VIDERE ET VIDERI

Department of Physical Science, 2023

MAR BASELIOS COLLEGE OF EDUCATION

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Binoj T

Principal's Message

I am very happy and proud to know that the Physical Science department of Mar Baselios College of Education Bathery is going to release a science magazine titled ‘Videre et Videri'. Let this magazine be an eye opener to the readers and let it glow their inner lights to its zenith.

Special congratulations to the whole team who worked hard in fulfilling the dream....

Congratulations

Jayakala M

Vice Principal's Message

I am very happy to know that the second year physical science students are going to publish the e-magazine titled “Videre Et Videri”.

I personally wish all the students associated with the magazine’s successful publication, heartfelt congratulation for their commendable effort and wish everyone a bright future.

Members of the Editorial Board (2022-2023)

Binoj T

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Jayakala M

Vice Principal &

Staff advisor

Remya Raj E T

Student Editor

Arathi K N

Joint Student Editor

Remya Raj

Editor's Note

"Science knows no country because knowledge belongs to humanity, and is the torch which illuminates the world".

- Louis Pasteur

Dear reader,

Science is the way of understanding and perceiving anything around you, without fear and judgement. As world keeps moving, science facilitates us to see things and to be seen. This inspired us to choose the title "**Videre et videri**" which signifies '**to see and to be seen**' in Latin. From battling the COVID pandemic to leading human race to the light of knowledge of truth, the role of science is beyond recognition. Its unravelling power has always motivated us to indulge in discussions on various matters of science, and eventually lead us to creating a magazine on the same. The articles included here are little packs of knowledge on different areas of science, beaded loosely to fit into anyone's pocket.

In fact, the torch bearer for this venture is our class teacher, also the vice principal, whose encouragement could only fuel the fire we all had. Since the pandemic, learning systems had a face change and that had made us to shift to a digital magazine instead of traditional one.

And this is how it goes **......**

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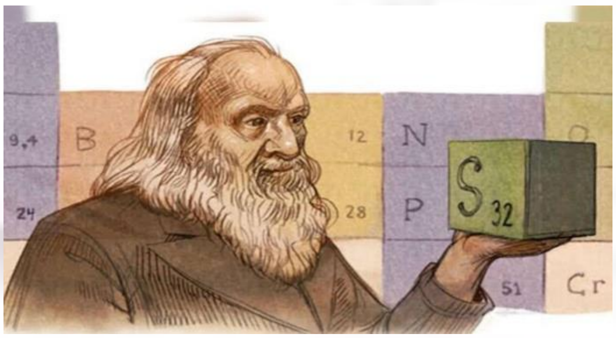
Marshalin Maria Paul

FAVOURITE SCIENCE GOOGLE DOODLES

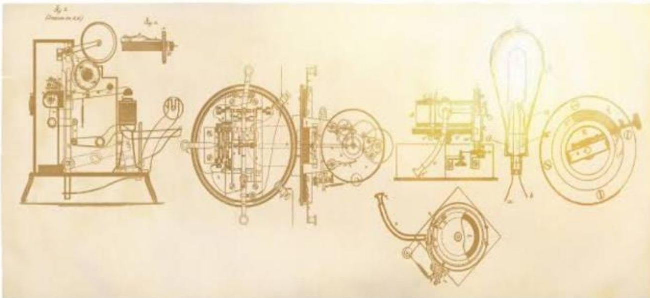
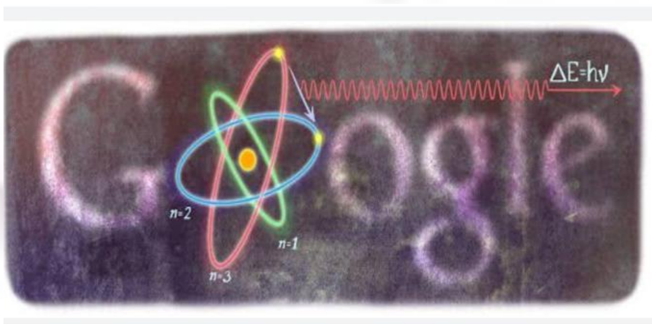
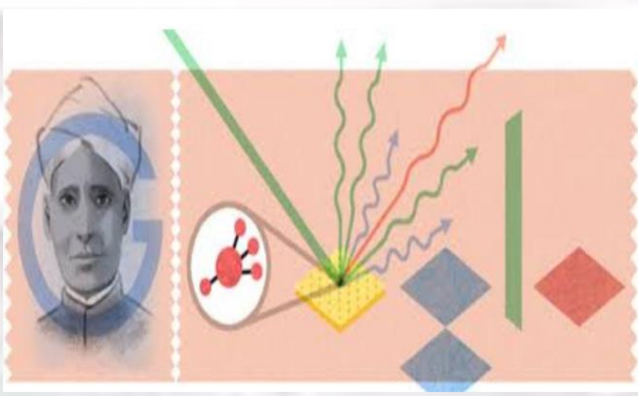
A Google Doodle is a special, temporary alteration of the logo on Google's homepages intended to commemorate holidays, events, achievements, and notable historical figures. The first Google Doodle honored the 1998 edition of the long-running annual Burning Man event in Black Rock City, Nevada, and was designed by co-founders Larry Page and Sergey Brin to notify users of their absence in case the servers crashed. Initially, Doodles were neither animated nor hyperlinked—they were simply images with tooltips describing the subject or expressing a holiday greeting. Doodles increased in both frequency and complexity by the beginning of the 2010s. In January 2010 the first animated Doodle honored Sir Isaac Newton. The first interactive Doodle appeared shortly thereafter celebrating Pac-Man, and hyperlinks also began to be added to Doodles, usually linking to a search results page for the subject of the Doodle. In addition to celebrating many well-known events and holidays, Google Doodles celebrate artists and scientists on their birthdays.

Doodles are the fun, surprising, and sometimes spontaneous changes that are made to the Google logo to celebrate holidays, anniversaries, and the lives of famous artists, pioneers, and scientists. Since 1998, more than 2000 different Doodles have appeared on the Google homepage around the world. Google has celebrated the birthdays of some fascinating female scientists over the past years. Nowadays doodles are designed and published by a team of employees called "doodlers". The team has created over 5000 doodles for google homepages around the world. A group of Googlers get together regularly to brainstorm and decide which events will be celebrated with a doodle. Google holds competitions for school students to create their own Google doodles, referred to as "Doodle 4 Google". Winning doodles go onto the Doodle4Google website, where the public can vote for the winner, who wins a trip to the Googleplex and the hosting of the winning doodle for 24 hours on the Google website. The ideas for the doodles come from numerous sources including Googlers and Google users. The doodle selection process aims to celebrate interesting events and anniversaries that reflect Google's personality and love for innovation. Doodles Wiki is a community site that anyone can contribute to Discover, share and add your knowledge.

Now we are living in a digital world. Science related google doodles are interesting and disclosing many inventory facts. It promotes scientific attitude and scientific temper in viewers. It develops curiosity in the views to know more about the events highlighted in the google logo. We're smitten with the Google's iconic nods to major events in world history, especially when they are science themed. Here are some of our favourite science Google Doodles.

	This Google Doodle marks the anniversary of the day Danish astronomer Olaus Roemer discovered the speed of light by measuring the timings of an eclipse of jupitor’s moon lo from two different distances
	This doodle on the Google home pages in many countries around the world shows Russian chemist Dmitri Mendeleev in the act of setting down the periodic table- the comprehensive system of classifying the chemical elements.
	Google marked the 50th anniversary of the historic first Moon-landing by NASA's Apollo 11 mission with an interactive video doodle. The Doodle celebrates the epic moment in the history of mankind by taking viewers through the journey to the Moon and back, narrated by Apollo 11 mission astronaut Michael Collins, who is famous for orbiting the Moon in solitude

	Google Doodle Celebrates German Chemist Friedlieb Ferdinand Runge Who Identified Caffeine. Runge is best remembered for identifying caffeine, the psychoactive drug present in coffee beans which is responsible for stimulating the central nervous system.
	This Google Doodle honors the life of a legendary scientist and physicist Marie Curie, winner of Nobel prizes for her work in chemistry and physics. On her 144th birthday, Google honors her contributions to radiology, science, and the first world war.
	Google doodle celebrates 100th birthday of a renowned Indian chemist Asima Chatterjee, who was also the first female Doctorate of Science in India from an Indian university. The doodle shows a skeletal formula and a drawing of Chatterjee with green leaves for hair, a nod to her work in Indian medicinal plants

	The logo illustrates some of Edison’s most famous inventions including the electric light bulb, phonograph, and the motion picture camera in his 164th birthday. Edison holds over 1,000 U.S. patents and is the most well-known inventor of all time.
	Google has a special logo on their home page for Niels Bohr's 127th birthday. The doodle is depiction of the Bohr model of the hydrogen atom, which, though simple, is still the introduction of quantum mechanics for many students.
	Google doodle celebrates the 125th birth anniversary of the scientist with an illustration of the Raman Effect. While Raman’s face is featured behind Google’s G, the two Os that follow demonstrate the Raman Effect, a discovery that saw him win a Nobel Prize in 1930.
	Google doodle celebrates the life and work of British biophysicist and xray crystallographer Rosalind Franklin, whose research led to the discovery of structure of DNA.

	Google doodle recognizes Jan Ingenhousz, the 18th century Netherlands scientist credited with discovering the photosynthesis process. He discovered and published his research on plants producing oxygen in the sunlight and carbon dioxide in the dark.

