

BHAVAN'S VIVEKANANDA COLLEGE

OF SCIENCE, HUMANITIES AND COMMERCE, SAINIKPURI, SECUNDERABAD ESTD - 1993. ACCREDITED WITH 'A' GRADE BY NAAC. AFFILIATED TO OSMANIA UNIVERSITY, AUTONOMOUS COLLEGE

COVID 19: A PARADIGM SHIFT

IS COVID A BOON OR A BANE? BLESSING OR A RUE? FIND IT OUT

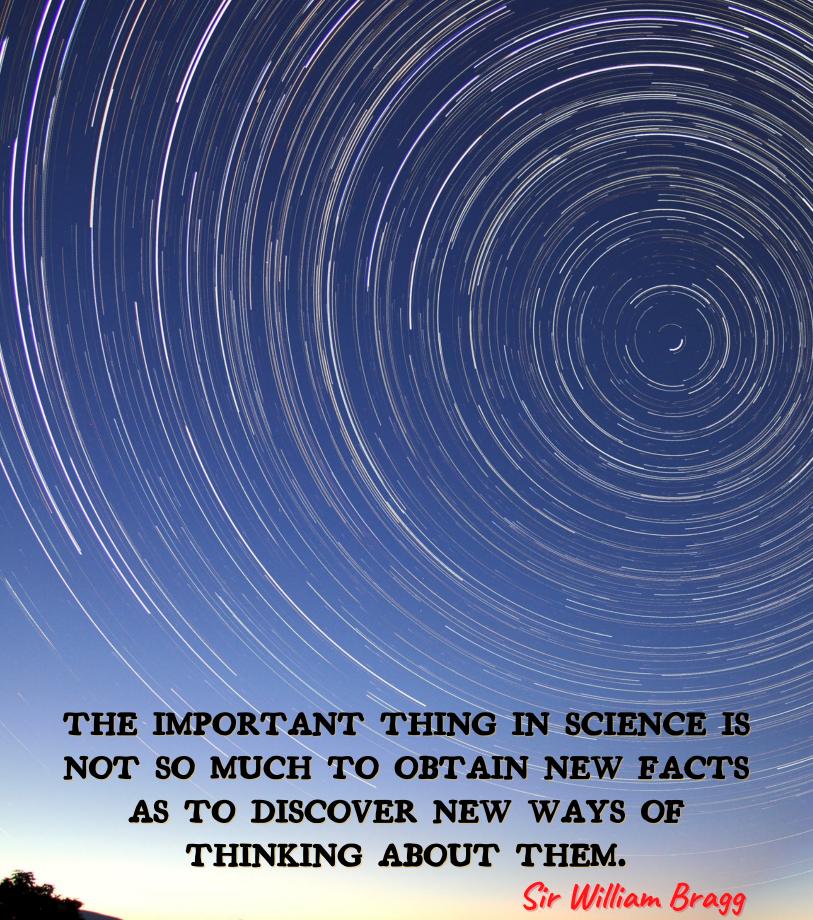
TETRA QUARK DISCOVERY

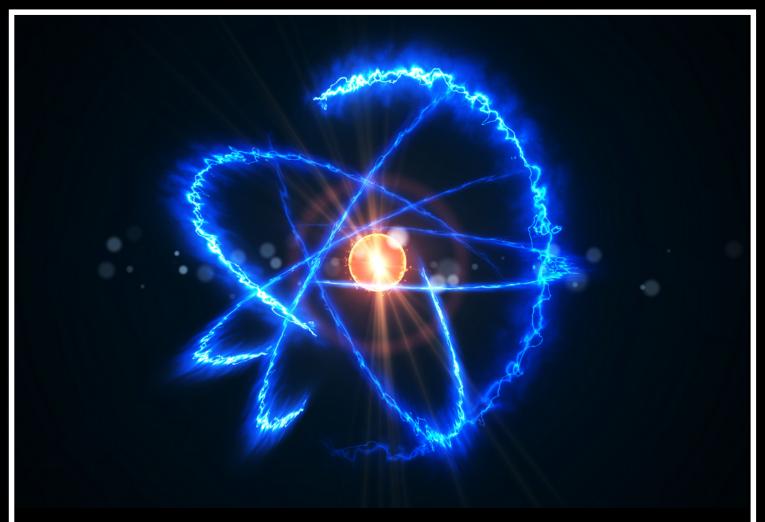
THE LHCB COLLABORATION HAS WATCHED A KIND OF FOUR-QUARK PARTICLE THAT HAS NEVER BEEN SEEN

