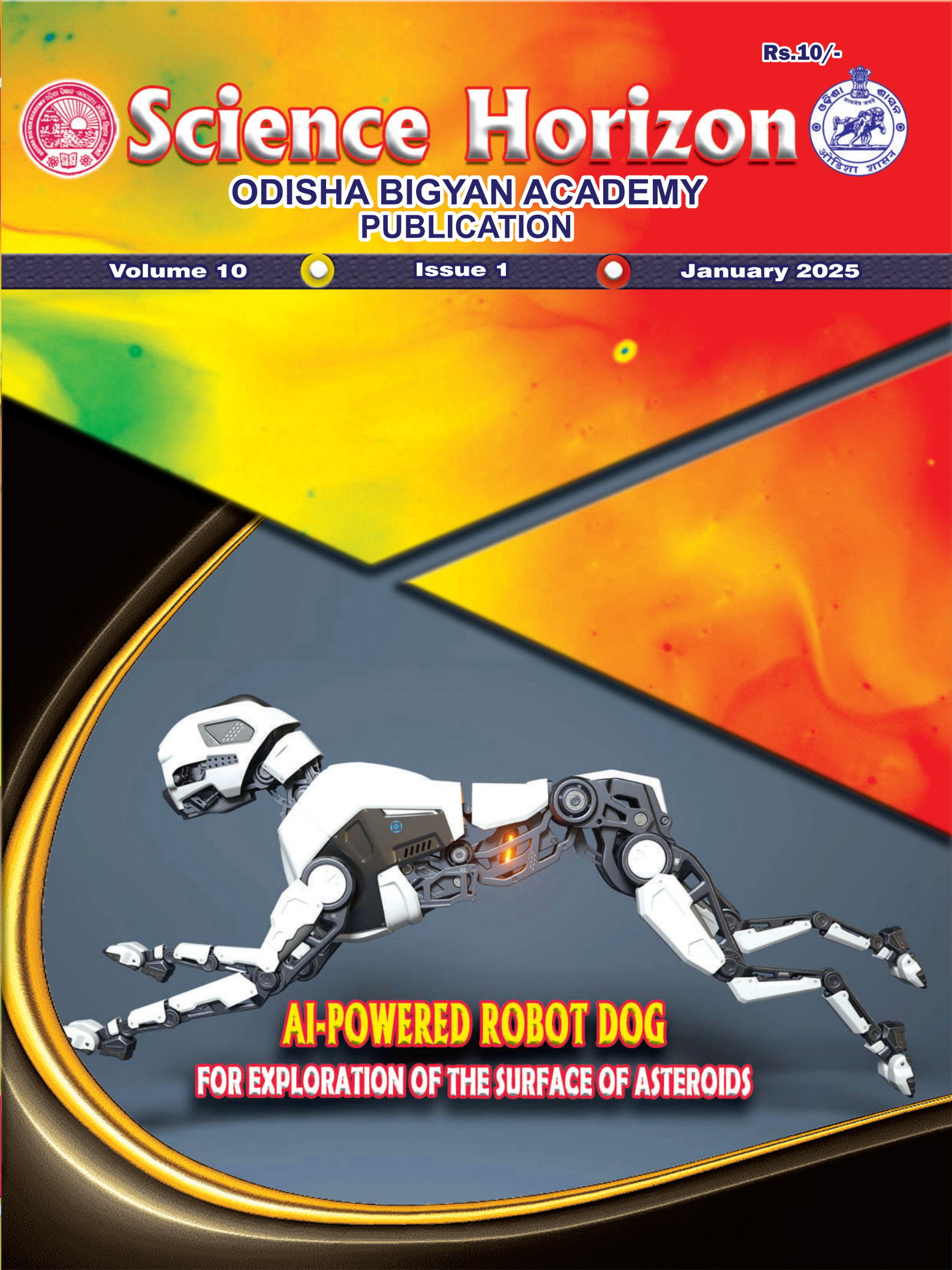

AI-POWERED ROBOT DOG

FOR EXPLORATION OF THE SURFACE OF ASTEROIDS

Using the James Webb Space Telescope (JWST), astronomers have discovered a fourth world in a strange system of ultralight "super puff" planets. The new extrasolar planet or "exoplanet" was discovered around the sun-like star Kepler-51, located around 2,615 light-years away in the constellation of Cygnus (the Swan). Remarkably, the new world, designated Kepler-51e, isn't just the fourth exoplanet found orbiting this star; all these other worlds are cotton-candy-like planets. That means this could be a whole system of some of the lightest planets ever discovered.

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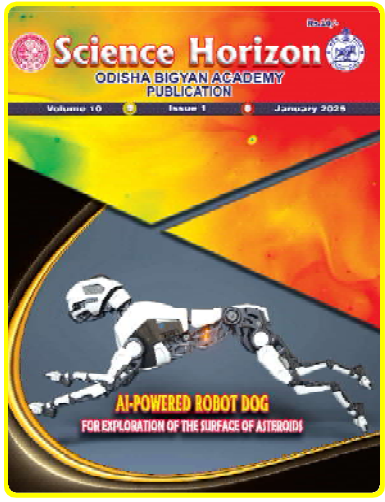

EDITORIAL BOARD

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CONTENTS

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Editorial

1 SCIENCE AND TECHNOLOGY IN 2024

We have passed 2024 and have entered into the New Year 2025. Let us have a look at some of the outstanding development in science and technology last year. Although research in science is a continuous process, the result we get from it is the desired one for us.

China's Chang'e-6 mission was launched to the Moon on 3 May and its 3200 kg- lander spent two days drilling and scooping material on the lunar surface before sending the samples to Earth. This is the first time we received soil samples from the far side of the Moon. The rocks and dust were collected from the deepest part of the South Pole – Aitken Basin, which is assumed to be the largest and oldest impact crater on the Moon. It is expected that lot of unknown data on the Moon can be known by analysing the samples. Preliminary investigation has revealed that the lunar far side was volcanically active as recently as 2.8 billion years ago.

From 1930s, it is known that the universe is expanding and in the last decade of the last century it was known that it is expanding more rapidly than previously calculated. But the exact expansion rate, known as Hubble Constant is not known. It is the cosmological parameter that sets the absolute scale, size and age of universe. University of Chicago scientists led by Prof. Wendy Freedman have made a new measurement of Hubble Constant. The new value is 69.8 km s^{-1} Mpc^{-1}. Earlier there were two values such as 67.0 and 72.0 calculated in two different methods. Freedman and her team calculated it using a kind of star known as a red giant and they used NASA's Hubble Space Telescope data for this.

Remi Lam, a researcher at the Google DeepMind, London has developed a method for accurate weather prediction using Artificial Intelligence (AI). The AI forecasts are by many measures better than the conventional ones. It takes just light minutes to produce a group of 15-day forecasts that are more accurate that the conventional ones.

Ekkehard Peik and his colleague Chirstian Tamm have built world's first nuclear clock. This clock relies on the energy transitions of electrons that orbit an atomic nucleus. It is so accurate that it gains or losses only a second every 40 billion years. Peik and Tamm are the physicists working at Germany's

National Metrology Institute in Braunschweig.

Scientists have found a way to transform giant panda skin cells into stem cells. The stem cells can then be nudged into becoming any kind of cell in the body and could help researchers breed more giant pandas (*Ailuropoda melanoleuca*) and develop treatments for their diseases. Although giant pandas are no longer considered endangered, they are still a vulnerable species.

Scientists have discovered a cause of lupus and a possible way to reverse it. Lupus is a disease that occurs when body's immune system attacks its own tissues and organs (autoimmune disease). Inflammation caused by lupus can affect many different body systems including joints, skin, kidneys, blood cells, brain, heart and lungs. People with lupus have too much of a particular T cell associated with damage in healthy cells and too little of another T cell associated with repair. A protein called interferon is mainly to blame for the T-cell imbalance. Scientists have developed a drug called anifrolumab, that blocks interferon, and thus prevent the T-cell imbalance.

Menstrual blood can potentially be used to measure blood sugar. In early 2024, the U.S. Food and Drug Administration approved a new diagnostic menstrual pad called the Q-pad and A1C Test by the biotechnology research company Qvin. The Q-pad is an organic cotton pad that collects the blood and then it is analysed in a laboratory to find the individual's average blood sugar level over three weeks through the A1C biomarker.

Scientists have been able to impregnate a southern white rhino using in-vitrofertilization (IVF). Researchers in Kenya implanted a southern white rhino embryo into another of the same species using the technique resulting in a successful pregnancy. The technique can be used to save the northern white rhino from total extinction. There are two species of white rhinos: northern and southern. The northern white rhino is on the verge of extinction due to poaching with only two females remaining. Luckily, scientists have sperm preserved from the last male rhino, which could be combined with an egg from the female and implanted into a southern white rhino female to act as a surrogate.

Scientists have discovered six exoplanets that revolve around a star in a rare pattern called orbital resonance. The star similar to the Sun named HD110067 is located about 100 light years from Earth. The planets, larger than Earth but smaller than Neptune, revolve around the star in a celestial distance known as orbital resonance. This means that for every six orbits completed by planet b, the closest planet to the star, planet c makes three, planet d does two, planet e completes four, planet d does three and the outermost planet g completes one.

I wish all the authors and readers of Science Horizon a very happy and prosperous New Year 2025.

Er. Mayadhar Swain
Editor

2

STORY OF THE ELECTRON (PART-13)

[1]Balaram Sahoo
[2]Prafulla Kumar Pujapanda

Schrodinger's wave equation became the cynosure of physicists. Pauli could see the relative ease, the wave equation allowed to solve the problem of hydrogen. Wave mechanics according to Born was 'the deepest form of quantum laws.

The two theories were different in their mathematical formalism. Heisenberg's matrix mechanics was based on the particle nature, observed phenomena and discontinuity. Schrodinger employed wave equation, non-observable phenomena and continuity. Both gave exactly same answers.

Heisenberg was however not pleased. His brilliant intelligence could immediately see the infirmity of Schrodinger's theory. The wave gradually spreads over space and ultimately diffuses; but the particle remains as it is clearly packed and impact. When an electron is released from its nucleus, according to Schrodinger the wave function psi (ψ) spreads out through space. But when the electron reveals itself by a detector such as a TV screen it appears as a point. Now attention was turned from mathematical forms of the two theories to physically meaningful interpretations.

Schrödinger never believed in the particle nature of the electron. According to him there were no quantum jumps. There is only one continuous transition from one standing wave to another. Emission of radiation was due to some resonance phenomena.

Werner Heisenberg

Schrödinger proposed that the wave function of an election was like a cloud like distribution. Electric charge travels through space. The wave function cannot be directly measured since its mathematics may be a complex number. But the p^2 has a real meaning $|p(x,t)|^2$, the smeared out density of electric charge in space at a time t. Schrodinger introduced the concept of wave packet. The development of wave packet was to interpret

quantum wave solution as locally compact wave groups. Such packets show position of localization for spreading momentum. The narrower wave packet shows a better localized position of the wave packet (Fig.1). He argued that the electron only appeared to be a particle-like but not a particle, despite overwhelming evidence in its favor like photoelectric effect. None of these phenomena could be explained without discontinuity and quantum jumps. In spite of these Schrödinger believed that particle like electron was an illusion.

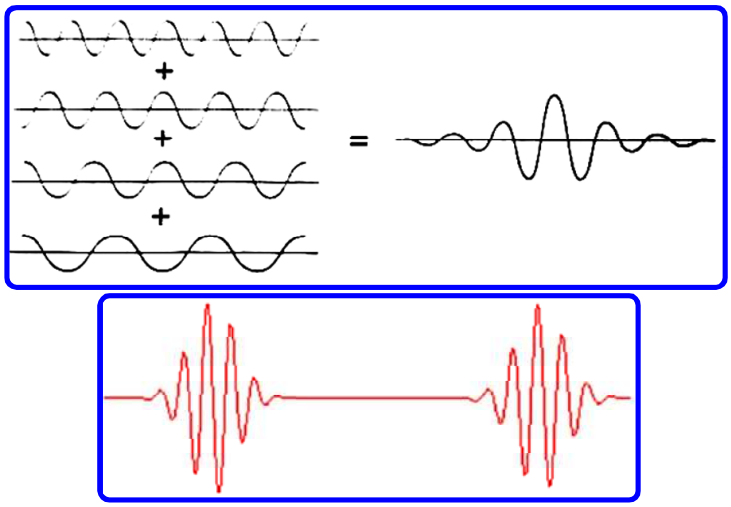

Figure 1: A wave packet formed from the superposition of a group of waves

Born was of the view that the square of the wave function was real. It does not give the actual position of an electron, only its probability. For example, if the value of the wave function at x is two times its value at y then the probability of the electron being at x is four times than that at y.

Bohr had a different interpretation. He argued that the micro-physical object like an electron does not exist until an observation is being made. When an observation is being made the wave function collapses. The probability of all other possibilities vanishes or becomes zero.

The fame of Schrodinger grew like a wild fire as soon as his paper on wave mechanics appeared. He was invited to present his work in person by various institutions. Arnold Sommerfeld and Wilhelm Wien of Munich invited Schrodinger to deliver a talk at the fortnightly seminar of physicists on 21st July which he readily accepted. Heisenberg was at the time working at Copenhagen and came to Munich to hear Schrödinger.