Akhila P Suku

Athulya Manoj

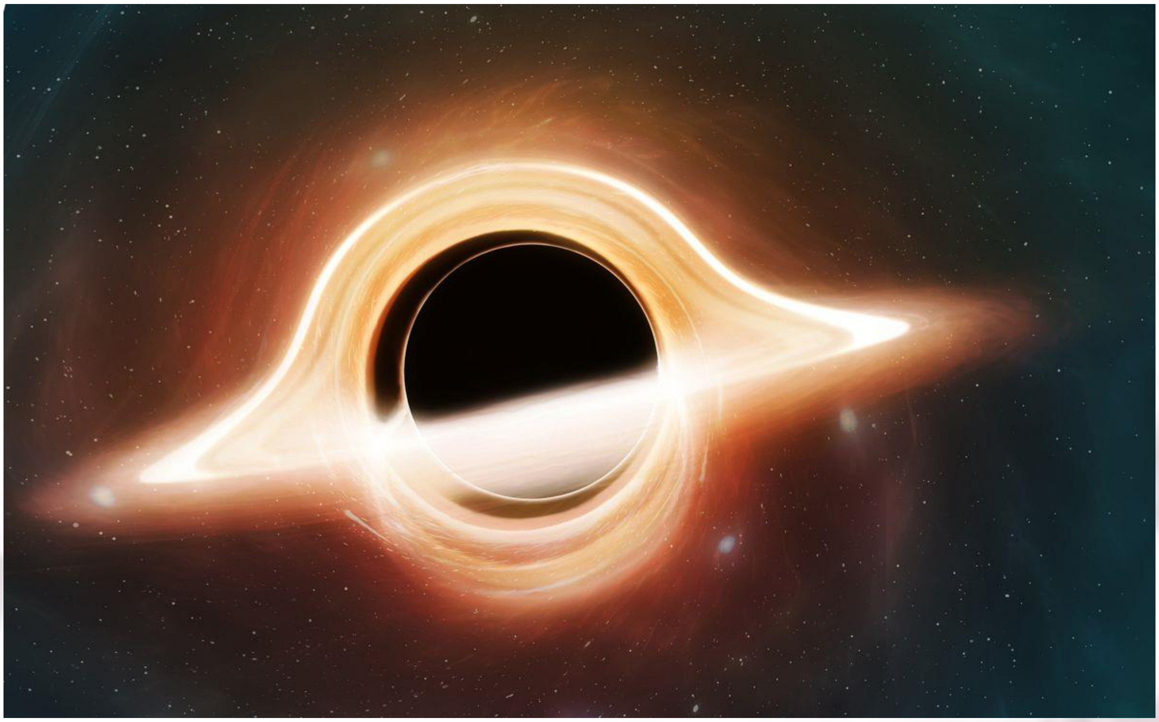
THE PHYSICS OF AURORA

'The stunning swirls of light dazzle the night skies' this is how aurora is described in the view of a tourist. In the upper northern hemisphere this aurora is termed as 'northern lights' or aurora borealis' and in lower southern hemisphere the aurora is termed as southern lights or aurora australis. When we discuss these stunning natural phenomena first, we should know about some other important things. Such as the Sun, Solar wind, Earth's Magnetic field and Earth's Atmosphere. This phenomenon starts right from the middle of the Sun. The Sun is the giant burning star in our solar system. The Sun can be described as a power plant which produces an enormous amount of high energy. There are three main parts to the Sun's interior: the core, the radiative zone, and the convective zone. The core is at the center. At the core of the sun there is high temperature and pressure where the nuclear fusion reactions that power the Sun occur.

Moving outward, next comes the radiative (or radiation) zone. Its name is derived from the way energy is carried outward through this layer, carried by photons as thermal radiation. The third and final region of the solar interior is named the convective (or convection) zone. It is also named after the dominant mode of energy flow in this layer; heat moves upward via roiling convection. Due to this nuclear reaction energy releases and thus light radiates outwards. And eventually from the outer layers the heat moves to the surface by convection. These charges contain electrical charges and these charges make strong magnetic fields inside the sun. In some regions in the sun these magnetic fields are pushed outwards (sunspots are formed). Electrically charged particles of hot gas are called plasma, this plasma will drag the magnetic field further outward. And this plasma will flow out from the corona (outermost part in the sun's atmosphere) of the sun as a stream of charged particles this is called Solar wind. As the wind travels off the sun, it carries charged particles and magnetic clouds. Emitted in all directions, some of the solar wind will reach the earth. If the charged particles carried by the solar wind reached a planet's surface, its radiation would do severe damage to any life that might exist.

Earth has its magnetic field which extends from the South pole to North pole. And this magnetic field of earth acts as a protective layer for Earth. The charged particles which accelerate from the sun reach the earth's magnetic field and get deflected. But some charged particles travel along the magnetic field of earth and reach the atmosphere of poles. The electrons from the particle interact with atoms (like nitrogen and oxygen) in the atmosphere. The interaction makes the atoms jump into a higher energy state and thus emit photons of different colours. That we see as Aurora.

The next question: what makes these charged particles turn into light emitting photons? Auroras are in fact caused by interactions between energetic particles from the Sun and the Earth's magnetic field. Invisible magnetic field lines travel from the Earth's northern magnetic pole to its southern magnetic pole. The immediate cause of the ionization and excitation of atmospheric constituents leading to auroral emissions. These high-speed particles from solar wind strike the atom or molecule in Earth's atmosphere. When the electron in one of the atoms gets excited into a higher level, now the atom is in the excited state. After a while the electron in the excited state jumps back into the original lower energy state. It releases a photon and this is the reason for the spectacular auroral emission. The color of the emission differs according to the electron and element in which the particle got interacted. The composition and density of the atmosphere and the altitude of the aurora determine the possible light emissions. When an excited atom or molecule returns to the ground state, it sends out a photon with a specific energy. This energy depends on the type of atom and on the level of excitement.



THE BLACKHOLE: KEY TO THE MYSTERIOUS WORLD

RASHEEDA K

The idea of black holes was rediscovered in 1916, after Einstein published his theory of gravity. Karl Schwarzschild then solved Einstein's equations for the case of a black hole, which he envisioned as a spherical volume of warped space surrounding a concentrated mass and completely invisible to the outside world. Dr. Hawking is best known for his discovery that black holes emit radiation which can be detected by special instrumentation. His discovery has made the detailed study of black holes possible. They are born most likely as a result of supernova explosions of massive stars. On late stages of evolution such a star consists of a compact and dense core and an extensive rare envelope. Finally, the core loses stability and collapses into a black hole. The envelope is erupted out and observed as a supernova phenomenon. During all the process the collapsing core is surrounded by some plasma, which is very good conductor. Usually, it is considered as a critical argument that the core, and, consequently, the newborn black hole cannot have any significant charge.

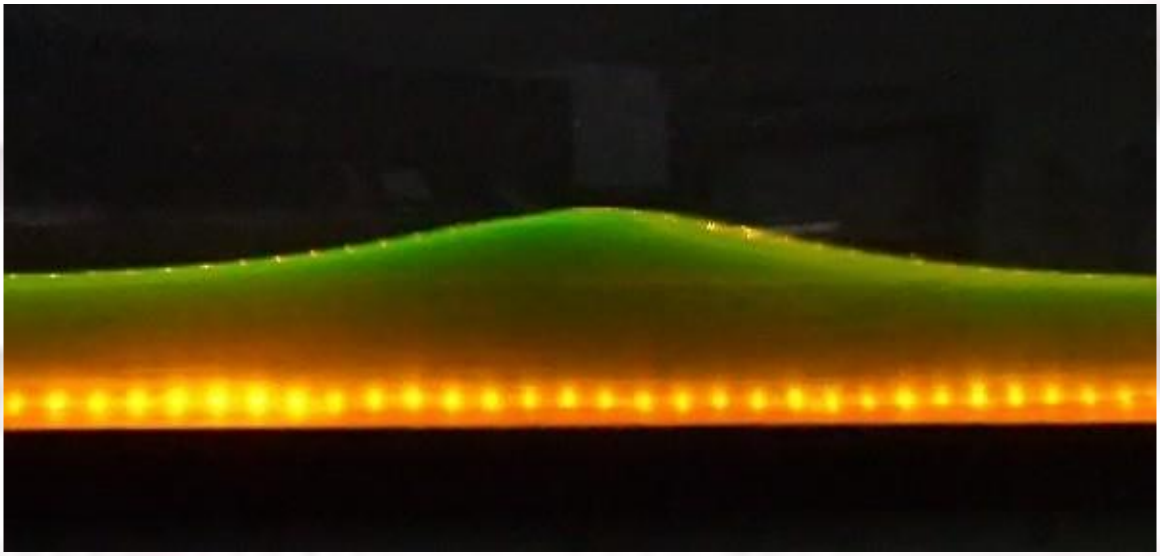
Scientists can't directly observe black holes with telescopes that detect x-rays, light, or other forms of electromagnetic radiation. We can, however, infer the presence of black holes and study them by detecting their effect on other matter nearby. If a black hole passes through a cloud of interstellar matter, for example, it will draw matter inward in a process known as accretion. A similar process can occur if a normal star passes close to a black hole. In this case, the black hole can tear the star apart as it pulls it toward itself. As the attracted matter accelerates and heats up, it emits x-rays that radiate into space. Recent discoveries offer some tantalizing evidence that black holes have a dramatic influence on the neighborhoods around them – emitting powerful gamma ray bursts, devouring nearby stars, and spurring the growth of new stars in some areas while stalling it in others. Most black holes form from the remnants of a large star that dies in a supernova explosion. If the total mass of the star is large enough (about three times the mass of the Sun), it can be proven theoretically that no force can keep the star from collapsing under the influence of gravity. However, as the star collapses, a strange thing occurs. As the surface of the star nears an imaginary surface called the "event horizon," time on the star slows relative to the time kept by observers far away. When the surface reaches the event horizon, time stands still, and the star can collapse no more – it is a frozen collapsing object. Even bigger black holes can result from stellar collisions. Soon after its launch in December 2004, NASA's Swift telescope observed the powerful, fleeting flashes of light known as gamma ray bursts. Chandra and NASA's Hubble Space Telescope later collected data from the event's "afterglow," and together the observations led astronomers to conclude that the powerful explosions can result when a black hole and a neutron star collide, producing another black hole.

Although the basic formation process is understood, one perennial mystery in the science of black holes is that they appear to exist on two radically different size scales. On the one end, there are the countless black holes that are the remnants of massive stars. Peppered throughout the Universe, these "stellar mass" black holes are generally 10 to 24 times as massive as the Sun. Astronomers spot them when another star draws near enough for some of the matter surrounding it to be snared by the black hole's gravity, churning out x-rays in the process. Most stellar black holes, however, are very difficult to detect. Judging from the number of stars large enough to produce such black holes, however, scientists estimate that there are as many as ten million to a billion such black holes in the Milky Way alone.