ELECTRIPHYING WORLD

Connectivity through Contagion

ISSUE #5





Department of Physics and Electronics

Issue #5 2020-2021

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Message from VICE CHAIRMAN

Today, the role of a college is not only to pursue academic excellence but also to motivate and empower the students to be lifelong learners, critical thinkers, and productive members of an ever-changing global society.

I am extremely delighted to know that the Department of Physics and Electronics has come up with its fifth Issue of "ElectriPhying World" during these difficult times. This marks growth and gives life to the thoughts of every inquisitive thinker in our college.

Leveraging science to manage the virus is the only reliable way forward. It is the opportunity that rises out from adversity.

I congratulate the entire team of the magazine and their associated staff members for their hard work, zeal and dedication in bringing out this issue at such tiring times.

Air Cmde (Retd.) J. L. N Sastry, VSM VICE CHAIRMAN



Message from PRINCIPAL

Albert Einstein once said, "The important thing is to never stop questioning". Looking at the fifth issue of ElectriPhying World, it comes to me as an absolute delight seeing such progress at these very turbulent times. The faculty and students have put in great efforts in bringing up the current edition of magazine comprising of fascinating articles, inquisitive information and many more.

At such difficult times, Science and Technology have helped us spread our roots of knowledge far into the world of learning. The theme perfectly suits the current times. Science paved such ways into our lives that 'Connectivity through Contagion' has been so much easier than it would have been.

I congratulate the entire team of the magazine and their associated staff members for the amount of hard work and dedication they put into bringing this issue.

My best wishes to the Head of the department and the editorial board members for the release of the fifth Issue of ElectriPhying World.

Prof. Y Ashok Principal



Message from VICE PRINCIPAL

Departmental Magazine ElectriPhying World displays a wide spectrum of creative skills ranging from writing to editing and from designing to publishing. I take pride in giving my message to fifth issue of magazine titled Connectivity through Contagion.

'ElectriPhying world' is a milestone which marks the overall growth of the student community unfolding their creativeness and imagination. It is started with an intention to ignite their minds and provide an opportunity to express their skills and talents.

Since then it has been customary to the department of Physics and Electronics to publish the magazine every two years with a new contemporary theme. My heartfelt wishes to the editorial team and I wish them the very best for the release of the 5th issue of the magazine.

B. NIRAIMATHI
Vice Principal
Head of the department



Message from FACULTY COORDINATOR

I have a couple of questions that are on my mind these days. One of the things that I find helpful as a professor in the field of science is tracing through what questions have risen to prominence in scientific or intellectual communities at different times and places. It's fun to chase down the answers, the competing solutions, or suggestions of how the world might work that lots of people have worked toward in the past.

I personally believe that ElectriPhying World is one such answer. To get in tune with the developments in the field of technology and its implementation to reach the common man at such times, the cover page theme for the fifth issue of the magazine is chosen to be 'Connectivity through Contagion'. Every single contribution to the magazine is informative and made with creativity, scientific thinking.

It has been an honor to be a part of the editorial team of ElectriPhying World. My heartfelt acknowledgements to the editorial and publication team for their relentless and untiring efforts in bringing the current issue. I congratulate all the members of the magazine team for their successful accomplishment.