The title of the talk was "New results of wave mechanics." Question answer session began soon after Schrodinger concluded his talk. Heisenberg's patience had already been exhausted; he stood up and forcefully pointed out that Schrödinger's theory did not explain Planck's radiation law, Franck-Hertz experiment, the Compton Effect and photoelectric effect. He further emphasized that none of these phenomena could be understood without accepting discontinuity and quantum jump. Before Schrodinger could explain, Wien intervened and said "in due course of time Schrodinger will take into account of these factors." Embarrassed Heisenberg, as if thrown out of window wrote to Bohr outlining the details of the proceedings of the event. Bohr lost no time in inviting Schrodinger to Copenhagen to present his version of wave mechanics and participate in discussion.

Schrödinger arrived at Copenhagen on 1st of October 1926. Bohr was at the station to

receive him. It was the first time that they met. After exchange of pleasantries discussion on quantum mechanics began in right earnest. Each presented his own physical picture on quantum atom. Schrodinger could not accept the quantum jump. Bohr countered that one can never deny it since it was an observable phenomena and was the pillars of the beginning of quantum theory. Schrodinger did not believe that there was a complete break with classical reality, where as Bohr believed that there was no point going back to electron orbits and continuous path in the realm of atomic physics.

Schrodinger was accommodated in the guest room adjacent to Bohr's residence so as to maximize the use of time. Emotions running high for each one's perception and conviction relating to physical interpretation of quantum physics, but both agreed there was still much to be done to fully explain quantum mechanics. In spite of all ordeal and unpleasant expressions during the intellectual discussion of quantum atom the personal relations among them remained kind, nice, amiable, cordial and memorable.

Without reaching any meeting point on physical interpretation, either matrix or Wave, Schrodinger returned to Zurich and in the second half of December, 1926 left for USA to give a series of lectures on wave mechanics at the University of Wisconsin. He returned to Zurich in April. For his fundamental contribution to wave mechanics he was awarded with the position of professorship at the Berlin University as successor to Max Plank. Berlin was the temple of physics. There he met for the first time Einstein who was looking worried over the probabilistic interpretation of quantum atom.

Einstein was the first in 1916 to suggest the concept of probability to explain spontaneous emission of radiation as electron jumps from one orbit to another. Born took the concept seriously to explain the probability interpretation of wave mechanics.

Einstein now disapproved the concept of probabilistic nature in finding the electron. If the concept on probability is accepted he has to pay a price for it. The theory of relativity was built on causality and determinism. Causality is the principle that an effect has a cause. Determinism is that effect must follow from that cause. Einstein would not give up causality and determinism. He wrote to Born "Quantum Mechanics is certainly imposing but an inner voice calls me that it is not yet the real thing." To express his disapproval on the probabilistic view of Born, he expressed his most famous quotation "He does not play dice". 'He' means here God.

"God does not play dice" inspired Heisenberg to achieve one of the greatest and fundamental idea in the history of quantum theory 'The Uncertainty Principle'.

To Continue….

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3

THE MAN WHO COUNTED LIGHT

Dr. Bijay Kumar Parida

Counting Light

Counting light! What do you mean and how do you count light? A beam of light is like a stream of water, starting from somewhere and going somewhere. What do we mean by counting water? The question seems to have no answer for a stream of water but is meaningful if you consider the molecular structure of water, because molecules being discrete particles can in principle be counted. Similarly, if we imagine a beam of light to be constituted of particles, then it should be possible to count the number of those particles. Indeed, it has been established that light is associated with particles called photons (see the box). However, since the number of photons is usually huge [for example, a green light (500 nm)-producing 10-watt electric bulb emits around 2.5 x 10^{19} photons per second] and they come with a distribution of energy, statistical tools are used to count them as a function of energy. Such a statistical tool was developed by the Indian physicist S. N. Bose for light using the principle of quantum mechanics in 1924. The tool became known as quantum statistics in general and Bose statistics or Bose-Einstein statistics in particular. He is therefore in a popular language said to be the person who 'counted light'. Moreover, a class of elementary particles were found to follow Bose statistics and are called 'bosons'. It is this story that we want to present here briefly in commemoration of the centennial year of Bose statistics.

S. N. Bose adopted the quantum or photon form of light to develop his statistical calculations. Before elaborating on the statistics invented by him, let us take a quick look at his life and work.

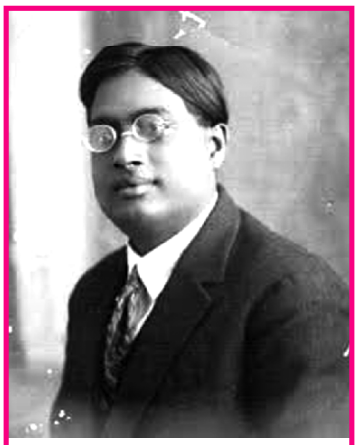
Bose in Brief

Well-known as S. N. Bose the world over, his full name was Satyendra Nath Bose. He was born on 1 January 1894 in Calcutta (present day Kolkata). He was a brilliant student standing first at the Intermediate, B.Sc. and M.Sc. examinations of Calcutta University (Presidency College). Interestingly, the second position at the B.Sc. and M.Sc.examinations was bagged by Meghanad Saha (1893-1956) who became another great physicist and Bose's collaborator, colleague, and lifelong friend. Bose joined the University College of Science of Calcutta University in 1917 as a Lecturer in

The curious journey of light: Light, a form of energy that enables us to see, has undergone a curious journey over centuries in an effort to unravel its nature. It was the legendary Sir Isaac Newton (1642-1726) who visualized light as particles ("corpuscles" in his language), but his contemporary Christiaan Huygens (1629-1695) propounded the wave form of light and Thomas Young (1773-1829) firmly established the wave nature of light through his famous double-slit interference experiment, in early 1800. Thereafter, light was unambiguously considered as a wave [not mechanical but electromagnetic in nature as theorized by James Clerk Maxwell (1831-1879) in 1865 and experimentally confirmed by Heinrich Hertz (1857-1894) in 1888].

But, at the dawn of the 20th century the perspective changed in favour of light (electromagnetic waves in general) as discrete packets of energy or energy quanta, somewhat similar to particles, first by Max Planck (1858-1947) in 1900 for explaining blackbody radiation and by Albert Einstein (1879-1955) in 1905 for explaining photoelectric effect. Then, in 1924, Louis Victor de Broglie (1892-1987) conjectured that every material particle with non-zero momentum is associated with a wave, thereby conceptualizing the wave-particle duality of matter. Accordingly, light or electromagnetic radiations may be viewed as waves or a stream of particles called photons, with zero rest mass and nonzero momentum. The earlier name of the light particle, 'light quantum', became 'photon' in 1926, proposed by G.N. Lewis, rhyming with well-known names of subnuclear particles like electron and proton.

Physics. In 1919 Bose and Saha published their translation of the original German papers of Einstein and Minkowski in a volume named *The Principle of Relativity* with an effort to introduce their students to the new revolutionary concept of relativity. He joined the newly established University of Dhaka (then called Dacca) as a Reader in Physics in 1921. He went on a tour to Europe, where great research was being done at several famous centres with a financial grant from his university in 1924, with an aim to introduce new theoretical and experimental curricula in the university. He personally met with Einstein,



Satendra Nath Bose

Meghanad Saha

his mentor, during this tour, in Berlin apart from many other stalwart physicists of the time. In 1945 he became the Khaira Professor

of Calcutta University. He held many other important academic positions including the vice-chancellor of Viswa Bharati.

He was a versatile genius with contributions in fields like chemistry, biology, soil science, minerology, philosophy, fine arts including music and painting, archaeology, literature, and languages besides physics (theoretical and experimental). He played a pivotal role in writing popular science articles in Bengali by establishing the Bangiya Bijnan Parishad (Science Association of Bengal) and himself writing and speaking in Bengali. He was also fluent in Germany and French.

Bose died on 4 February 1974 following a massive heart attack. Thereby ended the regime of a most illustrious person and scientist.

He received numerous awards and honours including the Padma Bibhusan (1954), Fellow of the Royal Society (1958), President of the National Science Academy (1949), Member of the Rajya Sabha (1952-1958), and National Professor (1959). An advanced level research institute called the S.N. Bose National Centre for Basic Sciences (SNBNCBS) was established in his honour in Calcutta in 1986. His name was proposed no fewer than four times for the most coveted Nobel Prize, but was never considered although other scientists have won the Prize based upon his path-breaking quantum statistics.

On the family front, Bose had an early marriage as per the custom of the day; the groom and the bride were aged 20 years and 11years respectively.They had seven surviving children.

Let us now go back to the story of the Bose-Einstein statistics.

The Bose-Einstein Statistics

Towards the end of the nineteenth century, inadequacies of classical physics became quite evident thereby indicating the requirement of new approach to matter and radiation. Two such phenomena namely the blackbody spectrum and photoelectric effect, observed experimentally, could not be explained using classical rules. Max Planck, a German physicist made the first successful attempt in 1900 to explain the blackbody spectrum by assuming the revolutionary concept of quantization of energy. A blackbody by definition is an idealized object which absorbs and reemits all radiant energy falling on it at any temperature.He arbitrarily assumed that the electromagnetic energy associated with the blackbody radiation occurs in discrete packets of energy or quanta, the energy of one quantum being given as $h\nu$ where ν is the frequency of the radiation and h is a constant of proportionality, which came to be called the Planck constant (h = 6.62 x 10^{-34} J.s) and became the signature of the new theory of physics called the quantum theory. On the basis of this assumption Planck deduced a formula for the spectral energy density for blackbody radiation that fitted the experimental findings most satisfactorily. Planck won the 1918 Nobel Prize in Physics for his concept of energy quanta. In 1905 Einstein successfully explained photoelectric effect (light of frequencies more than a minimum incident on certain metal surfaces eject electrons which

may be collected to produce what is called the photocurrent) by assuming the incident light to comprise a stream of light quanta (later known as photons) such that a light quantum on colliding with an electron on the surface of a metal such as sodium expels the electron from the metal. For his explanation of the photoelectric effect Einstein won the 1921 Nobel Prize in Physics.

Then, in 1924 S. N. Bose attempted to rederive the Planck formula treating the blackbody radiation to be a collection of discrete particle form of the electromagnetic radiation or photons, as assumed by Einstein to explain the photoelectric effect. For this Bose introduced a new form of counting the number of photons by assuming them to be identical and indistinguishable. He then used a method of counting to find the distribution of energy levels of photons inside a blackbody at a given temperature, which then led to the Planck radiation formula. In a sense Bose combined the revolutionary ideas of Planck and Einstein to deduce his new statistical method, applicable to a collection of light quanta in an enclosed space such as a blackbody.

Realising the importance of his novel approach, Bose immediately sent his paper to the British journal Philosophical Magazine, which had earlier published some of his papers. But this paper was not accepted by the journal most probably because of the novel idea of Bose. He then sent his four-page paper titled 'Planck's Law and the Light-Quantum Hypothesis' to Einstein along with a letter dated 4 June 1924. It may be kept in mind that at that time Einstein was at the pinnacle of success as a theoretical physicist and professor placed in Berlin, a prime centre for research and had already won the Nobel Prize whereas Bose, 15 years younger than Einstein, was an unassuming, budding physicist working as Reader in Physics at the newly established Dacca University in British India. We reproduce Bose's letter below to illustrate his confidence and boldness.

Respected Sir,

I have ventured to send you the accompanying article for your perusal and opinion. I am anxious to know what you think of it. You will see that I have tried to deduce the coefficient $\frac{8\pi\nu^2}{c^3}$ *in Planck's Law independent of classical electrodynamics, only if the ultimate elementary region in the phase-space has the content* h^3*. I do not know sufficient German to translate the paper. If you think the paper worth publication, I shall be grateful if you arrange for its publication in Zeitschrift für Physik. Though a complete stranger to you, I do not feel any hesitation in making such a request. Because we are all your pupils though profiting only by your teachings through your writings. I do not know whether you still remember that somebody from Calcutta asked your permission to translate your papers on Relativity in English. You acceded to the request. The book has since been published. I was the one who translated your paper on General Relativity.*

Yours faithfully,

S. N. Bose

Upon receiving Bose's paper Einstein immediately realized the merit and potential

of Bose's new approach, himself translated the paper into German and on 2 July 1924 sent the same to the famous German journal of physics *Zeitschrift für Physik* as desired by Bose. He conveyed the same to Bose through a letter of acknowledgment and praise he hand-wrote in German on the same day. Einstein's letter became a kind of testimonial for Bose and enhanced his reputation in his university and among his peers. The paper came out promptly, most likely in its August 1924 issue of the journal. Interestingly, in the printed paper author's name appeared as "Von Bose" without his initials S. N. In German the word 'von' means either an honorific title before author's surname or, the prepositions 'from' or 'of'. Whatever be the purpose of 'von', the paper came with an endnote from Einstein strongly recommending the paper and indicating that he himself would soon be extending Bose's approach to an ideal gas.

True to his word, Einstein applied Bose's approach, aimed at massless photons in an enclosure, to ideal gases with nonzero mass and published two papers in September 1924 and January 1925. Bose's original paper along with the above papers of Einstein became famous as the Bose-Einstein statistics, a cornerstone of modern physics and a vital tool to study the fundamental structure of matter.