On the other end of the size spectrum are the giants known as "supermassive" black holes, which are millions, if not billions, of times as massive as the Sun. Astronomers believe that supermassive black holes lie at the center of virtually all large galaxies, even our own Milky Way. Astronomers can detect them by watching for their effects on nearby stars and gas.

Binary blackhole

Sreejitha E S



SOLITON

The early history of solitons or solitary waves began in August 1834 when the Victorian engineer John Scott Russell observed a solitary wave traveling along a Scottish canal. The definite theory was not published until 1895 by Korteweg and de Vries, working in Amsterdam. This subject was reborn in plasma physics in 1958 with the discovery, by J.H. Adlam and author, of solitary waves in a collision less plasma containing a magnetic field. In 1965 Zabusky and Kruskal found, by numerical investigation, that such wave retains their identity after colliding. This Particle - like behaviour lead these authors to introduce the term soliton to replace the term solitary wave.

It was two competing teams of physicists have found a way of manipulating atoms in a Bose-Einstein condensate (BEC) to form soliton waves. Solitons are stable localized waves that propagate through a medium without spreading. William Phillips from the US National Institute of Standards and Technology (NIST)in Gaithersburg and colleagues used pulses of laser light to “imprint” a standing wave into a BEC of sodium atoms and a matter-wave interferometer to prove that the wave maintains its phase pattern as it travels through the material.

Bose-Einstein condensation is first predicted by Einstein and Indian physicist Bose in 1924-1925. It is an exotic quantum phenomenon that was observed in dilute atomic gases for the first time in 1995. The “condensate” here is a state of matter of a dilute gas of bosons at temperatures close to 0 kelvins, which is different from the “condensate” in day life. One of the interesting dynamical features in the context of Bose-Einstein condensate (BEC) is the formation of matter wave solitons such as bright solitons, dark Solitons, vortex solitons, and gap solitons, which have been experimentally achieved before. recent experimental technique for managing non linearity have attracted considerable attention. During the past decades work towards BEC in weakly interacting system has been carried forward with the Excitonic in semiconductors and called trapped atoms. BEC has been observed in excitonic system, but a complete theoretical treatment lacking. The pioneering work towards BEC in atomic gases was performed with the spin- polarized atomic hydrogen., In the mean field theory BEC system can be well described by the Gross- Pitaevskii (GP) Equation whose coefficients in front of cubic terms comes from the interatomic interaction. Under certain condition, the GP equation can be converted into classical nonlinear Schrodinger equation (NLS). It is known that at low densities the three-body interaction can be neglected and S-wave two body interactions achieve a dominant position. However, the three body interactions play a key role in BEC at high densities. Similarly, a BEC with two and three body interactions can be described by the GP equation with cubicquintic nonlinearity, also called the variable coefficient cubic – quintic nonlinear Schrodinger equation.

The formation of matter wave soliton is one of the attracting dynamical features in the context of exotic Quantum phenomenon called Bose-Einstein condensate. They appear in the diverse context of science and engineering such as fibre optic communication, dynamics of wave in shallow water, transport along DNA and other macromolecules. Solitons may be either bright or dark depending on the details of the governing non-linear equations. Thus, the formation of solitons in Bose-Einstein condensate, on the basis of the nonlinear Schrödinger equation, the so-called Gross-Pitaevskii (GP) equation which is a mean-field description of BECs.

Experimental demonstration of a Soliton gas

Archana Rajeev

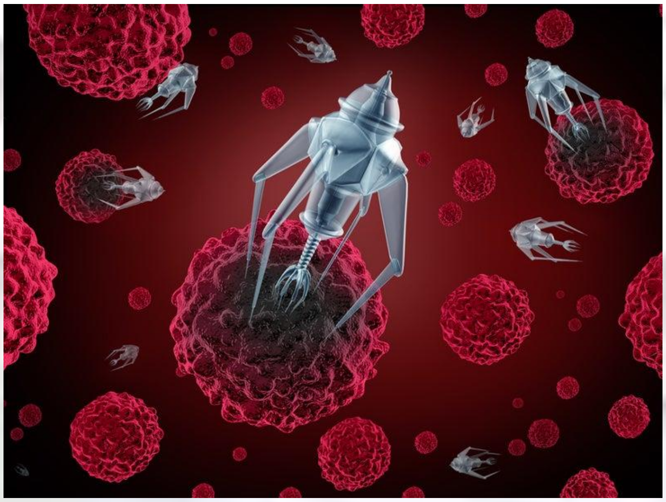
NANOTECHNOLOGY AND ITS FUTURE APPLICATIONS

Nanotechnology, also shortened to nanotech, is the use of matter on an atomic, molecular, and supramolecular scale for industrial purposes. The earliest, widespread description of nanotechnology referred to the particular technological goal of precisely manipulating atoms and molecules for fabrication of macroscale products, also now referred to as molecular nanotechnology. A more generalized description of nanotechnology was subsequently established by the National Nanotechnology Initiative, which defined nanotechnology as the manipulation of matter with at least one dimension sized from 1 to 100 nanometers (nm)

Applications:

1.

Doctors inside your body: Wearable fitness technology means we can monitor our health by strapping gadgets to ourselves. There are even prototype electronic tattoos that can sense our vital signs. But by scaling down this technology, we could go further by implanting or injecting tiny sensors inside our bodies. This would capture much more detailed information with less hassle to the patient, enabling doctors to personalize their treatment.



2.

Sensors, sensors, everywhere: These sensors rely on newly invented nanomaterials and manufacturing techniques to make them smaller, more complex and more energy efficient. For example, sensors with very fine features can now be printed in large quantities on flexible rolls of plastic at low cost. This opens up the possibility of placing sensors at lots of points over critical infrastructure to constantly check that everything is running correctly. Bridges, aircraft and even nuclear power plants could benefit.

3.

Making big data possible: All these sensors will produce more information than we've ever had to deal with before – so we'll need the technology to process it and spot the patterns that will alert us to problems. The same will be true if we want to use the "big data" from traffic sensors to help manage congestion and prevent accidents, or prevent crime by using statistics to more effectively allocate police resources.

4.

Tackling climate change: The fight against climate change means we need new ways to generate and use electricity, and nanotechnology is already playing a role. It has helped create batteries that can store more energy for electric cars and has enabled solar panels to convert more sunlight into electricity.

5.

Nanobots: Nanobots are nanoscopic machines programmed to deliver a specific task. They've been functional on both bioorganic matter and inorganic matter and have been central in many of today's significant advancements in virology, clean energy, water filtration and 3D printing.

Nanobots can deliver medicine, move as a unit to improve the source collection of wind and solar resources, clean contaminated water and link together to replicate a 3D object and enact the point of its function.

6.

Nanomedicine: Nanomedicine is already a thriving area of practice. The term refers "to the use of materials at the nanoscale to diagnose and treat disease. Some researchers define nanomedicine as encompassing any medical products using nanomaterials smaller than 1,000 nanometers. Others more narrowly use the term to refer to injectable drugs using nanoparticles smaller than 200 nanometers."

(The image shows the bamboo like structure of nitrogen – doped carbon nanotubes for treatment of cancer)

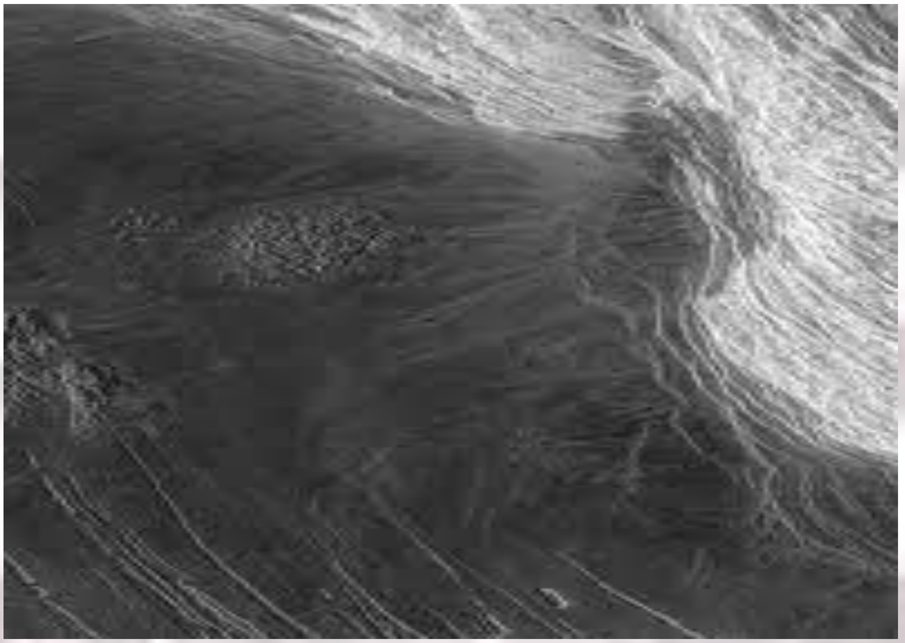
7.

Energy applications: Nanotechnology is finding application in traditional energy sources and is greatly enhancing alternative energy approaches to help meet the world's increasing energy demands. Many scientists are looking into ways to develop clean, affordable, and renewable energy sources, along with means to reduce energy consumption and lessen toxicity burdens on the environment.

(New solar films incorporate nanoparticles to create lightweight, flexible solar cells)

Nanotechnology and its microscopic universe offer gigantic possibilities for contemporary science and industry. This field, which flourished between the 60s and 80s, has surged in the last two decades with a booming global market whose value will exceed 125,000 million dollars in the next five years according to the Global Nanotechnology Market.

Anitta Johny



ICE ON VENUS

It was suggested that the similarity between the amount of CO_2 in the atmosphere of Venus and the total amount of gas evolved by earth raises a serious question about the absence of terrestrial amounts of water on Venus. His solution to this dilemma postulates that the water is present in the form of polar ice caps.