V R MANJULA
CHIEF EDITOR
TEACHER COORDINATOR

Message from

STUDENT COORDINATORS

What we noticed over the years is that people were starting to see science as entertainment and not as a tool or a lens to understand the world. The thing that scientists do is ask great questions. We need people who can interrogate and probe the world so they can develop their muscle of being critical thinkers. We saw that missing.

ElectriPhying World is a solution that solves this part of the problem. It shows science's entertainment with great demonstrations and also implants the idea of critical thinking and scientific learning. The team has spent a lot of energy thinking about how to get science to resonate with people.

Having the theme "Connectivity through Contagion" helps us build a runaway of scientific thinking on this mountain of a pandemic. The theme helps the reader connect their scientific thinking with others. The featured articles take us through these tiring times and on how Science is helping us pass through it. The following articles are a proof of brimming flow of knowledge, thirst for curiosity and the incredible brains students from our college hold.



The team put in gigantic amount of effort from liasoning, authenticating, editing and designing this edition of the magazine. We hope you enjoy reading it as much as we enjoyed bringing it out to all of you.

On that note, Happy Reading!!

G RITHIKA D SAI MAHATHI (STUDENT COORDINATORS)

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CONTENTS

- 1 Covid 19- A Paradigm Shift
- 5 Post-Covid 19 Future
- 7 Frugal Science in Covid 19
- 9 Everything about COSMOS
- **12** Women in Science
- **14** Our definition of Physics
- **15** Auditory Illusions
- **17** Want to see your grandkids?
- 19 Coffee Break
- 21 MEMS
- **23** Our definition for Electronics
- **25** Quantum Entanglement
- **26** Time flies
- **27** Tetra Quark Discovery
- 29 Fermi Paradox
- **31** Fast Radio Bursts
- **33** The interstellar Journey

- **35** Memes Corner
- 37 Arduino Uno vs Arduino Micro
- **39** The Missile Man
- **43** Teleportation
- 45 A New Regime
- 47 Physics Nobel Prize Winners 2019
- 48 Physics-an enigmatic way of life
- **49** Physics Slang
- 51 A Different Approach to Learning
- 53 Coffee Break
- 55 WIGIG Tech
- **57** Comet Swan
- 58 Physics Nobel Prize Winners 2020
- 59 How to See Without Glasses
- 61 Quantum Internet
- 63 Microbots
- 65 Interview With An Alumnus
- 67 Interview With A Scientist
- 69 Coffee Break
- 71 Field Trip to HCU
- 73 Departmental Events
- 79 Photo Vault



COVID 19. A PARADIGM SHIFT

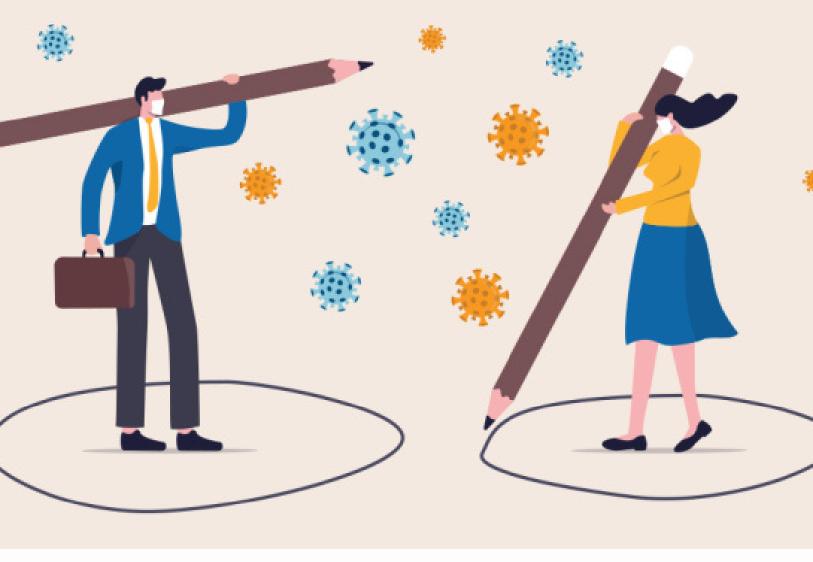
- G. RITHIKA (MECs 2)