The Bose-Einstein Condensate

Further, Einstein's calculations led to the speculation that the atoms obeying the new statistical method would tend to collect together in a state of minimum energy at a very low temperature and low pressure. This quantum state came to be known as the Bose-Einstein condensate (BEC). The condensate behaves like a giant atom showing properties distinct from those of the four well-known states of matter namely solid, liquid, gas, and plasma. Hence BEC came to be known as the fifth state of matter. The theoretical speculation of BEC could only be verified experimentally 70 years later. In 1995 a couple of experiments in USA observed the formation of BEC in dilute gases of alkali atoms following which the 2001 Nobel Prize in Physics was jointly awarded to C. Weimann, E. A. Cornell, and W. Ketterle.Unfortunately, neither Bose nor Einstein was around then to actually see their speculation becoming a reality.

The concept of BEC is found to be useful in areas like macrostate quantum mechanics including superconductivity and superfluidity, quantum computing, precision clocks used in GPS systems, development of new materials, etc.

Bosons

It was further found that there are fundamental particles with integral spin quantum number (0, 1, 2, etc.) that follow the B-E statistics. These were named 'bosons' (byPaul Dirac) after the original propounder of the method, S. N. Bose. Bosons are carriers of the fundamental interactions of nature, crucial to the structure of matter. The remaining elementary particles are known to have half-integral spin (1/2, 3/2, etc.), follow the statistical principle called the Fermi-Dirac statistics (developed independently by the Nobel Laureates Enrico Fermi and Paul Dirac

in 1926) and named 'fermions' (again byPaul Dirac). Hence, it is popularly said that half the particles of our universe obey the law originally deduced by S. N. Bose.

Uniqueness of Bose

As a student at school, Satyendra was once awarded 110 marks out of maximum 100 in a mathematics test deliberately by his teacher as he was able to answer all the questions correctly including the alternatives in the allotted time.

Bose had a tendency to close his eyes even in meetings giving an impression of sleeping, but he actually followed the proceedings with a fully alert mind. Once he closed his eyes at a lecture by the Nobel Laureate Neils Bohr at Saha Institute of Nuclear Physics, Calcutta. At one point Bohr apparently had a problem in his presentation and asked Bose for help. Bose got up instantaneously, offered a solution to Bohr, and again went back to his closed eyes stance. Another time another Nobel Laureate Joliot Curie was giving a lecture at the same venue. He wanted someone to translate his French into English and nobody came forward, but Bose immediately opened his eyes and started the translation.

Interestingly, Bose never tried to get a Ph.D. degree for himself in spite of which he became a professor and professor emeritus at Calcutta University and then the National Professor of India. He also received an honorary D.Sc. from Delhi University apart from highest honours from other universities.

According to a story, when a student asked his teacher who S.N. Bose was, the teacher replied, "You do not know who he was? Half of the particles in the universe obey him!"The story may or may not be correct, but its message is clearly true.

Summing up

Undoubtedly, Satyendra Nath Bose was one of the most important scientists of India in the British era. His name is immortalized in the form of three crucial terms in modern science namely, the Bose-Einstein statistics, Bose-Einstein condensate, and bosons.He is unique to have got his name permanently associated with Einstein, who changed our perception of the universe.The year 2024 has a special significance in connection with Bose on three counts. Counting from 2024, he was born 130 years ago (1 January 1894), he died 50 years ago (4 February 1974), and he founded quantum statistics 100 years back in 1924.Our heartfelt homage to this great soul and son of India.

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4

THE INTERNATIONAL YEAR OF QUANTUM SCIENCE AND TECHNOLOGY

Dr. Narottam Sahoo

Welcome to a transformative new year - 2025, the International Year of Quantum Science and Technology! Declared by the United Nations, this milestone marks a century of groundbreaking advancements in quantum mechanics, a revolutionary framework that has reshaped our understanding of the universe.

Quantum science is not merely a field of study; it is the cornerstone of tomorrow's innovations. From securing our digital infrastructure to driving breakthroughs across industries, quantum technologies are unlocking possibilities that were once unimaginable.

As we step into this journey into 2025, the International Year of Quantum Science and Technology (IYQ2025) stand as a global celebration of the profound impact of quantum mechanics over the past hundred years. It is a testament to the power of human ingenuity and the promise of quantum advancements to redefine industries, inspire global collaboration, and unveil the universe's most profound mysteries. This year invites us all to explore and embrace a future brimming with innovation, discovery, and limitless potential.

Quantum Science

Quantum science, a field born from the curiosity of early 20th-century physicists, has evolved from an intellectual curiosity to a cornerstone of technological advancement. Its principles challenge our classical understanding of the world. For instance, particles can exist in multiple states simultaneously - a phenomenon known as superposition - and become "entangled," remaining connected across vast distances. For decades, these concepts were mostly confined to research labs and theoretical physics papers. But today, quantum phenomena are not only understood; they are being harnessed in practical, powerful ways.

Quantum science explores the curious

and fascinating rules that govern the smallest particles in the universe, like atoms and subatomic particles. These particles don't behave according to the familiar laws of classical physics, such as Newton's laws of motion. Instead, they follow the strange, often counterintuitive laws of quantum mechanics.

Imagine a computer so powerful that it can solve complex problems within seconds, tasks that would take today's supercomputers millennia to complete. Quantum computers, a focus of global scientific endeavor, offer just that potential, and companies and governments are racing to unlock their capabilities. Such computers are not just faster; they approach problem-solving in an entirely different way, opening new paths in fields like drug discovery, cryptography, climate modeling, and artificial intelligence.

Quantum Technology: A Revolution in the Making

Quantum science is not just an abstract area of theoretical physics; it's the foundation of technologies that could revolutionize industries ranging from computing and medicine to communication and cryptography. Here are some of the most exciting breakthroughs expected in the coming decades:

1. Quantum Computing: Traditional computers, no matter how powerful, process data using bits, which can represent a 0 or 1. Quantum computers operate using quantum bits, or qubits, which leverage superposition to represent both 0 and 1 at the same time.This could allow quantum computers to solve complex problems in seconds that would take today's supercomputers millions of years, particularly in fields like drug discovery, climate modeling, and artificial intelligence.

2. Quantum Communication: As cyber threats evolve; quantum communication promises a new era of secure communication. Quantum encryption uses the principles of entanglement and uncertainty to create virtually un-hackable communication networks. Any attempt to eavesdrop on a quantum-encrypted message alters its state, immediately alerting the intended recipient.

3. Quantum Sensing: Quantum sensors can measure changes in the physical world with unprecedented precision. This could lead to advances in medical imaging, enabling earlier and more accurate diagnoses. They could also improve navigation systems, scientific measurements, and environmental monitoring in ways that were previously unimaginable.

The year 2025 was chosen as the International Year of Quantum Science and Technology because the field is rapidly approaching a tipping point. While quantum technologies have long been the subject of laboratory research, they are now moving into the realm of practical application. Governments and companies around the world are pouring billions of dollars into quantum research, setting the stage for breakthroughs that could dramatically impact society.

Quantum mechanics was developed in the 1920s by scientists like Heisenberg, Born, Pauli, Dirac, Schrödinger, Landau, von Neumann, and Bohr. The United Nations has proclaimed 2025 as the International Year of

Quantum Science and Technology (IYQ) to celebrate the 100th anniversary of quantum mechanics.

Major global initiatives, such as the European Union's Quantum Flagship program, India's National Quantum Mission, and China's aggressive investments in quantum research, signal that the race to develop quantum technologies is accelerating. By 2025, many experts believe we will witness significant milestones in quantum computing and communications, making it a perfect time to raise awareness and encourage international cooperation.

International Year of Quantum Science and Technology

The United Nations declared 2025 as the International Year of Quantum Science and Technology to commemorate 100 years of quantum mechanics, a field pioneered by legends like Heisenberg, Schrödinger, and Bohr. The year also marks a tipping point for quantum technologies, as they transition from laboratory experiments to real-world applications. Initiatives like the European Union's Quantum Flagship program, India's National Quantum Mission, and China's significant investments in quantum research underscore the global momentum in this domain.

The International Year of Quantum Science and Technology aims to:

1. Educate the public about quantum principles and their real-world applications.
2. Inspire young minds to pursue careers in quantum science.
3. Foster global collaboration among governments, industries, and academia.
4. Highlight the societal and ethical implications of quantum technologies.

Bridging Science and Society

One of the major themes of the IYQST 2025 is to bridge the gap between scientific discovery and societal needs. Quantum technologies are poised to have a profound impact on everything from healthcare and finance to energy and defense. As such, it's crucial that governments, industries, and the general public understand both the risks and opportunities.

For instance, quantum computing could interrupt industries like banking by breaking traditional encryption methods, but it could also enhance cybersecurity through quantum encryption. Quantum sensors could revolutionize fields like oil exploration, but they could also lead to job displacement in industries that rely on traditional methods. The ethical and societal debates surrounding quantum technologies will be central to discussions in 2025.

India's Quantum Vision

India is stepping boldly into the quantum future with its National Quantum Mission (NQM), launched in 2023. With a budget of ₹ 6,003.65 Crore, the mission aims to:

- Develop quantum computers with 50–1000 physical qubits.
- Establish secure satellite-based quantum communication links.
- Advance quantum sensing technologies for precision navigation and medical imaging.

- Innovate in quantum materials and devices for next-gen applications.

The mission's four thematic hubs-focused on quantum computing, communication, sensing, and materials-position India as a global leader in quantum science and applications.

Celebrating Quantum Milestones

On April 14, we mark World Quantum Day - a tribute to 4.14, the rounded first digits of Planck's constant, a tiny but profound value that underpins the very fabric of our universe. Planck's constant isn't just a number; it's the key to understanding quantum physics, a field that has redefined the boundaries of human knowledge. This fundamental constant governs the behaviors of particles, energy, and time at the most intricate levels, shaping technologies that impact our lives today, from semiconductors in electronics to atomic clocks.

World Quantum Day, within the larger context of the 2025 International Year of Quantum Science and Technology, invites people of all ages to explore and appreciate the ways quantum science influences our world. It encourages us to ask questions like: Why is Planck's constant so important? Did you know it's now used to define the kilogram? By delving into such fundamental questions, we celebrate a field that not only explains the nature of reality but also powers innovations that are changing how we live, work, and connect.

The Gujarat Council on Science & Technology (GUJCOST), working under the Department of Science & Technology, Government of Gujarat has been recognized as an academic partner for IYQ2025, has curated a series of outreach programs. These initiatives aim to:

- Ignite curiosity among students and educators.
- Foster a deeper understanding of quantum technologies among the general public.
- Showcase India's quantum achievements on the global stage.

In celebration, we're in the process of preparing the 'Quantum Calendar', a vibrant initiative recording landmark quantum events throughout history, so that every day can be a 'quantum day'. Imagine discovering when quantum physics was first taught in the school, or learning about pivotal quantum milestones that changed the course of science! This Quantum Calendar is designed to inspire curiosity, honouring our quantum heritage and fostering an appreciation for the journey that has brought us to this day.

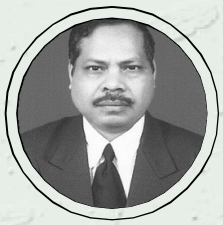
Inspiring the Next Generation

The International Year of Quantum Science and Technology is not just a celebration; it's a call to action. By inspiring young minds to explore quantum science, we lay the foundation for a future driven by innovation and discovery. These future leaders will harness quantum principles to address global challenges, from climate change to healthcare, shaping a brighter, more connected world.