It is the purpose of this note to call attention to some weakness in the arguments. In order to have extensive icecaps at the poles of Venus the temperature there must be well below freezing. The available observation does not support this condition. Clark and kuzmin has reported interferometric radiometer measures at 10.6 cm, which indicate temperature above 420^{o}k at the poles. Ligby argues that these results are probably invalid because of the large amount of attenuation caused by the intervening atmosphere. However, the attenuation could act to decrease the observed temperature from its true value; this implies that the poles are even warmer than the values suggested by Clark and kuzmin. Furthermore, these authors found an increase in temperature towards the equatorial limb, where the atmospheric attenuation would be just as large as at the poles.

Arathi K N

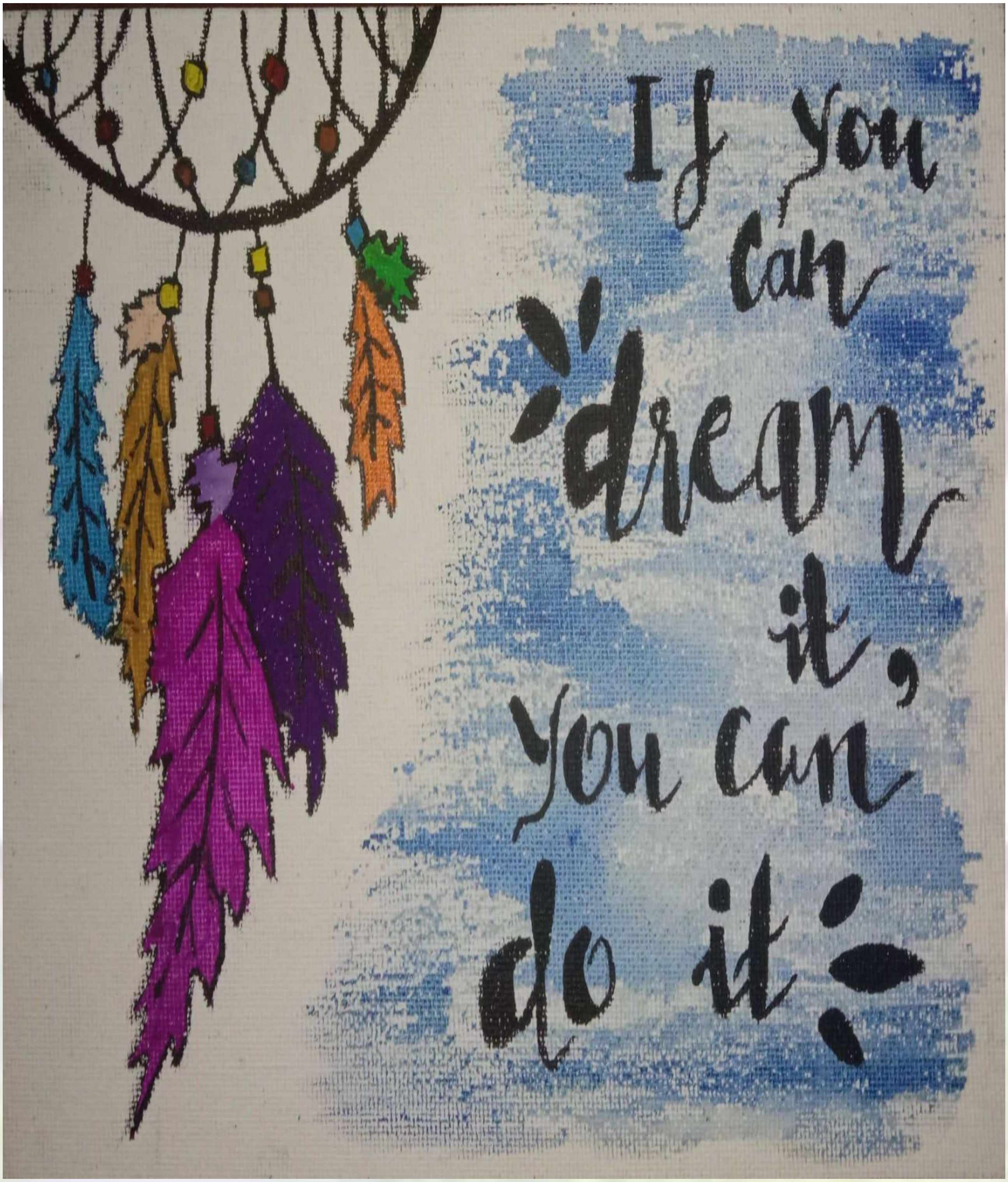
INTRODUCTION TO DIELECTRIC SPECTROSCOPY

ARATHI K N

Broadband Dielectric Spectroscopy (BDS) and Nuclear Magnetic Resonance (NMR) spectroscopy are the experimental tools to study molecular dynamics in a broad frequency (10-6 Hz to 10+11 Hz) range and at different temperatures. It has the additional advantage that the sensitivity of the measurements increases with decreasing separation of the electrodes and hence with decreasing amount of sample material. Using nanostructured electrode arrangements; the ultimate goal of measuring the dynamics of single molecules or isolated molecular assemblies becomes feasible. This offers exciting perspectives for sensor applications and for bio-physics. Using nano-structured electrode arrangements in BDS enables one to address a multiple of novel physical topics. It is possible to measure the molecular dynamics of sub molecular layers of polymers. With refinement of this approach, it will be possible to study the dynamics of isolated grafted polymers in a wide frequency and temperature range.

Furthermore, it is using modern preparative techniques - possible to anchor biological macromolecules on surfaces of doped silicon. Thus, one can also expect measurements of the molecular dynamics in proteins and DNA. For sensor applications, it could be of interest to determine the dielectric properties of immobilized enzymes interacting with an appropriate partner molecule. For applications of polymer batteries, charge transport in polyelectrolytes close to solid-state surfaces is of central importance; this can be studied using nano-structured electrodes as well. The complexity richness of the dynamical behavior of glass-forming polymers demands the combination of several experimental techniques in order to achieve a full characterization of the different dynamical processes and their possible interconnections.

Broadband dielectric spectroscopy and quasielastic neutron scattering turn out to be very useful complementary techniques for such an investigation. While BDS observes the dielectric permittivity, which reflects the orientational dynamics of the molecular dipoles in the sample. Precise information on the temperature dependence of the characteristic times and the spectral shape of Polymer Dynamics by Dielectric Spectroscopy can be obtained from BDS.



Akhila P Suku

Stella Sabu

ARTIFICIAL INTELLIGENCE IN PANDEMIC

During the current global public health emergency caused by novel coronavirus disease 19 (COVID-19), researchers and medical experts started working day and night to search for new technologies to mitigate the COVID-19 pandemic. Artificial intelligence works in a proficient way to mimic like human intelligence. It may also play a vital role in understanding and suggesting the development of a vaccine for COVID-19. This result-driven technology is used for proper screening, analyzing, prediction and tracking of current patients and likely future patients. The significant applications are applied to tracks data of confirmed, recovered and death cases.

In this worldwide health crisis, the medical industry is looking for new technologies to monitor and controls the spread of COVID-19 (Coronavirus) pandemic. AI is one of such technology which can easily track the spread of this virus, identifies the high-risk patients, and is useful in controlling this infection in real-time. It can also predict mortality risk by adequately analyzing the previous data of the patients. AI can help us to fight this virus by population screening, medical help, notification, and suggestions about the infection control. This technology has the potential to improve the planning, treatment and reported outcomes of the COVID-19 patient, being an evidence-based medical tool.

I) Early detection and diagnosis of the infection

AI can quickly analyze irregular symptom and other 'red flags' and thus alarm the patients and the healthcare authorities. It helps to provide faster decision making, which is cost-effective. It helps to develop a new diagnosis and management system for the COVID 19 cases, through useful algorithms. AI is helpful in the diagnosis of the infected cases with the help of medical imaging technologies like Computed tomography (CT), Magnetic resonance imaging (MRI) scan of human body parts.

II) Monitoring the treatment

AI can build an intelligent platform for automatic monitoring and prediction of the spread of this virus. A neural network can also be developed to extract the visual features of this disease, and this would help in proper monitoring and treatment of the affected individuals. It has the capability of providing day-to-day updates of the patients and also to provide solutions to be followed in COVID-19 pandemic.

III) Contact tracing of the individuals

AI can help analyze the level of infection by this virus identifying the clusters and 'hot spots' and can successfully do the contact tracing of the individuals and also to monitor them. It can predict the future course of this disease and likely reappearance.

IV) Projection of cases and mortality

This technology can track and forecast the nature of the virus from the available data, social media and media platforms, about the risks of the infection and its likely spread. Further, it can predict the number of positive cases and death in any region. AI can help identify the most vulnerable regions, people and countries and take measures accordingly.

V) Development of drugs and vaccines:

AI is used for drug research by analyzing the available data on COVID-19. It is useful for drug delivery design and development. This technology is used in speeding up drug testing in real-time, where standard testing takes plenty of time and hence helps to accelerate this process significantly, which may not be possible by a human. It can help to identify useful drugs for the treatment of COVID-19 patients. It has become a powerful tool for diagnostic test designs and vaccination development. AI helps in developing vaccines and treatments at much of faster rate than usual and is also helpful for clinical trials during the development of the vaccine.

VI) Reducing the workload of healthcare workers

Due to a sudden and massive increase in the numbers of patients during COVID-19 pandemic, healthcare professionals have a very high workload. Here, AI is used to reduce the workload of healthcare workers. It helps in early diagnosis and providing treatment at an early stage using digital approaches and decision science, offers the best training to students and doctors regarding this new disease. AI can impact future patient care and address more potential challenges which reduce the workload of the doctors.