When we talk about Paul, the first thing that crosses our mind is the conversation of Paul the Apostle and the road to Damascus. Now it is also a well-known phrase meaning to a sudden turning point in one's life. Covid-19 or SARS-Cov-2 or Coronavirus has been one such turning point in everyone's life which just changed the way of life.

When physicists said that there is physics in everything, they meant everything, including how a climacteric disease like Covid-19 is transmitted and tackled. From the generation of virus-laden respiratory droplets to dispersing in the air to inhalation or deposition on surfaces, a team from John Hopkins University in the U.S tried to decode the flow physics of coronavirus transmission. Being a science student we all have heard about the fluid dynamics-the branch of applied science that is concerned with the movement of liquids and gases. After the first case of coronavirus was reported every scientist on earth was on a quest to know more about this fatal disease and the first question raised was how does this virus transmit and that is where fluid dynamics played a part. Fluid dynamics intersect with nearly every aspect of this pandemic. The way droplets are formed and carried, how they infect others, the ventilators that are used to treat patients with severe effects, in preventive measures like face masks, sanitizers, and many other problems that are ultimately related to fluid flow.

There is a lot that we don't know about the novel Coronavirus but with the help of advancement in technology and evolution in tools, we were able to identify the features, characteristics, structure, etc. that helped in categorizing different forms of the virus and find different solutions. On the same note of discussion, X-ray crystallography is the most commonly used tool for unraveling protein structures. Crystallization is helpful because it results in the repetition of huge numbers of molecules in an ordered, 3D lattice so that all their tiny signals reinforce one another and become detectable - by photographic plates in the early days and by active pixel detectors today. X-ray crystallography utilizes electro-magnetic radiation to produce wavelengths that can help generate 3D detailed structures of the virus. To help during a pandemic, these techniques have to provide results very quickly. X-ray crystallographic methods used to be slow, but with the use of automation, fast computing platforms, and highquality X-rays, it is possible to get structures very quickly Physics instruments like Advanced Photon Source (Argonne National Laboratory, USA), The National Synchrotron Light Source II (Brookhaven National Laboratory, USA), SLAC'st





Stanford Synchrotron Radiation Light source (SSRL) (USA), and the Advanced Light Source at Lawrence Berkeley National Laboratory (USA) are operating to keep open several x-ray protein crystallography beamlines strictly for coronavirus research. Cryo-Electron Microscopy is another technique used for obtaining structural information. Cryo-EM is the electron microscopy method applied to samples cooled to very low temperatures. CT Scans-Computed Tomography imaging technology, widely known as a CT scan, uses a narrow beam of X-rays quickly rotated around the patient to produce cross-sectional images or" slices" of the body. We have all learned these concepts in theory but the question about applying these theories in such situations of emergency is true knowledge. When investigated deeply knowingly or unknowingly the theories we learned have always been used in every situation of real life. Any topic has its pros and cons and, in this matter, COVID is never any more special than others. To be honest, our lives paused for months, few people lost jobs, few people gained, few people lost lives, few got new ones and COVID 19- a fuel to tech adoption is an understatement.

When such a problem arose as a caution reminding about the gaps we had in our knowledge and tools and helped prepare for future fights. There are several devices out there, many of many of which work along with similar principles. Some of the devices on the frontline are your basic infrared laser thermometer device (also known as an infrared laser gun). Other devices are much more advanced, such as thermal imaging cameras which give the user a picture of any localized heat spots on the person. Some are even wearable temperature monitoring devices. The common things that unite all the devices on the frontline are that they are designed to measure the temperature of the person without needing to be in direct contact with the person being scanned. This clearly explains the extent of human's possibility to innovate when needed. Many of the larger analysis methods – from drones to cameras that can measure multiple people simultaneously – also utilize AI, the Internet of Things (IoT) and deep learning methods to more accurately analyze the data. AI is also being used to predict and monitor the spread of the disease across countries. UVD disinfectant robots spread ultraviolet rays in hospitals to kill bacteria and viruses.