.....To be Continued at Page No.-23

5

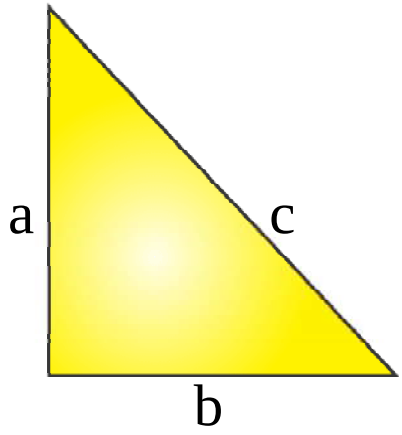
ELEGANT EQUATION: 3
$c^2 = a^2 + b^2$
(PYTHAGORAS THEOREM)



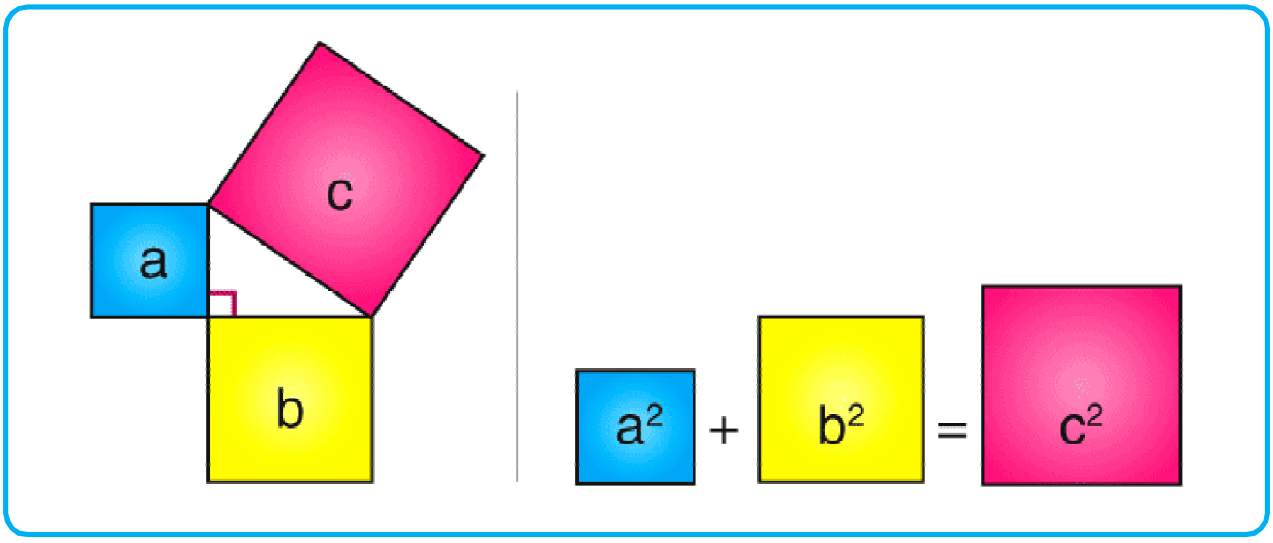
Er. Mayadhar Swain

The Pythagoras theorem which is also referred to as the Pythagorean theorem explains the relationship between the three sides of a right-angled triangle. According to the Pythagorean theorem, the square of the hypotenuse is equal to the sum of the squares of the other two sides of a triangle.

The Pythagoras theorem equation is expressed as, $c^2 = a^2 + b^2$, where 'c' = hypotenuse of the right triangle and 'a' and 'b' are the other two legs. Hence, any triangle with one angle equal to 90 degrees produces a Pythagoras triangle and the Pythagoras equation can be applied in the triangle.

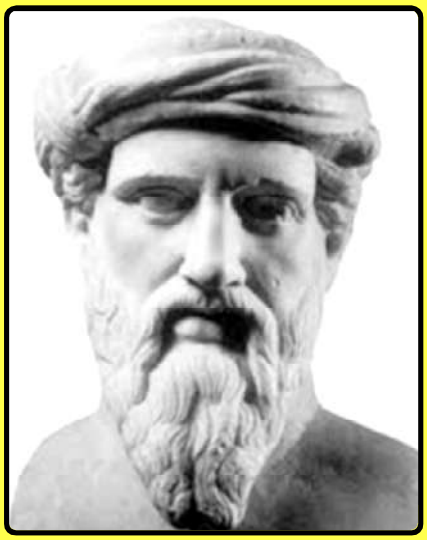


Consider three squares of sides a, b, c mounted on the three sides of a triangle having the same sides as shown.



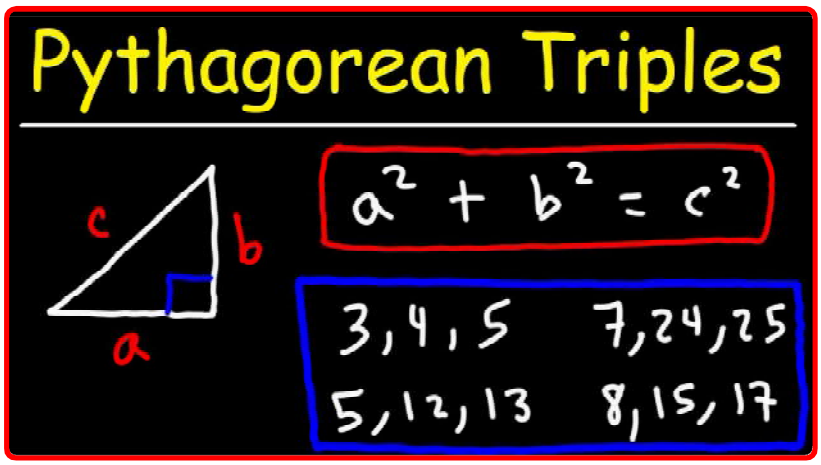
Pythagoras (570 BC - 490 BC) was a Greek philosopher, mathematician, and founder of the Pythagorean brotherhood that, although religious in nature, formulated principles that influenced the thought of Plato and Aristotle and contributed to the development of mathematics and Western rational philosophy.

Little is known about his life. He was born in the Greek city of Samos, Ionia. His father was Mnesarchus, a gem-engraver, a merchant originally from the city of Tyre and his mother was a local woman named Pythais. He visited Egypt and Babylon, which would have provided him the opportunity to cultivate himself from a very early age. He emigrated to Croton in southern Italy.In this Italian city he founded his school, known as "the Pythagorean brotherhood", in which both men and women were admitted. They referred to themselves as "mathematicians" (*matematikoi*) since they believed reality is essentially mathematical in nature, and they applied and promoted the study of numbers beyond their use in commerce and political matters.



Pythagoras

Pythagoras himself likely wrote no books, and Pythagoreans invariably supported their doctrines by indiscriminately citing their master's authority. Pythagoras, however, is generally credited with the theory of the functional significance of numbers in the objective world and in music. He is also credited with the geometric construction of the first perfect solids and the discovery of perfect and amicable numbers as well as polygonal numbers. His work with triangles and the square root is a cornerstone of this discipline. He was among the first to point out that the morning and evening stars are the same planet: Venus. He also taught that the Earth was the centre of the universe (geocentric model) and that the orbit of the Moon was inclined to the equator of the Earth. He is credited with the discovery of the laws of regular musical intervals and the invention of the monochord. Beyond the eponymous theories, Pythagoras' name is honored with a lunar crater (Pythagoras) and an asteroid (6143) in the solar system.



By Pythagoras Theorem,

Area of square "a" + Area of square "b" = Area of square "c"

The theorem is named for the Greek philosopher Pythagoras, born around 570 BC. The theorem has been proved numerous times by many different methods – possibly the most for any mathematical theorem. The proofs are diverse, including both geometric proofs and algebraic proofs, with some dating back thousands of years.

Pythagorean Triples

The integer solutions to the Pythagorean Theorem, $a^2 + b^2 = c^2$ are called Pythagorean Triples which contains three positive integers a, b, and c. Example: (3, 4, 5), (5, 12, 13), (7, 24, 25) etc.

History of Pythagoras Theorem

Pythagoras theorem is believed to have been introduced by the Greek Mathematician Pythagoras of Samos and hence it is named after him. Although Pythagoras introduced the theorem, there is evidence that proves that it existed in other civilizations too, 1000 years before Pythagoras was born. The oldest known evidence is seen between the 20th to the 16th century B.C in the Old Babylonian Period. The Pythagorean theorem was also known to early Chinese scholars and appeared in the sacred texts of ancient India related to altar building.The *Sulbasûtras* were Indian ritual texts containing geometrical content related to fire altar construction. In the earlier *Baudhâyana Sulbasûtra*, a special case of the Pythagorean theorem was given for the case of an isosceles right triangle. The general version involving a rectangle was subsequently stated in the *Kâtyâyana Sulbasûtra*.

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6

SPLENDOUR OF 2025 WITH A DENT

Santosh Kumar Nayak

On the eve of 2025 New Year, the number 2025 attracts the attention of students who love numbers. Here is detail dissection of 2025.

First of all 2025 is a perfect square. See the following facts of 2025.

1) $2025 = 45^2$ (perfect square)

2) $\frac{2025}{2+0+2+5} = \frac{2025}{9} = 225$

(divisible by sum of its digits)

3) $\frac{2025}{20+25} = \frac{2025}{45} = 45$

(divisible by sum of its two parts)

4) (75+60) (75-60) = 2025 (product of sum & difference of two numbers)

5) $117^2 - 108^2 = 2025$

6) $51^2 - 24^2 = 2025$

7) $205^2 - 200^2 = 2025$

8) $1013^2 - 1012^2 = 2025$

9) $339^2 - 336^2 = 2025$

10) $53^2 - 28^2 = 2025$

11) 2025 has 15 number of divisors. They are 1, 3, 5, 9, 15, 25, 27, 45, 75, 81, 135, 225, 405, 675, 2025

12) 2025 as product of two numbers

1 x 2025 = 2025 (both 1 & 2025 are perfect squares)

3 x 675 = 2025

5 x 405 = 2025

9 x 225 = 2025 (both 9 & 225 are perfect squares)

15 x 135 = 2025

25 x 81 = 2025 (both 25 & 81 are perfect squares)

27 x 75 = 2025

45 x 45 = 2025

The above facts are not a result of tedious work but a easy one by unique factorisation theorem.

$2025 = 3^4 \times 5^2$

According to unique factorisation theorem any natural number 'n' can be written as follows.

$$n = p_1^{\alpha_1} \times p_2^{\alpha_2} \times .... \times p_n^{\alpha_n}$$

where $p_1\ p_2\ ....\ p_n$ are prime numbers

$\alpha_1, \alpha_2, ... \alpha_n$ are positive integer.

Now look at the square roots

1. $\sqrt{3593^2 - 2968^2} = 2025$
2. $\sqrt{2031^2 - 156^2} = 2025$
3. $\sqrt{2295^2 - 1080^2} = 2025$
4. $\sqrt{2385^2 - 1260^2} = 2025$
5. $\sqrt{3177^2 - 2448^2} = 2025$
6. $\sqrt{3375^2 - 2700^2} = 2025$
7. $\sqrt{5265^2 - 4860^2} = 2025$

Now watch the beauty of following serieses

1) $3^7 - 3^6 + 3^4 = 2025$
2) $2^0 + 2^3 + 2^5 + 2^6 + 2^7 + 2^8 + 2^9 + 2^{10} = 2025$
3) $1^3 + 2^3 + 2^3 + 4^3 + 6^3 + 12^3 = 2025$
4) $1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 + 7^3 + 8^3 + 9^3 = 2025$

The actual splendour lies in the sum of four squares.

According to Lagranges theorem, we can write any positive integer as sum of at most four perfect squares. Here we write 2025 as sum of four squares in 45 different ways. But in one case out of 45 cases, we cannot able to write as a sum, but as a Linear combination. We take this as “a dent in splendour”. Watch the following;

$1^2 + 2^2 + 24^2 + 38^2 = 2025$

$2^2 + 12^2 + 14^2 + 41^2 = 2025$

$3^2 + 4^2 + 8^2 + 44^2 = 2025$

$4^2 + 3^2 + 20^2 + 40^2 = 2025$

$5^2 + 20^2 + 24^2 + 32^2 = 2025$

$6^2 + 15^2 + 42^2 + 0^2 = 2025$

$7^2 + 4^2 + 14^2 + 42^2 = 2025$

$8^2 + 5^2 + 44^2 = 2025$

$9^2 + 2^2 + 2^2 + 44^2 = 2025$

$10^2 + 1^2 + 18^2 + 40^2 = 2025$

$11^2 - 3^2 + 8^2 + 43^2 = 2025$ (dent, look at the negative sign)

$12^2 + 10^2 + 10^2 + 41^2 = 2025$

$13^2 + 16^2 + 40^2 = 2025$

$14^2 + 1^2 + 8^2 + 42^2 = 2025$

$15^2 + 10^2 + 10^2 + 40^2 = 2025$

$16^2 + 5^2 + 12^2 + 40^2 = 2025$

$17^2 + 6^2 + 10^2 + 40^2 = 2025$

$18^2 + 6^2 + 12^2 + 39^2 = 2025$

$19^2 + 8^2 + 40^2 = 2025$

$20^2 + 20^2 + 35^2 = 2025$

$21^2 + 12^2 + 12^2 + 36^2 = 2025$

$22^2 + 4^2 + 9^2 + 38^2 = 2025$

$23^2 + 10^2 + 10^2 + 36^2 = 2025$

$24^2 + 4^2 + 8^2 + 37^2 = 2025$

$25^2 + 10^2 + 20^2 + 30^2 = 2025$

$26^2 + 2^2 + 16^2 + 33^2 = 2025$

$27^2 + 36^2 = 45^2 = 2025$ (Pythagorean triad)

$28^2 + 4^2 + 21^2 + 28^2 = 2025$

$29^2 + 20^2 + 28^2 = 2025$

$30^2 + 1^2 + 10^2 + 32^2 = 2025$

$31^2 + 8^2 + 10^2 + 30^2 = 2025$

$32^2 + 2^2 + 6^2 + 31^2 = 2025$

$33^2 + 6^2 + 30^2 = 2025$

$34^2 + 2^2 + 9^2 + 28^2 = 2025$

$35^2 + 4^2 + 28^2 = 2025$

$36^2 + 2^2 + 14^2 + 23^2 = 2025$

$37^2 + 16^2 + 20^2 = 2025$

$38^2 + 9^2 + 10^2 + 20^2 = 2025$

$39^2 + 2^2 + 4^2 + 22^2 = 2025$

$40^2 + 5^2 + 20^2 = 2025$

$41^2 + 2^2 + 4^2 + 18^2 = 2025$

$42^2 + 1^2 + 2^2 + 16^2 = 2025$

$43^2 + 4^2 + 4^2 + 12^2 = 2025$

$44^2 + 5^2 + 8^2 = 2025$

$45^2 = 2025$

Now without Magic Squares the discussion may be incomplete. So watch the Magic Squares of 3rd order and 5th order.