VII) Prevention of the disease

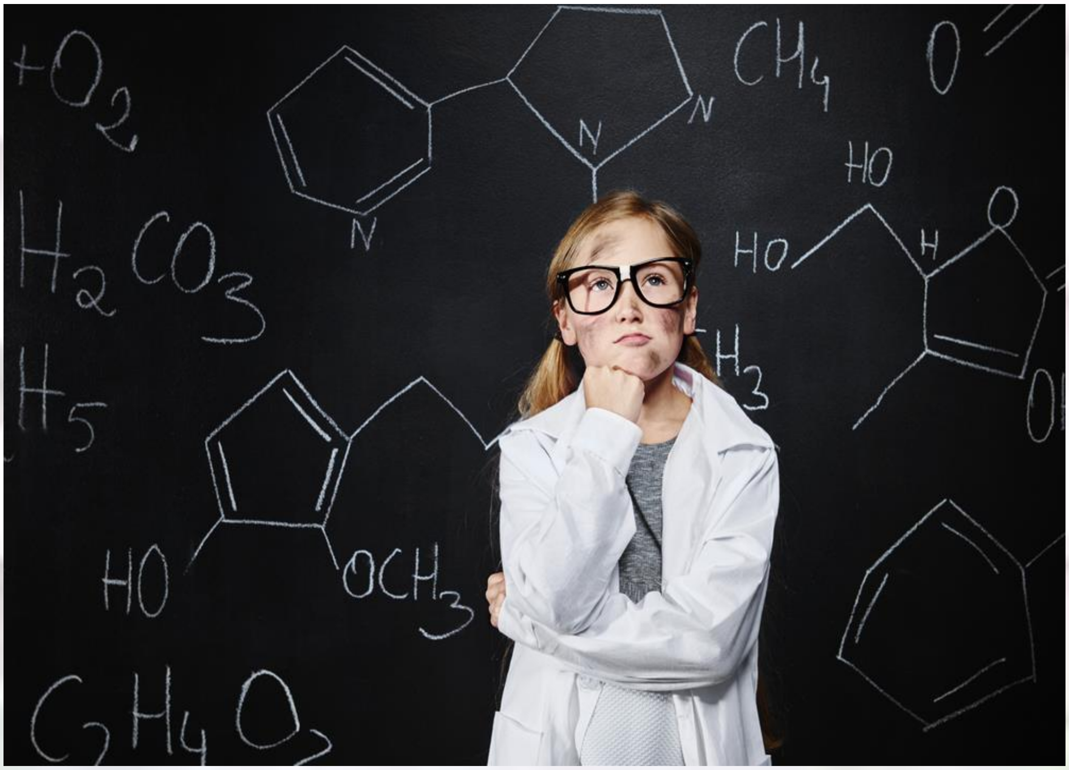
With the help of real-time data analysis, AI can provide updated information which is helpful in the prevention of this disease. It can be used to predict the probable sites of infection, the influx of the virus, need for beds and healthcare professionals during this crisis. AI is helpful for the future virus and diseases prevention, with the help of previous mentored data over data prevalent at different time. It identifies traits, causes and reasons for the spread of infection. In future, this will become an important technology to fight against the other epidemics and pandemics. It can provide a preventive measure and fight against many other diseases. In future, AI will play a vital role in providing more predictive and preventive healthcare.

Conclusion & future perspective

Adopting a three-pronged approach based on testing, isolation and contact tracing is warranted to combat COVID-19. It is necessary to exploit the available knowledge base to develop effective chemotherapeutic agents against COVID-19, taking cues from lessons learnt in the past during other such outbreaks.

As there is no silver bullet available to cure the disease, we need to hasten progress on all fronts ranging from surveillance and monitoring to prevention and treatment. AI was found to be on par with and even more accurate than human experts in COVID-19 diagnosis and drug discovery. We need bigger datasets for training AI models and a legal framework and ethical considerations for sharing data before AI takes the forefront in diagnosis and other areas. Several bottlenecks in harnessing AI to its full potential in the current scenario are availability and sharing of clinical and epidemiological data, computational resources, scalability, privacy and ethical concerns.

Thahasin Aboo



SCIENTIFIC CURIOSITY: GENERATING NEW SCIENTISTS

While the world still mourns the loss of Professor Hawking — a renowned scientist famed for his work on black holes and relativity, I am stuck with some curiosities. Why do we have only a limited number of extraordinary scientists on earth? Why are we not able to nurture such incredibly intelligent talent in large numbers?

Curiosity is the mother of invention, they say.

It was the curiosity of knowing the reason behind the fall of an apple which made Isaac Newton invent the Laws of Motion. Aryabhatta, Kepler, Einstein and a few more, were those super-brains who led the path to scientific advances. I wonder – why, we did not have another Galileo since generations? Why is that a person who was on a wheelchair from the age of 21, had so much to contribute to the world of science, while those who have access to facilities and luxuries reach nowhere close? Why don't we have more of CV Raman, Homi Bhabha, Ramanujan?

Another question, which triggers, is to understand how these super intelligent scientists could bring out universally powerful inventions in the absence of advanced tools and technology! I am sure there were no calculators, no mechanism to measure gravity or no instrument to calibrate resistance et al. in those days! In my opinion, the current generation too has the potential to deliver path-breaking researches & discoveries; however, their curiosities are misplaced and not aligned with productivity.

Recent India lost many famous actresses, and the saga was over-traded in the naive human mind. As a teacher student, students demonstrated unprecedented curiosity in knowing more about the incident and even spent hours discussing it in school corridors! However, one would rarely find these students stretching their thoughts & debating over subjects of scientific interests.

My concern is about 'curiosity' – aren't we as a generation, insidiously getting digressed in the application of curiosity?

In an interview, Apple co-founder Steve Wozniak mentioned that in India we measure success by academic excellence, but people lack creativity. Right or wrong, as he may be; the fact of the matter is that the students of science, not just in India but across the globe might not be encouraged to be curious & hence creativity is becoming scarce.

It seems that the 'art of thinking' is getting extinct today. When the student is not exercising the ability to think and when the thoughts are restricted within boundaries of available information; innovation & creativity become a severe casualty. Learning is a direct function of asking questions. As a teacher, during our class, we should encourage the students to ask questions – how so ever basic, advanced, crazy or ridiculous those might be.

In the delusory race of growth, somewhere, we seem to have compromised with curiosity, or worst killed it altogether. Say for example the students of physics would appreciate that while arriving at the formulae for Force as 'Mass x Acceleration' ($F = ma$) the primary, two, confirmed hypotheses available were:

1) Force is directly proportional to Mass ($F \propto m$)
2) Force is directly proportional to Acceleration ($F \propto a$)

This led to an obvious conclusion that Force has to be directly proportional to both combined, i.e., Mass x Acceleration ($F \propto ma$).
To convert this hypothesis into an equation, the researchers supposed the existence of an unknown constant "k" in the scheme of things and delivered the formulae "$F = kma$".

Later, for mathematical convenience, it was assumed that the value of this constant (k) is equal to one (1) and thereafter, the students of science in schools and universities across the world are being taught Newtons Second Law of Motion with the equation "$F = ma$."

The point to be specifically observed is that "k" which is an inexplicable constant introduced in the equation, remains unexplained and less understood. Over the years, the students of science have taken this "k=1″ as given and never questioned it. To my knowledge, the current age science basics have many such hidden and inbuilt constants, which have never been challenged. Whatever research being undertaken by the new age scholars is getting built on the ambiguous foundation of such constants! No one, probably, is keen to question these laws or is curious enough to think beyond the established framework.

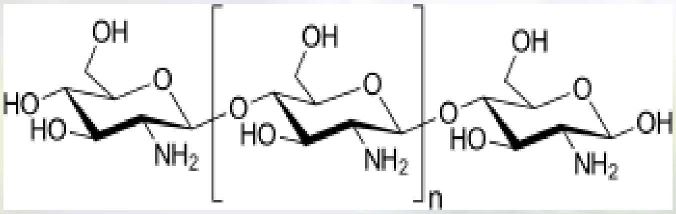
This lack of curiosity, possibly, could be the reason that world has not seen more Newtons and Visvesvaraya's thereafter! I recommend that our schools should encourage students to ask questions, challenge opinions as well as theorems and be motivated to extract never before corollaries. I sincerely implore the policymakers in the field of education & research to work towards nurturing the fundamental human parameter of 'curiosity' – this must be designed as an integral element in the education framework for our future generations. Lest, we get stuck with misplaced curiosities and allow our youth to get unduly keen on the stories of deaths, dramas or other social happenings all around. Only the power of curiosity can lead us to the next big 'Eureka moment' in the world of science & research.

Jaslin Sakkariya

CHITOSAN

Chitosan is a linear polysaccharide composed of randomly distributed beta (1-4)-linked D- glucosamine and N-acetyl-D-glucosamine (acetylated unit). It is made by treating the chitin shells of shrimp and other crustaceans with an alkaline substance like a sodium hydroxide.

Chitosan is a bioactive polymer with a wide variety of applications due to its functional properties such as antibacterial activity, non-toxicity, ease of modification and biodegradability. The membrane form of this polymers has a typical thickness in the range of approximately 300-400 micrometer. Due to its low cost, easy film-forming capacity, environmental friendliness, alkalis stability, biodegradability, excellent mechanical properties, and thermal stability, it is very valuable in the preparation of membranes. Many studies have reported that chitosan has an excellent ability to form micro spheres, membranes and fibers which gave it a significant advantage over other absorbable membrane materials in the design of packaging structures. It is insoluble in water, but chitosan is porous, so it is capable of retaining water.



Chemical structure of Chitosan

Properties of Chitosan

Most of the naturally occurring polysaccharides e.g., cellulose, dextrin, agar and agarose are natural and acidic in nature, whereas chitin and chitosan are examples of highly basic polysaccharides. Their properties include solubility in various media, solution, viscosity, polyelectrolyte behavior, ability to form films, metal chelation, optical, and structural characteristics. Chitosan undergoes the reactions typical of amines, of which N-acylation and Schiff reactions are the most important. Chitosan glucans are easily obtained under mild conditions but it is difficult to obtain cellulose glucans. N-acylation with acid anhydrides or acyl halides introduces amido groups at the chitosan nitrogen. Acetic anhydride affords fully acetylated chitins. Linear aliphatic N-acyl groups higher than propionyl permit rapid acetylation of hydroxyl groups in chitosan.

Chitosan forms aldimines and ketimines with aldehydes and ketones, respectively, at room temperature; reaction with ketoacids followed by reduction with sodium borohydride producesglucans carrying proteic and non-proteic amino acid groups. N-carboxyl-methyl chitosan is obtained from glyoxylic acid. Chitosan and simple aldehydes produce N-alkyl chitosan upon hydrogenation. The presence of more or less bulky substituent weakens the hydrogen bonds ofchitosan; therefore, N-alkyl chitosan's swell in water in spite of hydrophobicity of alkyl chains.They retain the membrane forming property of chitosan. Chitosan is more versatile in comparison to chitin due to the presence of amino groups at the C-2 positions.