All these examples are about how electronics help in tackling the virus. Some of what we are doing now to combat COVID-19 in 2020 is based on science from papers published in the 1930s. We've learned so much since then, and there is still scope for advancement and new methods. Even after so much advancement, there is still a question mark when a new problem arises amid nowhere and as usual humans with the help of knowledge on science will always tackle them. So, is COVID a boon or a bane? Blessing or a true? Seems like a hypothetical question but the real test is whether it will leave a mark in history as one of human's victory or defeat.

POST COVID-19 FUTURE:



Tech can be transformed

~Aryaman Gupta (MPCs 2)



A fear of bioterrorism has always resided in our minds. Various depictions in films or books have been made about a world in a pandemic. In today's reality the world is coping up with a pandemic situation and it is no lie that technology is the most important tool that keeps us united. COVID-19 has made us realise how meaningful human interactions are for making things work. The pandemic has affected labor-intensive sectors such as food, retail, logistics, and manufacturing businesses and that has resulted in a strong push to speed up robotics research.

Robots are now being used to clean infected areas and for delivering food to quarantined individuals. These prototypes are unlikely to make a difference now. However, the robots under development could make a difference in future disasters if the momentum for robotics research continues. During the pandemic, web-based education also has gained a lot of attention following the necessary influence. For one, Zoom Video conferencing showed exceptional growth, especially since the private sector turned to the work from home practice for their employees.

The Indian government has taken an active interest in creating a more robust backbone of the Indian technology industry, minimizing foreign direct investment requirements.

(Case in point is the central govt was ready to offer Rs.1 Crore to tech developers who can create an alternative to the video conferencing app Zoom).

Not only that, but mankind has also adapted the use of technology in detecting as well as curing COVID-19. Besides the development of the Aarogya Setu app and encouragement and participation of people in carrying out cashless transactions, Microsoft has developed a new chatbot to help people who have recovered from the COVID-19 virus determine if they can donate plasma to help with clinical research and treatment.

It's said that during a pandemic, the development of tools, kits, and vaccines are done at triple the rate, and today's situation proves it right. There are currently over 169 COVID-19 vaccine candidates under development, with 26 of these in the human trial phase. WHO is working in collaboration with scientists, business, and global health organizations through the ACT Accelerator to speed up the pandemic response.

When a safe and effective vaccine is found, COVAX (led by WHO, GAVI and CEPI) will ease the fair access and distribution of these vaccines to protect people in all countries. People most at risk will be prioritized.

The post-pandemic era will prove to be a pool of opportunities for entrepreneurs to take advantage of. We will see a drastic rise in the number of collaborations for the availability of various tools, leveraging more opportunities for online markets as well.



FRUGAL SCIENCE IN COVID-19

~ D Sai Mahathi (MPCs 2)

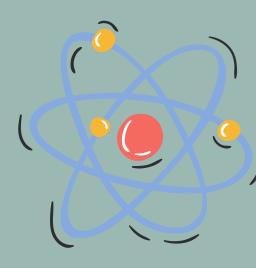
In 2015, on one of the tech giants, Bill Gates's Ted talks, the prediction that viruses pose the greatest risk of global catastrophe; when compared to other threats of humanity was posed. Gates claimed that if anything would kill over ten million humans over the next few decades, it's most likely to be an infectious virus instead of a war or missiles. His fears were not unsubstantiated. Almost a half a decade later, the novel Coronavirus, or as called now, COVID 19, has brought the world to its knees.