674	673	678
679	675	671
672	677	676

3rd order Magic Square

Add any row, column, or diagonal your sum will be always 2025. The numbers used are 671 to 679, total 9 numbers.

400	415	416	396	398
397	404	403	408	413
399	409	405	401	411
417	402	407	406	393
412	395	394	414	410

5th order Magic Square

Add any row, column, or diagonal your sum will be 2025, the numbers used are from 393 to 417, total 25 numbers.

SO, WELCOME – 2025

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.....Continuing from Page No.-17

Looking Ahead

As we are celebrating the possibilities of the quantum age, IYQ2025 serves as a reminder that the future is already here. This year-long celebration invites everyone-from scientists to students, policymakers to the public-to dream big and collaborate on building a quantum-powered future. Together, we can unlock the mysteries of the universe and redefine what's possible in the 21st century.

The International Year of Quantum Science and Technology marks a pivotal moment in human history. It bridges the gap between scientific discovery and societal impact, fostering global collaboration and ethical discourse. As we celebrate the quantum advancements of the past century, we also look forward to the breakthroughs that lie ahead. Let 2025 be a year of inspiration, exploration, and innovation, propelling humanity into a future where quantum science shapes every aspect of our lives.

So, gear up for an exciting year. The International Year of Quantum Science and Technology awaits you with its wonders, challenges, and opportunities. Together, let's take a quantum leap into the future!

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7

RULES OF BINOMIAL NOMENCLATURE

Basanta Kumar Choudhury

There are more than 7000 languages spoken by more than 7 billion people all over the world. There are millions of plant and animal species known by different names in their respective languages. Even in an established language like English, a plant product is known in different names at different places. For example, brinjal a well known vegetable all over the world, is known as 'aubergines' in England and 'Egg plant' in America. Lady's finger is also called 'Okra'; papaya is known in some parts of the world as 'papaw'. This creates a lot of difficulty in understanding and manipulating these plants and animals for the benefit of mankind.

To track and count the existing organisms, there was the need for universal way to identify them. Although naturalists like Bauhin brothers (Jean Bauhin and Gaspard Bauhin), John Ray, Joseph Pitton de Tournefort did some work in this aspect in this aspect during 16th and 17th century, but the work of Carolus Linnaeus (1707 – 1778) provided new impetus to this line of work. This Swedish naturalist was the Professor of medicine and Biology at the Upsala University. He himself was an avid collector of plants and he made arrangements for collection of plant specimens from different parts of the world by sending his students far away. Also, he arranged to collect plant specimens through missionaries and administrators. This huge collection of numerous plants from all over the world led him to think about bringing an order in the existing chaos. He set himself grouping and classifying all plants known upto his time. He proposed a system of classification which was published in "System a Nature" in 1735; he used the characters of the stamens; i.e. the number and nature of stamens to distinguish 20 classes belonging to the plant kingdom. He also used the number and nature of carpels to distinguish the orders; i.e. the subdivisions of his classes. Besides, presenting a system of classification of plants, Linnaeus published his botanical works of monographic and floristic nature and also books embodying his ideas of nomenclature

Carolus Linnaeus

of plants. 'Species planetarium', the first edition of which was published in 1753 contained all plants known to him till that date. It also contained a brief description of each species with distribution and previous reference. This monumental piece of work laid the foundation stone of binomial nomenclature for every species with a general name followed by specific epithet. The modern taxonomists have agreed to consider the year 1753 as the starting point of nomenclature of phanerogams, pteridophytes and sphagnum.

In the living world, species is the most basic unit of classification as well as taxonomic rank. Species is defined as a group of organisms that consist of similar individuals capable of inter-breeding or exchanging genes among themselves freely. A genus is a natural group of closely related species. When a species is more or less isolated, the genus becomes monotypic, which means it consists of single species only. Similarly a family is natural group of closely related genera. Closely related families make an order, orders into class and classes into divisions and divisions of plants and animals make plant and animal kingdoms respectively.

In 1867, an international conference was held in Paris to discuss the nomenclature of plants for guidance of the botanists. It was the first international botanical congress. The Binomial nomenclature proposed by Linnaeus was virtually accepted here. It was known as the Paris Code. Since then, the botanical congress sessions have been held a number of time at different parts of the world. The rules of naming the variety of plant taxa are published in a book known as International Code of Botanical nomenclature. There are 5 guiding principles in the code and 75 articles depicting the rules.

The guiding principles are mentioned below:

1) Botanical Nomenclature is independent of Zoological Nomenclature.
2) Names of the taxonomical groups should be governed by a rule of priority.
3) A taxox can have only one correct name.
4) Scientific names should be in Latin.
5) The rules of nomenclature are retroactive.

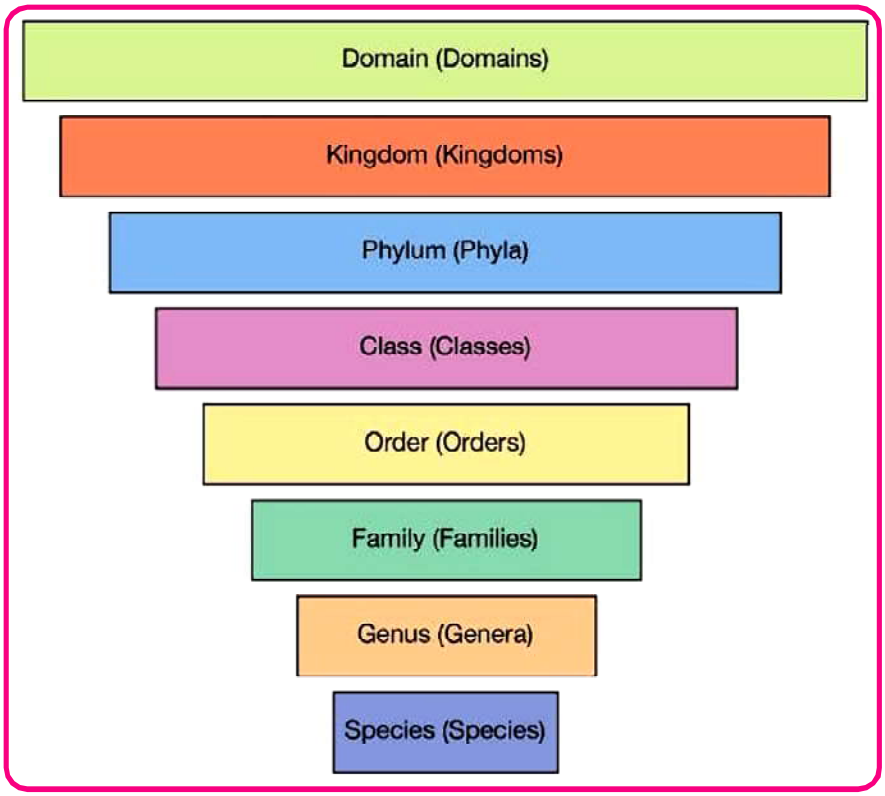
The important rules are the following.

1. Nomenclature Type: The nomenclature type is that constituent element (a specimen or a description or a figure) of a taxon to which the names are permanently attached. This need not be most typical or representative element but is the original material on which description of the taxon is attached.
2. Rules of Priority: In the case of a family or taxon, below the rank of the family, the earliest legitimate name should be considered valid (correct).

   For this purpose, 1st May, 1753 is taken as the earliest date for all plants excepting fungi, some algae, and Musci other than sphagnaceae. Therefore, the name appearing in 'Species Plantarium' of Linnaeus, are the earliest names for

the purpose of consideration of Rule of Priority and those published earlier are not to be given priority.

3. Names of Taxa: The name of a species, is a binary combination consisting of the name of the genus followed by specific epithet. The name of the genus is substantive in singular number. The specific epithet is an adjective and is of the same gender as the generic name or is a noun in opposition to the generic name. The specific epithet must not exactly repeat the generic name.



Taxonomic Classification

The name of a genus or a taxa of higher rank is spelt with a capital initial letter. All specific and intraspecific epithets should be written with small initial letter.

4. Effective and Valid Publications: Any printed matter when widely circulated is regarded as effectively published. It is sufficient if the printed matter is distributed at least to the botanical institutions with libraries accessible to the botanists generally.

The name of the taxon below its rank of genus is not validly published unless the name of the genus or species to which it is assigned is validly published.

He who first validly published the name of the taxon is the author of that name. It is necessary to cite the name of the author after the name of the taxon.

Later, the binomial nomenclature was accepted and adopted by zoologists, bacteriologists and to some extent by virologists international societies. It was unequivocally accepted that the basic unit of classification of living organisms is species. Each species has a combination of characters peculiar to its own. They have always a binomial nomenclature.

Sidhi, 24/732, Shree Vihar,
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8

GLOBAL WARMING

Er. Radhashyam Muduli

Introduction

The golden era of human civilization is over. By most intellect and hard work man has built this heaven like habitation on this beautiful planet, most luxurious and comfortable for him. After invention of science and technology, civilization has progressed in leaps and bounds. This high rate of development and moving beyond limits of the nature as per capacity of planet earth, the nature is now reacting strongly and sharply to wipe out this growing civilization, as everything available on this earth is in limited quantities.

After discovery of electricity, it was deployed as a special purpose energy for its versatile nature and now it has replaced all manual works and most human labor at homes and at offices / factories. Bullocks, camels, horses and human's forearms are out of scene and everywhere electrical energy is predominant. But the process through which this electricity is being generated is destroying the environment and the process is not at all sustainable. Government is approving this process as sustainable on plea of people's progress and finally people are getting affected through global warming and climate change.

Climate change has brought about following disasters to common man,

1. Sea level rise causing submergence of coastal regions
2. Global warming /heating, heat waves
3. Forest / wild fires
4. Floods through cloud bursting raining
5. Cyclones/ storms/tornados/typhoon/ hurricanes
6. Drought and famine
7. Loss and damage of crops
8. Landslides
9. Melting away of ice, snow, glaciers, permafrost from polar regions and mountain peaks

10. Spread of corona virus type epidemics
11. Fragile and cracks developing on high mountain slopes houses/building structures.
12. Extreme weather events like too much heat, too much rain, too much cold are being experienced covering most areas and at isolated areas
13. Change in pattern of rain with climate change

Global Warming Causes

1. Green house gas effects
2. Excess human developments by excessively exploiting nature, as nature has certain fixed capacity and beyond that it will lead to degradation of environment.
3. Direct heating of environment by waste heat being rejected /released from various industrial and domestic activities.
4. Thermal power plants are causing global warming by emitting green house gases and directly heating the environment through rejection of process heat.
5. On generation of electricity from fossil fuel sources, the cumulative waste heat amounts to heat equivalent to 50 million tons of coal burnt on every 24 hours / per day and this heat is directly heating the planet earth. The share of nuclear power is 10 million tons on this head with total 60 million tons of coal heat burnt per day is warming planet earth on continuous basis.
6. Domestic and industrial air conditioners and refrigerators are warming environment.
7. Deforestation is also causing global warming to go up.
8. We are progressing very fast with electricity and have surpassed the threshold limit of global developments.

Remedies for Global Warming and Climate Change

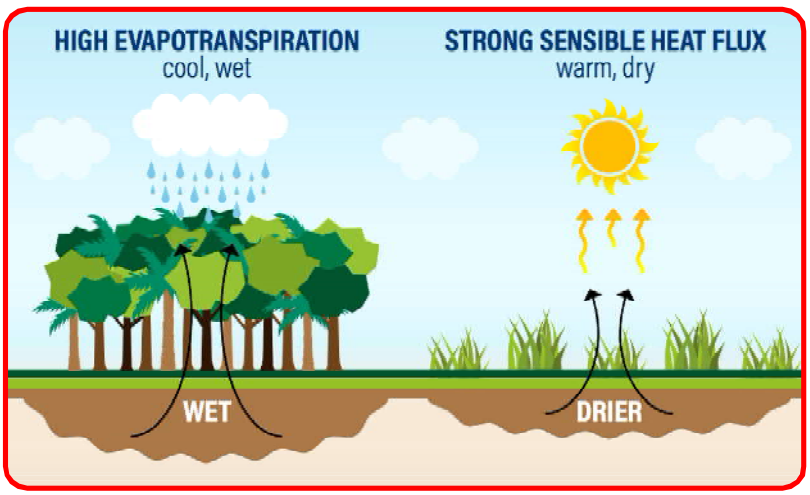
Though it has been officially recognized and accepted that this global warming is man made, no serious/urgent and exact steps has been adopted till date to combat global warming. A broad based target they have kept to limit the temperature rise of the century within 1.5 degree Celsius above the industrial era base, but the actual temperature rise has crossed this limit within 24 years in few EU nations by now. Agencies like COPs (global Conference of Parties), UNFCCC and all 198 nations of the world are actively associated with this task of controlling global warming. But the steps are inadequate to stop the disaster as they are not well and fully aware of the facts/ causes of global warming. They are considering only green house gases effects which is only 20% of the story. The major cause for which earth is directly getting heated up fast is waste heat being rejected from various industrial and domestic establishments is not being understood by them due to lack of sufficient exposure to the issue.