Sherin Shaji

INTRODUCTION TO PIEZOELECTRIC EFFECT

Piezoelectric Effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress. The word Piezoelectric is derived from the Greek piezein, which means to squeeze or press, and piezo, which is Greek for “push”.

One of the unique characteristics of the piezoelectric effect is that it is reversible, meaning that materials exhibiting the direct piezoelectric effect (the generation of electricity when stress is applied) also exhibit the converse piezoelectric effect (the generation of stress when an electric field is applied).

When piezoelectric material is placed under mechanical stress, a shifting of the positive and negative charge centers in the material takes place, which then results in an external electrical field. When reversed, an outer electrical field either stretches or compresses the piezoelectric material. The piezoelectric effect is very useful within many applications that involve the production and detection of sound, generation of high voltages, electronic frequency generation, microbalances, and ultra fine focusing of optical assemblies. It is also the basis of a number of scientific instrumental techniques with atomic resolution, such as scanning probe microscopes (STM, AFM, etc).

History of the Piezoelectric Effect

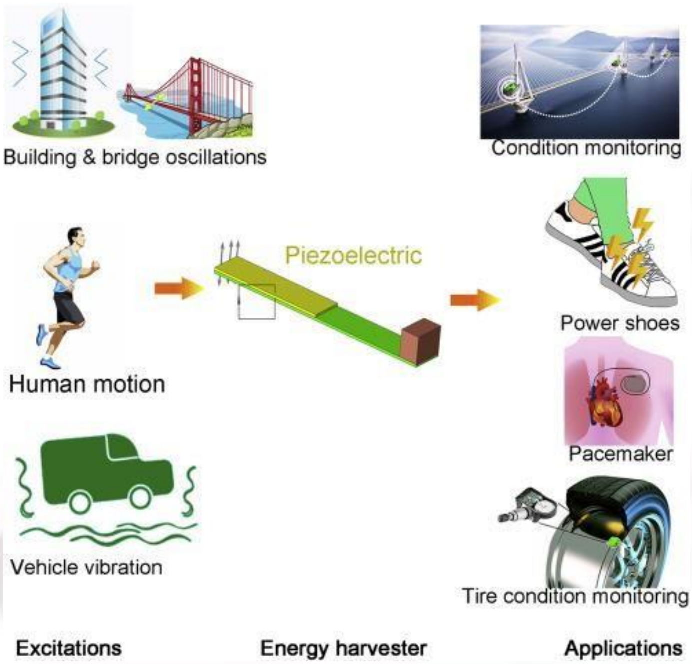
The direct piezoelectric effect was first seen in 1880, and was initiated by the brothers Pierre and Jacques Curie. By combining their knowledge of pyroelectricity with their understanding of crystal structures and behavior, the Curie brothers demonstrated the first piezoelectric effect by using crystals of tourmaline, quartz, topaz, cane sugar, and Rochelle salt. Their initial demonstration showed that quartz and Rochelle salt exhibited the most piezoelectricity ability at the time.

Over the next few decades, piezoelectricity remained in the laboratory, something to be experimented on as more work was undertaken to explore the great potential of the piezoelectric effect. The breakout of World War I marked the introduction of the first practical application for piezoelectric devices, which was the sonar device. This initial use of piezoelectricity in sonar created intense international developmental interest in piezoelectric devices. Over the next few decades, new piezoelectric materials and new applications for those materials were explored and developed.

During World War II, research groups in the US, Russia and Japan discovered a new class of man-made materials, called ferroelectrics, which exhibited piezoelectric constants many times higher than natural piezoelectric materials. Although quartz crystals were the first commercially exploited piezoelectric material and still used in sonar detection applications, scientists kept searching for higher performance materials. This intense research resulted in the development of barium titanate and lead zirconate titanate, two materials that had very specific properties suitable for particular applications.

Future Application of Piezoelectric Effect

It has become clear that engineers must find alternative solutions for the energy crisis. One promising alternative utilizes technology whose current applications range from sparking barbeque grills to powering clocks and lights. This technology is known as the piezoelectric effect in which pressure (or deformation) can generate electricity and vice versa. The piezoelectric effect can be used to harvest the energy used in walking to help reduce the impact of electricity generation on the environment, but unless the Nano-particles used in creating piezoelectric generators are carefully monitored these generators could cause more harm than good in this paper, we will discuss how scientists and engineers are looking to use this effect to generate electric power on a mass scale via piezoelectric floor tiles.



The concept relies on using the pressure from human footsteps to activate and generate power. The East Japan Railway Company (JR East) has installed piezoelectric tiles in a sub way that sees2.4 million passengers in the station each day.

Some nano- particles have been shown to be toxic to both humans and bacteria, and the use of piezoelectricity could spread these harmful Nano-particles if it is not regulated properly, which poses some ethical dilemmas. The piezoelectric effect identifies most closely with the Conference Topic area of energy. This effect is also cross disciplinary because it calls upon concepts of Materials Science, Mechanical, and Electrical Engineering because it is the bridge between mechanical and electrical energy.

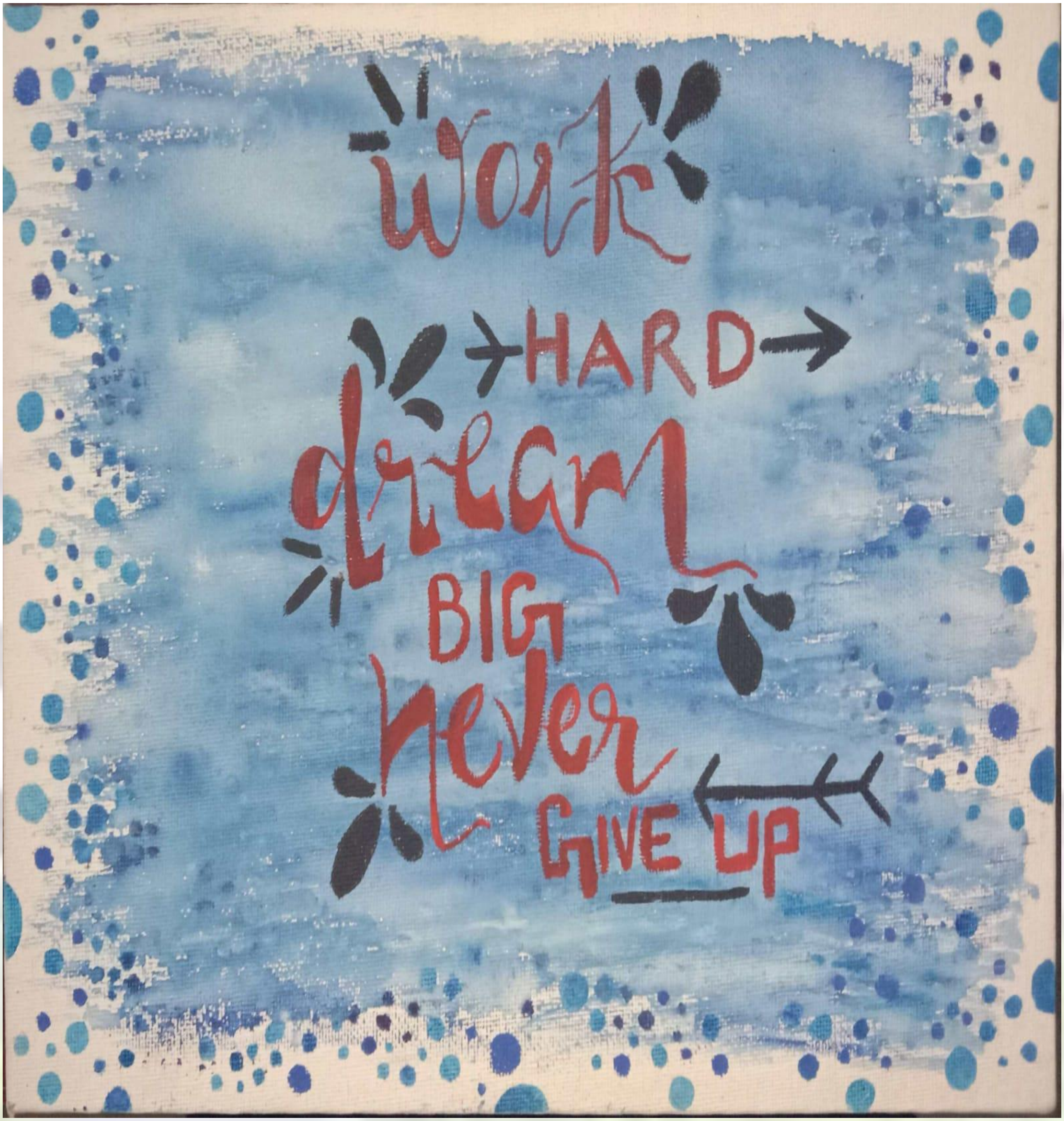
Akhila Thampi

PROTECTIVE ACTIVITY OF MUCUNA PRURIENS SEED EXTRACT AGAINST THE TOXIC EFFECTS OF VENOM OF ECHIS CARINATUS

The largest number of deaths due to animal attack in India, as well as in world is caused by snakes. Around 46,000 people die of snakebite every year in India as per reports. The major variants of snakes that cause these much deaths are viper, Indian Krait, Spectacled Cobra and saw scaled viper. Interestingly, there are also several Indian medicinal plants that can be used for the treatment of snakebites, as much as there are several snakes to bite. Several medicinal plants which appear in old drug formulas or which are passed orally from generations to generations are believed to be antidotes for snake bites.

Mucuna prurien is a traditional medicinal plant used widely for the treatment of various diseases and its seeds are used in many regions of the world for snake bites. It shows anti-venom activity against Naga species, Cobra and Krait by inhibiting the effect of venom. This medicinal plant is in use for centuries now and India has 14 species of Mucuna Pruriens in its flora.

In the research on its components that exhibit the anti-venom property, one of the proteins was isolated, identified and named as MP-4. The protein may belong to the Kunitz type protein inhibition family and can neutralize the proteases present in the snake venom. Some studies revealed that MP-4 does not offer direct protection against snake venom because, it is actually a poor inhibition of serine protease. Mucuna pruriens has another mode of action via immunological function, where there is cross reactivity to happening between proteins in the seed extracts and proteins in the snake venom. According to the phytochemical revealing, Mucuna pruriens have protein and non-protein components found and it is promoting strong anti-venom activity.