As it is seriously thought and studied the following steps are badly essential to combat global warming and associated climate change.

1. Human developments are to be stopped.
2. Fossil fuel fired thermal power plants are to be stopped
3. Nuclear power plants are to be stopped
4. Electric power consumption to be brought down to 20% of the present value
5. Humans have to give up luxury and comforts following an ascetic type life style.
6. Deforestation is to be stopped with enhanced plantation.
7. Conservation of natural resources has to be followed strictly.
8. Explore a need based work programme to repair the existing damaged environment.
9. How govt. is issuing sustainability certificate to power producers of nuclear and fossil fuel fired based plants which are not sustainable at all.
10. At present, earth is over populated and our basic needs like air, water, soil and sunshine in nature has got depleted, we have to economize the consumption of these natural resources.
11. Per capita energy consumption worldwide is to be brought down.

Horrors of Global Warming

1. Indonesian capital city Jakarta is getting submerged under sea water on sea level rise and the nation is shifting its capital to Bali / Borneo.
2. Italy is getting destroyed for continuous drought, floods, heat waves and wild fires, and set to vanish from world map.
3. World's trade is getting affected at junction of Panama canal where ships and vessels are getting stuck up due to low water level conditions along the linking canal out of drought conditions for last two years over the region for global warming.
4. Many more African countries including Madagascar are passing through hunger due to less production of crops, loss/ damage of crops out of global warming.
5. Recent floods during 2022-23 in Pakistan



How Deforestation is Affecting Global Water Cycles

submerging one third of geographical region of the country created history in world calamities killing 196 people with similar number missing.

6. Amazon rain forests are vanishing fast and eco system is badly affected.
7. Island country Maldives in South Asia is getting submerged in sea water on sea level rise from all sides creating threats to habitation of the citizens and their livelihood through tourism.
8. Storm Daniel brought heavy down pour / cloud bursting in Libya during mid September / October of 2023 and two number of hydroelectric dams in Derna city got washed away in which more than 11000 people killed and many more missing.
9. In 2023 Sikkim flash floods on October 4 heavy rains caused glacial south Lhonak lake in north eastern India to break its dams caused heavy rains out of cloud burst killing 34 people and affecting more than 60,000 people.
10. Himalayan region Joshi Math area is facing / developing cracks on roads and buildings with flash floods and landslides with formation of large thawing lakes at higher altitudes from melt away glaciers and permafrost on global warming /and on rise in ambient temperatures.
11. North American countries like Texas, California and Canada are facing frequent wild fires and heatwaves in recent couple of years creating threat to human habitation and properties on continuous basis.
12. More European countries have crossed their threshold limit of ambient temperature rise of 1.5 degree Celsius of century by now 2023, before 77 years turn of the century.
13. South American country Chile is experiencing the hotness of global warming as per reports that wildfires are spreading quickly with high speed winds killing 131 people this year 2024 summer.
14. Ambient temperature of February, 2024 in Morocco and China are exceeding the previous records. At places temperatures are seen to rise above 2 degree Celsius of pre-industrial era.

Conclusion

Climate change happenings are due to man made global warming. We can lessen the effects of climate change disasters by control of global warming which is advancing unabated through irreversible global heating. We have to adopt reversible heating of the environment to lower the extent of damage by pains taking methods and processes for each individual. While rejected waste heat is responsible for 60% of the cause of global warming and green house gas emission effects is only 15% of the cause of global warming, our scientists pay no attention on rejected waste heat factor at all. Therefore, it is time for the UNFCCC to step in to arrest the impact of global warming.

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9

A NOVEL APPROACH TO MITIGATE HUMAN-ELEPHANT CONFLICT

Rashmi Ranjan Das

Abstract

Human-Elephant Conflicts (HECs) are a growing problem that threatens both human livelihoods and efforts to conserve wild elephant species. Increasing conflicts between human populations and wild elephants, which frequently result from competition for resources like land, water, and food, are known as human-elephant conflicts. These conflicts have increased in frequency and severity as human settlements move into traditional elephant habitats, causing serious problems for both humans and elephant populations. Remote sensing technology has emerged as a vital tool for understanding and addressing this complex challenge. This technology offers insightful data on the habitat preferences, migration patterns, and probable conflict hotspots of elephants. By analysing elephant movements, assessing habitat changes, and implementing early warning systems, remote sensing contributes significantly to reducing the frequency and severity of HEC incidents. Collaborative efforts among local communities, governmental agencies, and conservation organizations, fuelled by the insights derived from remotely sensing, hold the promise of achieving sustainable coexistence between human and elephants in the region.

Human-Elephant Conflict

Introduction

Increasing conflicts between human populations and wild elephant species, which frequently result from competition for resources like land, water, and food, are known as Human-Elephant Conflicts (HEC). Conflicts have increased in frequency and severity as human settlements move into traditional elephant habitats, causing serious problems for both human livelihoods and efforts to conserve elephants (Mohandas et al., 2021). This struggle has wide-ranging effects on populations in Africa and Asia where elephants are allowed to wander. Crop raiding, property damage, and even human life loss are all examples of incidents. It is crucial for the survival of both species to find practical, long-term solutions to these issues. Regarding HEC, remote sensing technology is crucial. It involves gathering data across broad geographic regions using satellites, drones, and other aerial platforms. This technology offers insightful data on the habitat preferences, migration patterns, and probable conflict hotspots of elephants. Remote sensing enables researchers and conservationists to make educated judgments on land-use planning, the creation of wildlife corridors, and early warning systems. These decisions can be made possible by using advanced analytics and machine learning algorithms. The creation of strategies that strike a balance between human development and wildlife protection, and ultimately promote cohabitation between humans and elephants on a worldwide scale, depends on these data-driven initiatives.

Causes of Human-Elephant Conflict

Rapid urbanization and industrialization have led to the encroachment of elephant habitats. Human settlements and infrastructure development have reduced the available space for elephants to roam freely, forcing them into closer proximity to human communities (Ball et al., 2022). Agricultural expansion is a significant driver of human-elephant conflict in the region. Farmers often cultivate crops that are attractive to elephants, such as paddy and sugarcane, leading to frequent crop raids by these animals. The fragmentation of elephant habitats due to roads, railways, and human settlements has disrupted traditional elephant migration patterns. Fragmented habitats hinder elephants' ability to find adequate food and water resources, pushing them into inhabited areas in search of sustenance. Historic elephant migration routes have been disrupted by human activities and infrastructure. This disruption compels elephants to navigate unfamiliar terrain, increasing the likelihood of them entering villages and causing conflicts with humans.The behaviour of humans often exacerbates conflicts with elephants.In response to elephant raids on crops, some locals resort to harmful methods like using firecrackers or even poisoning, leading to negative interactions between humans and elephants. Lack of awareness and education about elephant behaviour and conservation further contribute to human-elephant conflicts.

Human-ElephantConflict arises primarily from habitat encroachment driven

by urbanization and industrialization, agricultural expansion, and fragmentation of elephant habitats. Disrupted migration routes also force elephants into closer contact with human settlements. Additionally, human actions and behaviour, including retaliatory measures against crop raids, further intensify conflicts. Addressing these issues requires a multi-faceted approach, including habitat protection, land-use planning, crop protection measures, and community education on elephant conservation and coexistence to mitigate the conflicts and promote peaceful cohabitation between humans and elephants in the region.

The Role of Remote Sensing in HEC Mitigation

Remote sensing plays a crucial role in mitigating Human-Elephant Conflicts (HECs) by providing valuable data for informed decision-making and proactive interventions. Remote sensing technologies enable the systematic collection of essential information related to HECs. This data includes elephant movement patterns, habitat usage, and human settlement dynamics, all of which are critical for understanding the conflict's root causes.Satellites provide a comprehensive view of large landscapes, allowing for the monitoring of habitat changes, vegetation health, and land-use alterations. This information helps identify potential conflict zones and facilitates early intervention.Aerial surveys offer a bird's-eye perspective to assess elephant populations, their migration routes, and the availability of resources such as water and forage. This data aids in predicting elephant movements and allocating resources accordingly.Camera traps capture images and videos of elephants and human activities in conflict-prone areas. They provide insights into the timing and nature of encounters, helping to design mitigation strategies and evaluate their effectiveness. GPS-equipped collars on elephants enable real-time tracking of their movements. This data aids in understanding daily and seasonal behaviours, allowing for proactive measures like early warning systems and targeted deterrents. Remote sensing technologies provide a holistic approach to HEC mitigation by gathering crucial data that informs policies and interventions. By monitoring elephant movements and human activities, stakeholders can work towards reducing conflicts and promoting coexistence between humans and elephants.

Through a variety of applications, including the monitoring of land use changes and human activity in elephant habitats over time, remote sensing technologies play an essential role in reducing Human-Elephant Conflict. These technologies include satellite imaging and drones. This data helps identify areas of potential conflict and track their evolution. Remote sensing can track elephant movements by using GPS collars and satellite imagery. This information aids in understanding elephant behaviour, including migration routes and foraging patterns, helping to predict their movements and potential interactions with human settlements. Satellite and aerial imagery provide valuable insights into the

condition and extent of elephant habitats. Conservationists can assess the quality and fragmentation of these habitats, helping to prioritize areas for protection and restoration. Remote sensing facilitates the analysis of elephant migration patterns and their response to environmental changes. This knowledge allows authorities to implement timely mitigation measures, such as early warning systems and protected corridors, to reduce conflicts between elephants and humans.

Through the following uses, remote sensing significantly reduces Human-Elephant Conflict by giving useful information and insights. By depicting important aspects like water sources, vegetation density, and topographical features, remote sensing technology helps to evaluate the elephant habitat. This data helps conservationists identify areas susceptible to HEC and implement targeted measures. Monitoring land use changes through satellite imagery enables researchers to track alterations in elephant habitats, such as deforestation or urban expansion. Understanding these changes allows for proactive planning and preservation of vital corridors for elephant movement. Remote sensing helps analyse forest fragmentation caused by human activities. By identifying fragmented areas, conservationists can focus on reconnecting these ecosystems, facilitating elephant movement and reducing confrontations with human settlements. Regular assessment of vegetation health assists in understanding the availability of food for elephants. This information aids in predicting elephant movements and implementing strategies to steer them away from agricultural areas. Overall, remote sensing technology enhances our ability to manage and mitigate HEC by providing timely and precise data for informed decision-making and proactive conservation efforts.

Remote sensing plays a crucial role in mitigating Human-Elephant Conflict by enhancing early warning systems, predicting elephant movements, alerting local communities, and facilitating response coordination.Remote sensing technologies such as satellite imagery and drones provide real-time data on elephant locations and behaviour. This information can be integrated into HEC early warning systems, allowing authorities to detect and respond to potential conflicts before they escalate.Remote sensing data, including habitat mapping and vegetation analysis, helps predict elephant movements. By understanding their migratory patterns, authorities can implement proactive measures to prevent encounters with human settlements.Remote sensing technologies enable the development of alert systems that inform local communities about approaching elephant herds. This empowers residents to take precautions, safeguard their property, and avoid confrontations. Remote sensing aids in coordinating responses during HEC incidents. It assists in deploying resources efficiently, such as deploying trained personnel or equipment to manage elephant herds and minimize damages.

Mitigation Strategies

Human-Elephant Conflict is a pressing issue arising from the growing overlap between human populations and wild elephant habitats. As human settlements encroach upon traditional elephant territories, conflicts escalate, jeopardizing both human livelihoods and elephant well-being. To address this challenge, various mitigation strategies have been developed, emphasizing community engagement, technological innovations, habitat protection, and policy advocacy. Community-based approaches form a cornerstone of HEC mitigation. Initiatives involve establishing community-based organizations and task forces that work collaboratively with wildlife authorities. By incorporating local knowledge and participation, these strategies yield more effective and sustainable solutions. Such partnerships foster a sense of shared responsibility, enabling communities to actively contribute to conflict resolution. Elephant-Friendly Crop Cultivation introduces practices that discourage elephants from raiding crops while ensuring minimal harm to them. Techniques such as chili-based deterrents, electric fences, and buffer crop planting help shield agricultural fields from elephant intrusion. This reduces the incentive for retaliatory actions against elephants, promoting coexistence. Compensation Schemes offer financial reimbursement to farmers for crop or property damage caused by elephants. Beyond easing the economic burden on affected communities, these schemes foster tolerance and discourage retaliatory measures against elephants. Awareness Programs are instrumental in fostering coexistence. Education initiatives inform communities about elephant behavior, safety measures, and the importance of conservation efforts. Promoting a sense of shared responsibility and understanding helps reduce conflict and improve human-elephant relations. Advanced technologies, including Remote Sensing and Geographic Information Systems (GIS), play a crucial role in mitigating HEC. Remote sensing involves using satellites, drones, and other platforms to collect data over large areas. This technology provides insights into elephant movement patterns, habitat preferences, and conflict hotspots. GIS-based mapping creates comprehensive databases of elephant habitats and human settlements, aiding in visualizing overlaps and identifying conflict-prone areas. By combining tracking data, GIS mapping, hotspot identification, and seasonal analysis, conservationists and local authorities develop informed strategies to mitigate conflicts and promote coexistence.

Protected corridors and habitat restoration are vital strategies for mitigating HEC. Corridors connect fragmented elephant habitats, enabling them to move freely and access resources. Habitat restoration efforts focus on improving corridor quality by planting native vegetation, maintaining water sources, and minimizing human interference. This ensures elephants have abundant forage and water, reducing conflicts with farmers. Securing migration routes and reforestation

initiatives further support sustainable coexistence. Research and collaboration are pivotal in understanding HEC dynamics. Researchers study elephant behavior and migration patterns, collaborating with local communities to gather valuable insights based on indigenous knowledge. Data sharing and coordination among governments, conservation organizations, and communities facilitate real-time response mechanisms and preventive measures. Policy advocacy ensures HEC mitigation is integrated into broader conservation and development policies, incentivizing coexistence and supporting affected communities. International cooperation is crucial in regions where elephant ranges cross borders. Collaboration among countries harmonizes strategies, improves information sharing, and protects elephant populations on a larger scale. In summary, mitigating HEC requires a multifaceted approach involving community engagement, technological innovations, habitat protection, and policy advocacy. These strategies must be implemented holistically to strike a balance between elephant conservation and the well-being of local communities living alongside these magnificent animals.

Conclusion

The human-elephant conflict is a pressing issue that demands a holistic approach for mitigation. Remote sensing technology has emerged as a vital tool for understanding and addressing this complex challenge(Acharya et al., 2016). By analysing elephant movements, assessing habitat changes, and implementing early warning systems, remote sensing contributes significantly to reducing the frequency and severity of HEC incidents. However, addressing the root causes of the conflict through community engagement, habitat protection, and policy support remains imperative for long-term solutions. Collaborative efforts among local communities, governmental agencies, and conservation organizations, fuelled by the insights derived from remote sensing, hold the promise of achieving sustainable coexistence between humans and elephants.

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10

PRETERM BABIES AND KANGAROO CARE

Prof. Ramesh Chandra Parida

According to a survey conducted by the World Health Organisation (WHO) in 2020, every year nearly 13.4 million preterm babies (born before 37 weeks of pregnancy) are born around the World (1 in every 10). The number is the highest in India, which is 3.02 million. About 50% of such births occur only in 8 countries. Those besides India, are Pakistan, China, Ethopia, Bangladesh, Congo and America respectively.

Generally these babies are of low birth weight (less than 2.5 kg), who suffer from low immunity, stunted growth, malnutrition and are prone to various physical and mental disorders. As they grow up they become easy victims of several chronic diseases including diabetes, high blood pressure and heart problems. According to the WHO one in five of them before attending the age of 5 and 14.8 percent of them before their first birthday die. Therefore, ensuring them a healthy and long life has become a serious challenge to the medical science. The scientists have been trying various ways and means to meet it and one of those, which has proved to be successful is Kangaroo Mother Care or Kangaroo Care, in short. Discovered by Dr. Edger Rey and Dr. Hector Martinez of Bogota in Coloumbia (1970s) it advises to hold the new born babies against the bare chests of the mothers with skin to skin contact for several hours in a day as do the kangaroo mothers to their babies. By adopting this method Rey and Martinez claim to have reduced the death rates of preterm babies by 70 percent.

The World Health Organisation defines kangaroo care as skin-to-skin contact between a mother and baby alongwith exclusive breast feeding (If the mother or birthing parent is not able to do this, another caregiver can step in). This contact should begin as early as possible after birth and happen for as many hours as possible per day. Ideally, the WHO recommends skin-to-skin contact for 8 to 24 hours daily. These recommendations apply to all babies born preterm or with low birth weight.

How to Do it

The mother should wear something that can be easily opened in front because her baby will rest against her bare chest. The baby should be in an upright position with his/her head resting to one side against the mother's chest and should wear only diaper, hat and

Skin-to-skin contact between a mother and preterm baby

socks. Once the mother and baby are settled skin-to-skin position the baby's back should be draped with a warm cloth to keep him warm and comfortable. During the session both should be in a relaxed mood and breathe normally. It is better to allow the baby to snuggle in and fall asleep. The process should be carried on in several sessions in a day, whose number and time can be according to the advice of the care team.

During kangaroo care certain guidelines should be followed by the mother. Those include putting away phones or other electronic devices, keeping the skin clean and healthy and avoiding smoking. If the mother is sick, she should avoid it and assign the responsibility to another care-giver.

Benefits

Kangaroo care has been found to ensure the following benefits;

i) It stabilizes baby's heart rate
ii) Improves his/her breathing pattern and makes it more regular
iii) Supports healthy sleep, including more quite sleep and longer cycles
iv) Ensures his/her growth
v) Relieves the pain the baby might be feeling and
vi) Lowers the risks of hypothermia, serious infections or death

Taking all these facts into consideration now kangaroo care has been widely accepted as a very effective method for ensuring proper health and long life to preterm and underweight babies. Even it can also be recommended for normal babies.

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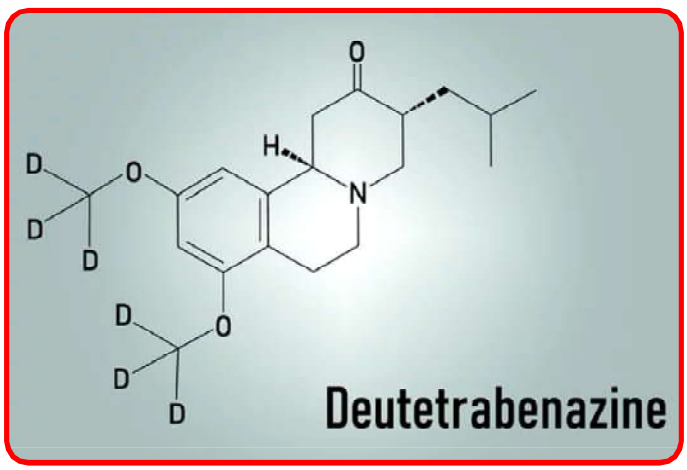
11

DEUTERATED DRUGS IN HEALTH CARE: PRESENT STATUS AND FUTURE PROSPECTS

Dr. Ashis Kumar Jena

The discovery of deuterium atom in 1931 and soon after the award of Nobel prize in chemistry to Harold Clayton Urey in 1934 motivated the scientific community to explore the deuterium atom in different fields including synthesis of deuterated organic molecules. A deuterated drug is a medicinal molecule in which one or more than one hydrogen atom of the drug molecule is replaced by its heavier stable isotope deuterium. There are two categories of deuterated drugs; deuterium counterpart of the conventional drug and de novo deuterated drugs. During the early 1960, two independent groups synthesized deuterated bioactive molecules such as d2-tyramine and d3-morphine respectively. These compounds exhibited decrease metabolism compared to parent compounds. Subsequently, many organic and medicinal chemists prepared the deuterated molecules. In the last couple of years, deuterated drugs have received intense attention due to its improved biological life, low toxicity, high efficacy and low dose requirement. After the FDA approval of drug Austedo (deutetrabenazine) in 2017, a deuterated version of tetrabenazine made by Teva Pharmaceutical Industries, the deuterated drugs have gained its momentum. The drug Austedo is intended to treat involuntary movement disorder, or chorea, in people with Huntington's disease. The deutetrabenazine showed improved pharmacokinetic profile, allowed a significant reduction in dose and dosing frequency compared to its undeuterated counterpart tetrabenazine. The main motto of making the deuterium switch of the conventional drug is to increase the retention time of the active drug components in blood plasma. This enables the drug molecules to achieve the greater efficacy and / or to avoid adverse side effects. In 2021, Donafenib, the deuterated version of sorafenib, was approved in China.



Incorporation of the deuterium atom in place of hydrogen atom at soft spot site can improve the pharmacokinetic properties of the deuterated molecules. This is due to strong deuterium-carbon bond, and thus able to modify its metabolism. Replacing hydrogen with deuterium in drug molecules results in lowering of toxicity by reducing the formation of toxic metabolites

A brief comparison between the conventional drug and its deuterated version is mentioned in Table-1.

A number of clinilically trials deuterated drugs such as d3-vitamin A (ALK-001), d6-dextromethrophan (AVP-786, phase 2/3), d8-ruxolitinib (CTP-543, phase 2), pioglitazone (DRX 065, phase 1), apremilast (CT-730, phase 1), d9-ivacaftor (CTP-656, phase 2), and d2-linoleic acid ethyl ester (RT001) with advantage due to deuterium switch is outlined in Table-2.

Apart from the deuterium switch of the conventional drug, the de novo deuterated drugs have recently developed. In 2022, Deucravacitinib was approved in USA for medical use towards the treatment of moderate-to-severe plaque psoriasis. This is the first novel deuterated drug without having its undeuterated counterpart in the market.

Currently, few other deuterated novel compounds namely BMS-986322, BMS-986202, deucrictibant and VX-984 are under clinical trials.

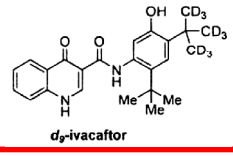
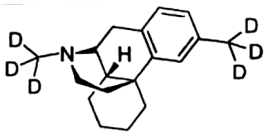
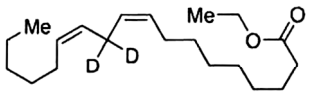
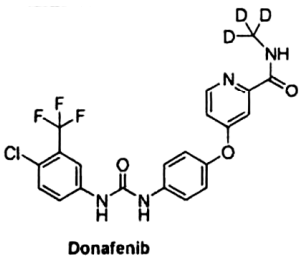
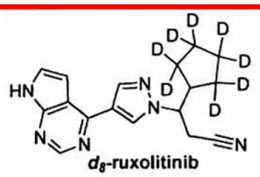
(De Novo deuterated clinically trial drugs)

The deuterated drugs resist the oxidative metabolism and there by improved the pharmacokinetic profile. However, the challenge lies in controlling the site and extent of deuterium enrichment in the drug molecules. Although there is a negligible difference of lipophilicity between hydrogen and deuterium atom, but when a number of

Table-1

Conventional Drugs	Deuterated Drugs
• Higher dose requirement	• Lower dose requirement
• Lower retention time in body	• Higher retention time in body
• Destruction in liver is more	• Destruction in liver is less
• More toxic	• Less toxic
• Low efficacy	• High efficacy
• High side effects due to less retention and high dose	• Less side effects due to more retention and less dose
• Large bio waste	• Less bio waste

Table-2

Deuterated clinically trial drugs	Therapeutic use	Side reactions of undeuterated counterparts	Advantage due to deuterium incorporation
 d_9-ivacaftor	Cystic fibrosis	CYP3A4 mediated oxidations	Increased PK parameters (longer t112)
 d_6-dextromethorphan	Agitation in Dementia of the Alzheimer's type	CYP2D6 mediated 0-dealkyation	Reduced amount of co-administered booster
 d_2-linoleic acid ethyl ester	Neurodegenerative disease	ROS-driven oxidation	Increased resistance to oxidative damage
 Donafenib	Hepatocellular carcinoma and other advanced solid tumours (multi-kinase inhibitors)		Higher dose absorption and exposure at steady state; longer median overall survival; lower incidence of adverse effects
 d_8-ruxolitinib	Alopecia areata	CYP mediated oxidations	Increased exposure and t1/2

deuterium atoms are present in the drug molecule, the additive effect of deuterium may affect the rate of absorption, and plasma protein binding etc. So translating the deuterated compounds from laboratory to life practice is a challenging task.

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12

ODISHA MILLET MISSION: GLOBAL EYE OPENER

Dr. Manas Ranjan Satpathy

In today's world modern man has become health conscious and always in search of better fitness diets. One such food which has attracted the mass is Ragi, Jower, Kangni, Khira, Kaudua etc. which are grouped under the name 'Millets'.Millet crop was widely cultivated in India before the green revolution i.e., till 1965-70, such crops were widely cultivated, which was 20% of the total grain production. But, after huge success of Green Revolution, its production fell to 8% of the gross productivity. The farmers choose to prefer crops like wheat, corn, etc. for their delicious taste and productivity and turned away from millet.

In each 100 grams of millet flour, it contains 382 calories, 75 grams of carbohydrate, 10.75 grams of protein, 4.25 grams of fat, 3.5 grams of dietary fiber, 14 milligrams of calcium, 3.94 milligrams of iron, 119 milligrams of magnesium, 224 milligrams of potassium and 4 milligrams of sodium, and various categories of vitamins B, E, etc. and confirmed to be more nutritious

compared to 100 gms of wheat or rice flour.

In 2007, the Government of India initiated the National Millet Mission with the objective of enhancing the production and consumption of millet crops in the country due to their superior nutritional benefits and luxuriant growth in dry as well as non-irrigated areas. Under this programme, financial assistance was provided to encourage farmers who cultivate millets in order to boost interest for such cultivation.