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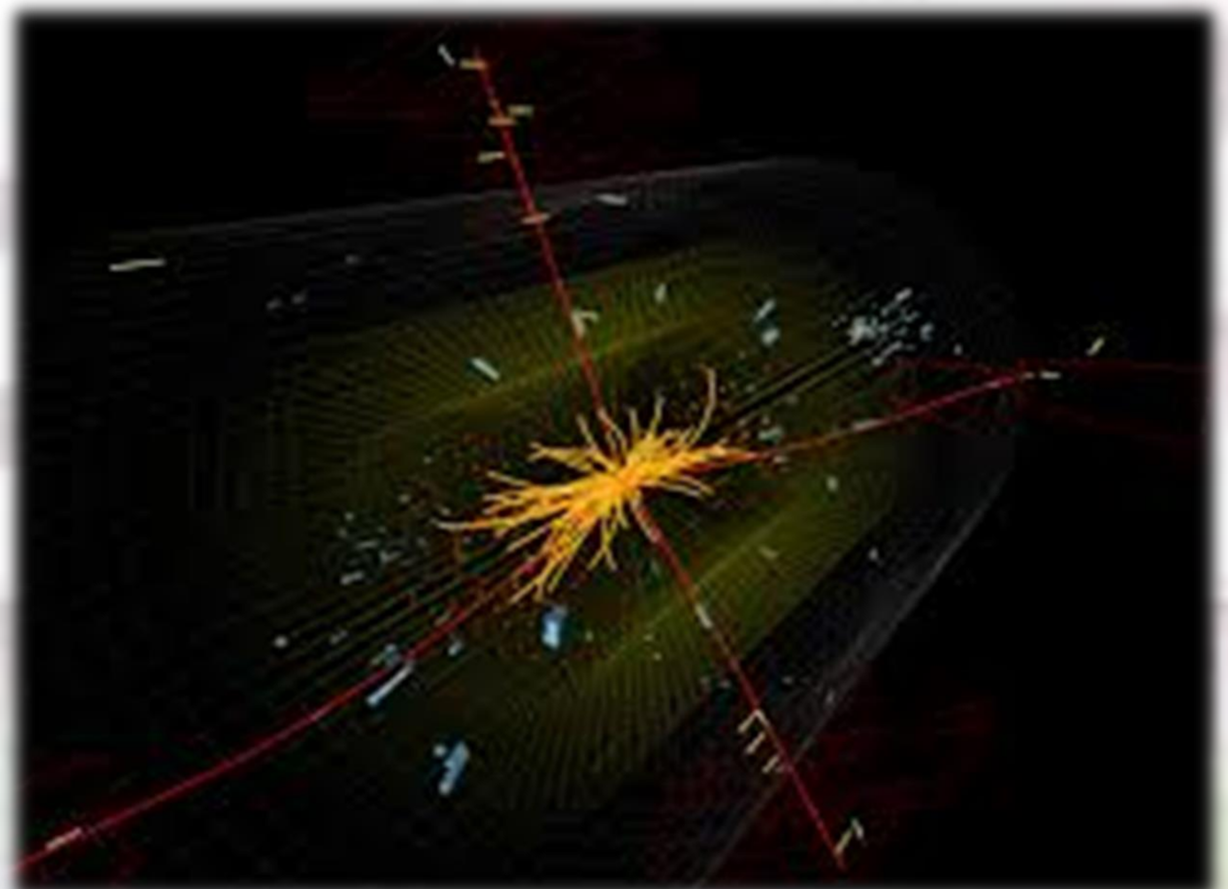


THE "GOD PARTICLE"

Science is a logical and methodical view of the universe. There is no place for stories or beliefs in science. Science proceeds through conclusions based on evidence. So, it is natural to be surprised when we hear science talking about a God particle. This has led to many misunderstandings.

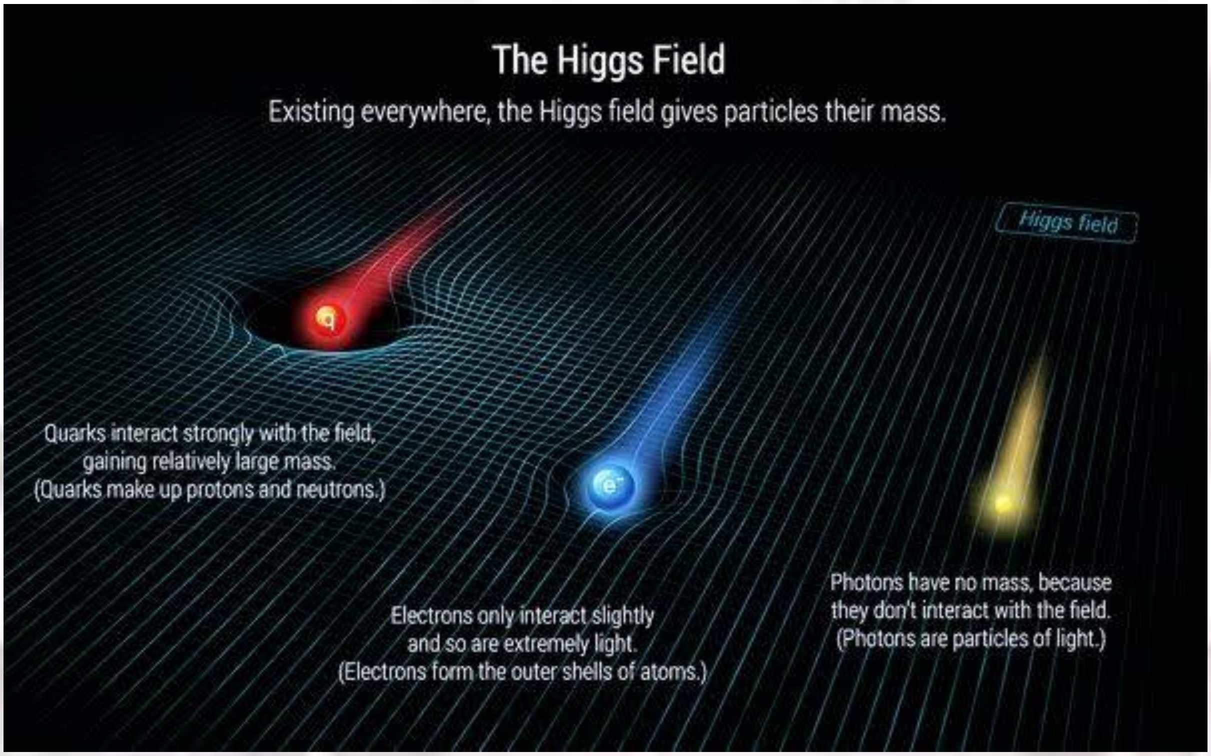
July 4 is the 10th anniversary of the discovery of the Higgs boson, also known as God's particle. After a search of more than 40 years, the particle was discovered in experiments on the Large Hadron Collider (LHC) at European Organization for Nuclear Research (CERN) near Geneva, Switzerland on July 4, 2012.

Considered one of the most important scientific discoveries of the modern era, the Higgs boson provides evidence for the Standard Model of Physics, which describes how various particles make the universe. The Standard Model of particle physics describes how the world is constructed. We know that all matter consists of particles, which are the building blocks of nature. These particles are governed by four types of forces — gravitation, electromagnetism, the weak force and the strong force. The Standard Model unites the building blocks of nature and three of these four forces (gravitation remains outside the model). For the Standard Model to be correct, the Higgs boson must exist. Without the Higgs boson, the Standard Model would fail. That is why it is known as the God particle.

Based on their characteristics, all subatomic particles belong to two broad categories: bosons and fermions. Bosons are named after the Indian physicist Satyendranath Bose who, along with Albert Einstein, proposed a theory on the characteristics of such particles.

There are several types of bosons, and the Higgs boson is one of them. This particle is named after the scientist Peter Higgs, who won the Nobel Prize for Physics in 2013, jointly with Francois Englert. In 1964, independently of each other, Peter Higgs and the team of Francois Englert and Robert Brout (who died in 2011) had proposed a theory that there is a particle that explains why other particles have a mass. This particle is the Higgs boson.

The Standard Model would only work if particles did not have mass. But most particles do have mass, which is why all matter has mass. How could the Standard Model be correct then? According to physics, space is filled with many invisible fields, such as gravitational field, electromagnetic field etc. One of these is known as the Higgs field, and was proposed by Englert, Brout and Higgs. All particles acquire mass only if they come into contact with the Higgs field. If the Higgs field disappeared, all matter would cease to exist.



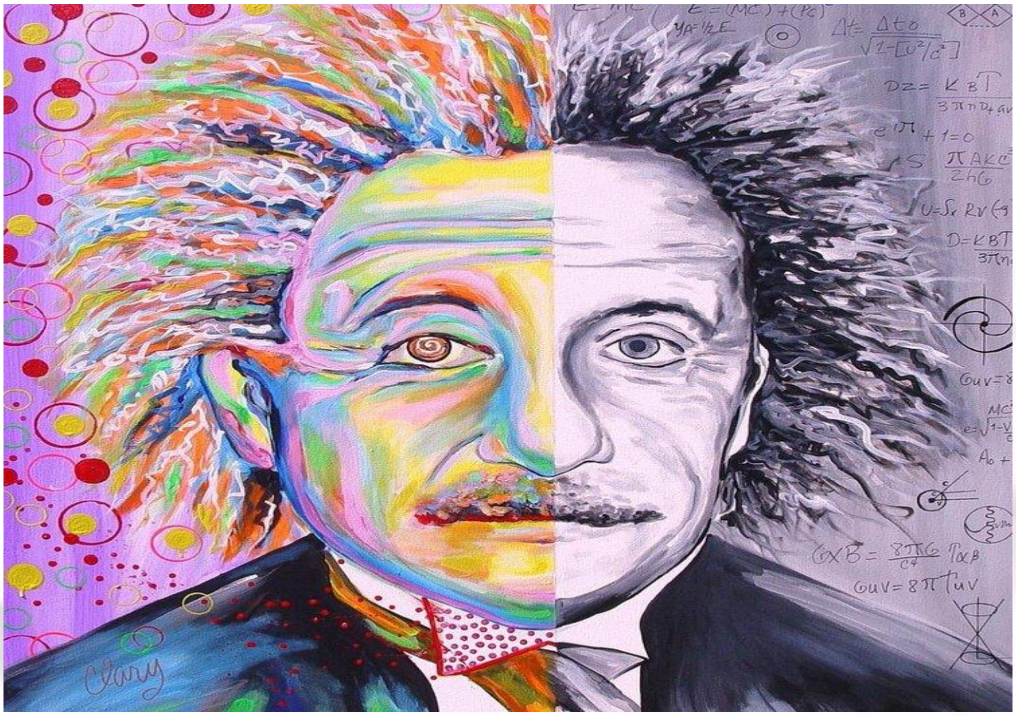
The Higgs particle is a vibration of the Higgs field. But until 2012, it existed only in theory. It had not yet been actually detected.