The success of millet mission is attributed to a Hyderabad based non-government organization 'WASSAN' and Naba Krushna Choudhury Centre for Development Studies who have worked jointly in coordination with the Department of Agriculture, Govt. of Odisha. Odisha's model was so successful that Maharashtra and Chhattisgarh Planning Commission directed their government agencies to prepare its own agenda taking Odisha Millet Mission as a model. Even the Indian government formed a task force to compare its Millet mission with the Odisha model and to set up a task force to rectify the discrepancy. Based on its successful implementation, Cambridge University in partnership with Odisha Millet Mission has proceeded to design options for the second Green Revolution. UN's Food and Agriculture Organization (FAO) is a specialized agency of the United Nations that leads international efforts to defeat hunger and The International Fund for Agricultural Development (IFAD) have considered Odisha Mission's approach as an advanced, laudable initiative in the field of agri-environment.

Objectives of Odisha Millet Mission

The mission aimed to increase consumption of millet per household, breeding of millet grains and conservation of species, establishment of millet processing industry in a decentralized manner, increase in production of millet grain, establishment of integrated institutions in millet processing, support in millet business. Millet will be introduced in ICDS's Midday meal and Anganwadi Centers also in PDS system.

In view of the increasing demand for millet worldwide and the need to create business opportunities, the Government of India claimed 2023 as the International Year of Millet at the United Nations and it was announced at the 75th General Session of UN.

Odisha is one of the largest producers of millets in India, along with Karnataka, Tamil Nadu and Andhra Pradesh. The State's millet production has increased significantly in recent years, and the government has been actively procuring millets. Current scenario for millets has changed in the minds of educated people. It is no longer a poor man's diet. It is being considered as a diet of high fibers. This food has penetrated till the dining tables and kitchens of a significant mass of elite society. The craze for millet and millet foods have increased significantly, thus, cultivation in dry areas of Odisha have increased thereby the farmers are getting a good margin, too.

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13

ENVIRONMENT IS OUR TRUE FRIEND!!

Sampurna Mishra

Everyday plant a tree in your garden,
Not a single tree should be harshen.
Vast and rich is our Mother Earth.
Inhaling Oxygen from trees which we worth,
Rocks and Mountains while they peep.
Other than lands, we have oceans, lakes and seas, so deep.
Number of unique birds come out and chirp!
Monkeys and Apes hang on branches of trees,
Elephants and Giraffes help to trim the trees and cut out the leaves.
Not only we should plant trees, but also take care of it.
Thank you my true friend, Our Environment, for this wonderful gift!

Class-VII, Narayana School,
NewTown, Kamarbari Road Behind TCS Eco Space,
NewTown, Rajarhat,
24 Parganas, North, Kolkata,
West Bengal - 700135

14

QUIZ: SOLID WASTE

Titaram Nanda Brahmachari

1) Which of the following is known as bio-medical waste?

a) Plaster casts b) Paper

c) Card board d) All of the these

2) Which of the following thermal technology is used for waste reduction?

a) Incineration b) Pyrolysis

c) Gasification d) All of these

3) In which of the following Municipal Solid Waste (MSW) contain(s) the highest percentage of moisture?

a) Food b) Yard

c) Both 'A' and 'B' d) Wood

4) Which type of colour dustbin is used for keeping anatomical waste in medical institution?

a) Yellow b) Red

c) Blue d) Black

5) Municipal Solid Waste (MSW) contain(s) large percentage of plastic waste:

a) Low Density Polythylene (LDPE)

b) Polyethylene Terephthalate (PET)

c) Polypropylene (PP)

d) Other plastic

6) Most of the MSW contain which of the following content?

a) Paper & Card board

b) Yard trimming

c) Plastic

d) Other plastic

7) Which formula is used to calculate moisture content?

a) $M_c = \frac{W_w - W_d}{W_w}$ b) $M_c = \frac{W_w + W_d}{W_w}$

c) $M_c = \frac{W_w + W_w}{W_d}$ d) $M_c = \frac{W_w - W_w}{W_d}$

8) Which of the following is known as E-waste?

a) Vacuum cleaners

b) Dish washers

c) Refrigerators

d) All of these

9) Maximum percentage of content found in hospital waste:

a) Cloth and Bandage

b) Needle and Syringe

c) Bio-degradable waste

d) Ceramic

10) Maximum ash content found in MSW:
a) Silt b) Glass
c) Food waste d) Yard waste

11) In which type of MSW minimum percentage of carbon content is found by dry weight?
a) Ash b) Metal
c) Glass d) Plastic

12) Fly ash is a type of _____
a) Municipal solid waste
b) Industrial solid waste
c) E-waste
d) Biomedical waste

13) Ash starts to burn at the temperature _____
a) >500°C b) >700°C
c) >1000°C d) >1300°C

14) Gravity Flow Autoclave is used for disinfection of medical waste. What is the required temperature, pressure and time for the above process?
a) >121°C, 15 PSI, 30 min
b) >135°C, 31 PSI, 45 min
c) >149°C, 52 PSI, 30 min
d) All of these

15) In _____Plastic Waste Management Rules stated in India.
a) 1998 b) 2005
c) 2008 d) 2017

16) Maximum plastic is used for _____
a) Packaging b) Handling
c) Waring d) All

17) The formula is used for measurement of size and size distribution of MSW:
a) $L_w = (L + W) / 2$
b) $L_w = (L + W + h) / 3$
c) $L_w = (L \times W)^{1/2}$
d) All of these

18) Which of the following solid waste is produced maximum in India?
a) Fly ash b) Red mud
c) Sludge d) Mine reject

19) Which of the following solid waste component(s) contain more amount of calorific value?
a) Plastic waste b) Food waste
c) Yard waste d) Wood

20) Which of the following chemical constituent has more percentage of MSW?
a) Carbon b) Hydrogen
c) Oxygen d) Nitrogen

ANSWER

01. (a)	02. (d)	03. (a)	04. (a)	05. (a)
06. (a)	07. (a)	08. (d)	09. (a)	10. (b)
11. (c)	12. (b)	13. (c)	14. (d)	15. (d)
16. (a)	17. (d)	18. (d)	19. (a)	20. (a)

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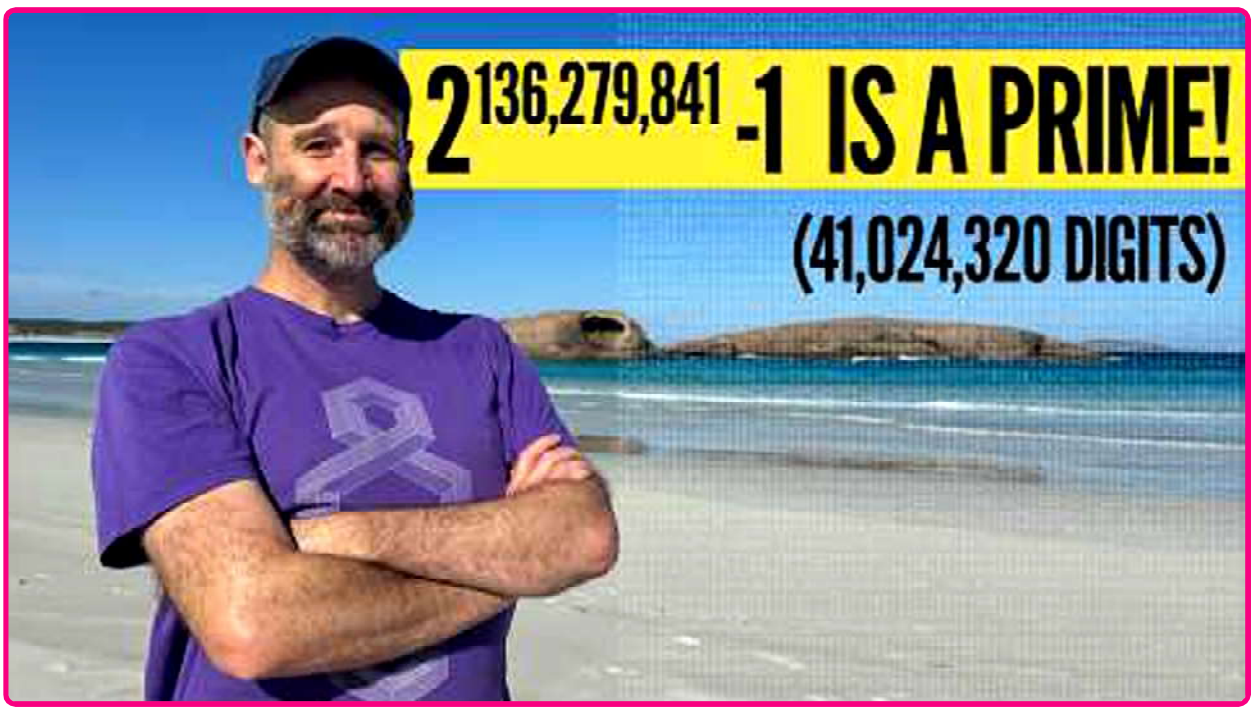
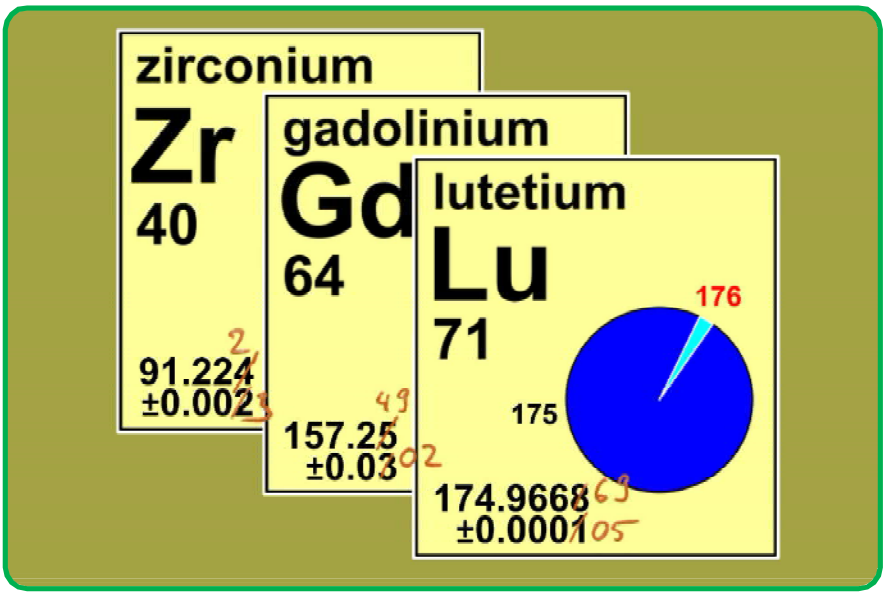
RECENT NEWS ON SCIENCE & TECHNOLOGY

Greatest Prime Number Discovered

On October 21, the Great Internet Mersenne Prime Search (GIMPS), a global community project dedicated to finding these incomprehensibly huge numbers, confirmed the 52nd Mersenne prime number which is is $2^{136279841}$-1. To translate, that's equivalent to multiplying the number 2 together 136,279,841 times, then subtracting 1. It is written as M136279841 and it has 41,024,320 digits.

Announced on 22.10.24, GIMPS explained that M136279841 was first suspected on October 11 by a 36-year-old former NVIDIA employee named Luke Durant using what's known as Fermat probable prime test. After Durant notified GIMPS of his possible breakthrough, several other computers around the world conducted multiple Lucas-Lehmer primality tests to ensure M136279841's prime-ness, leading to its official confirmation 10 days later.





Gadolinium, Lutetium and Zirconium All Have New Atomic Weights

The International Union of Pure and Applied Chemistry (IUPAC) has updated the standard atomic weights of gadolinium, lutetium and zirconium following a detailed review of their isotopic abundances. Gadolinium's standard atomic weight was revised from 157.250 to 157.249. Similarly, lutetium's weight changed from 174.9668 to 174.96669, while zirconium's was updated from 91.224 to 91.222. The revisions follow a review by IUPAC's commission on isotopic abundances and atomic weights, who noted that gadolinium's standard atomic weight had remained unchanged since 1969, based on isotopic data from the 1940s. Recent evaluations of their natural isotopic abundances prompted this update. For lutetium and zirconium, more accurate measurements of their isotopic compositions have been obtained since their weights were last updated in 2007 and 1983, respectively.

China's Cat-like Robot Dog Perfects Mid-air Jumps to Conquer Asteroid Surfaces

Chinese researchers have created an AI-powered robot dog capable of leaping across the rugged, low-gravity surfaces of asteroids.

Inspired by a cat's ability to twist and land on its paws, researchers from the Harbin Institute of Technology developed a robot using reinforcement learning.

The robot employs a "model-free" control system to swing its four legs in coordinated motion. Such a design allows the robot to adjust its posture mid-air, correct tilt, and even reorient to face a new direction. The advancement could transform how small celestial bodies are explored, offering new possibilities for space exploration and enhancing our understanding of these distant objects.

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EDITOR

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1. "SCIENCE HORIZON" aims at developing the scientific outlook of students as well as the general people and seeks to give them information on scientific developments. It is published as a monthly magazine.
2. The authors desirous of writing and contributing articles to the magazine should first assimilate the ideas of the theme and present it in simple language and popular style.
3. The authors are requested to send their articles by typing **(in MS Word)** to avoid errors in reading handwritten article and send it through e-mail given below.
4. The authors are requested to write clearly on one side of A4 size paper. The relevant pictures in 4cm X 6 cm size are welcome. **Photo copies of manuscripts are not accepted for consideration.**
5. Each article will be ordinarily of two to three printed pages in A4 size papers.
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