The CERN says the Higgs boson can't be "discovered" by finding it somewhere. It has to be created in a particle collision. But once created, it quickly decays into other particles. Scientists look for traces of these particles in data collected by the detectors.

The challenge is that the Higgs boson only appears in about one in a billion LHC collisions. But careful statistical analysis of enormous amounts of data uncovered the particle's faint signal in 2012.

On July 4, 2012, the ATLAS and CMS collaborations announced the discovery of a new particle. This particle behaved like the proposed Higgs boson should. But was it really the Higgs boson? By examining more data, scientists concluded in March 2013 that, indeed, some kind of Higgs boson had been discovered, according to CERN.

Christoph Paus, the MIT physicist who co-led the effort to detect the particle, is quoted as saying: “How could we be sure that it was the Higgs boson and not something else? It certainly looked like the Higgs boson, but our vision was quite blurry. It could have turned out in the following years that it was not the Higgs boson. But as we now know, with so much more data, everything is completely consistent with what the Higgs boson is predicted to look like, so we became comfortable with calling the narrow resonance not just a Higgs-like particle but rather simply the Higgs boson. If this particle is the Higgs boson, it will be a huge victory for the Standard Model. If anything, it will shed light on new areas of knowledge beyond the Standard Model.



THE SILENT ENCHANTED RELATION OF SCIENCE AND ART

Remya Raj E T

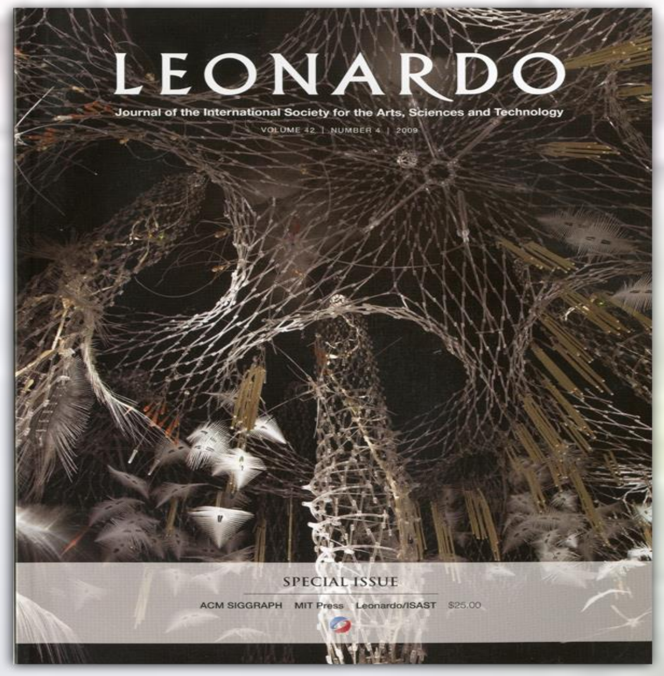
Traditions of ages have taught its pupils how much science differ from art and even divided them in to separate lines of thought. But a little deep thinking on the relation of arts and science will tell you how mutually dependent they are. Otherwise, you please tell me, when the curious eyes of space agencies meet many astronomical wonders in the universe, it is always the artist who give life to the boring scientific data they collect, so that normal people understand why their taxes are invested in space. Hence the steamy and subtle relation of arts and science is something we all should appreciate, enjoy and propagate, especially the ones who are the facilitators of young minds.

Both science and art are human attempts to understand and describe the world around us. The subjects and methods have different traditions, and the intended audiences are different, but the motivations and goals are fundamentally the same. A famous example for the interconnection between arts and science comes from how Charles Darwin sees the paintings of Marianne North as he considered North's paintings to be excellent examples of his theory of natural selection. Her brilliantly coloured paintings bring those species to life in their natural habitats as part of their ecosystems. One can see quite clearly from her work the adaptations that tropical plants have made to survive in different areas around the world, and the similarities between geographically close species. North has maintained a legacy not only through her artwork but also through several species for which she provided the first illustration and were later named after her. The theory of Darwin couldn't be visualized in a better way, which even Darwin agreed gleefully.

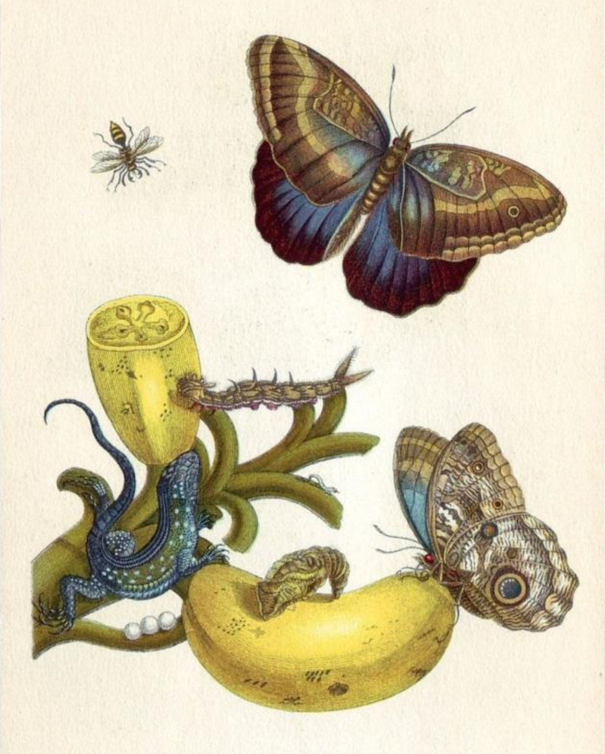
Another subtle, yet intricate relation of science and art is evident in the famous painting of Wright "*A Philosopher Giving a Lecture at the Orrery (in which a lamp is put in place of the sun)*" depicting an intimate gathering around a mechanical model of the solar system. It has recorded the growing popularity of science among public, from wonder to introspection.

The painting of Remembrandt "The Anatomy Lesson of Dr. Nicolas Tulp" is another best example of how art explains science to common man. The painting of the doctor with a partially dissected corpse and a throng of interested spectators eager to understand the workings of the human body is the evidence of artists recording scientific progress of each era.

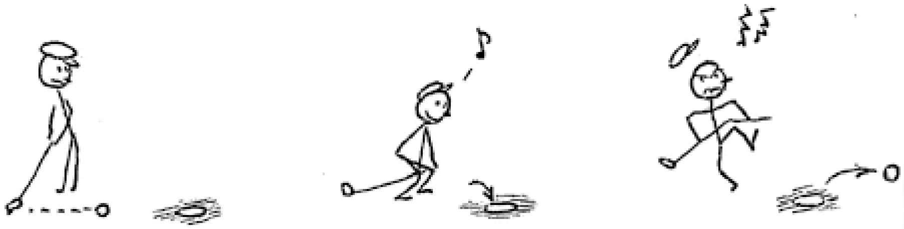
Now let's leave the renaissance and romanticism behind and peep into the modern world of science and art. The line that separates art and science in the modern age remains a superficial one; at the core, artists and scientists observe and interpret the world around them, though they may use different methods and expressions. And to our best, there is conscious efforts by many institutions and visionaries to bridge the artificial cultural divide that is prevalent in the society, pertaining to the science and art. Once the need to re-establish the close connection between art and science had become apparent, institutions began creating centers and think tanks for this purpose. Two pioneering examples are the Center for Advanced Visual Studies at MIT and Experiments in Art and Technology, a collaboration between New York artists and scientists at Bell Telephone Laboratories. The second one is the founding of the journal Leonardo, which publishes art and science studies, which was another important step in this direction by creating a dedicated academic space for artists and scientists to collaborate and share ideas.



An important feature of the modern merging of art and science is the understanding and communication of abstract and higher-order ideas. Like Mariane, who communicated her observations of insects and plants using sketches, Tadashi Tokieda, a mathematical physicist at Stanford University, creates artistic demonstrations of abstract mathematical concepts. Tokieda, a painter and mathematician, uses his unique background to create elegant toys that not only demonstrate exciting, realizable phenomena from his research, but also help to develop new hypotheses. David Goodsell, a structural biologist at The Scripps Research Institute, uses water colour and computer-aided illustrations to present the world of cellular structures and molecules. His work gives access to the nanoscale structures of life that would otherwise invisible to human eye.



Mariane's understanding of insects and plants



Tadashi Tokieda's pictorial representation of a little golf game, which he explains in the article in relation to oscillation mathematically.

David Goodsell's cross sectional representation of SARS CoV-2 virus

Science and art are two intricately woven threads of the same fabric. The pure existence of any one of them is nearly impossible. Art easily expresses science and makes it comprehendible for the public, just like how songs communicate the complex emotions of man. Sadly, their steamy relation isn't recognised by all, some even deny it even if they see it in the very front of their eyes. But how long can we bury our head in the sand.

Department of Physical Science – Batch 2021 - 2023

A glimpse to the wonderful bond we share as a team with all the inspiration, love and support from our dear teacher Jayakala Ma'am, we indeed had a terrific journey so far. And as it approaches an ending, leaving without sharing our most memorable and loving experiences at the end will be an injustice. After reading all the science stuff so far, let this be a refreshment and reminder to the love and care that exist among us along with all the science talks you hear.