One of the advances though, during these times is in Science and Technology. Let it be Open Science, AI, Frugal Science, Scientific Education; all these have seen a huge spike since March of 2020. One such area in science being Frugal Science has found its ways into the minds of innovators like Manu Prakash from MIT, Arnab Bhattacharya from TIFR India, Liz Hadly, Nichole Starr, the list goes on.

Frugal solutions are "JUGAAD" on a bigger scale. Frugality means tackling solutions at less cost in the least amount of time. Necessity is the mother of all invention. In response to the pandemic, wasting time (that is synonymous) with luxury will explode humanity at a rapid scale. Countries that have delayed their response seem to be in a worse state.

There are problems we should think about. What if we get a vaccine that isn't favorable? Will all the plastic tube shots be thrown creating a risk to the environment? Is there a higher risk of a potentially more dangerous virus that is coming after us? Are we ready for that risk?

The answers to these questions are supposed to be found soon. It might even be a possibility that someone might have found a solution to these problems while you were reading this article.





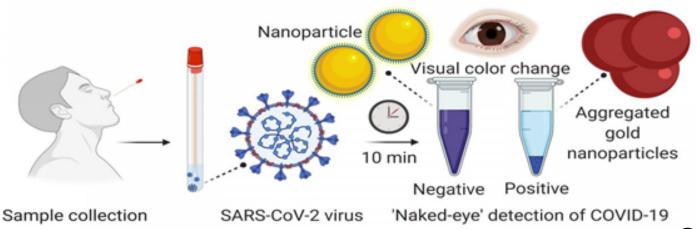
These solutions bear the characteristic feature of 'frugal innovation'. That is, doing a lot, with less, for the many, and being creative, innovative and resourceful from all the constraints around. These frugal solutions un-fabricate the societal barriers by providing innovations everyone needs.

Real-Time PCR (qPCR), LAMP and thermal cycler (PCR) are essential tools for COVID-19 testing. These are now made open source and are available to countries that can afford such methods at an inexpensive value. 120m rapid antigen tests are made available to middle-class countries for a faster COVID 19 detection test. This test is similar to a pregnancy test with two blue lines unveiling for positive. A precise and cheap paper-based test strip for detection of Covid-19 in less than 30 minutes has been approved by the Drugs Controller General of India for a commercial launch.

Repurposing of existing assets in the supply chain and reuse of the power of smartphones, the rapid transformation of existing operating infrastructure and repurposing of human resources, repurposing from malaria prophylaxis and treatment to make hydroxychloroquine, the list goes on.

Frugal solutions to tackle COVID 19, during the pandemic, look like a huge concept now right? Not really! In a recent study by two scientists from Imperial College of London and the University of Oxford, among the series of frugal innovations to tackle COVID 19, DIY Face Masks made it through the list. As I earlier mentioned, Jugaad runs through us. We are subconsciously working our way through this pandemic, applying fast and frugal solutions in our lifestyle, and even coming out of it sooner. Learning online, finding e-books, applying frugal solutions at a smaller level makes you an innovator too.

The physical barrier to the co-creation and innovation dealt by social distancing had mitigated in some ways through the better use of digital tools. The pandemic has seen the most effective innovation has been in the sharing of new knowledge through social media, transcending the traditional boundaries of knowledge production and consumption. So let's to push these boundaries to achieve global peace from pandemics, from viruses, and social de-fabrications.



D Sai Mahathi (MPCs 2)

Alright, welcome to the universe. We will start with Tyrion Lannister of physics - The Planck Length which is the smallest thing you can sensibly talk about. Next stop - we will meet our subatomic particle and see our first neutrino. Don't worry, she's lovely and she has a lot of friends. There are around 65 billion of them passing through just 1 square cm of Earth every second. Up next - we bump into quarks. These come in several flavours: Up, Down, Strange, Charm, Top and Bottom. These are about as close to the building blocks of nature as we have managed to get so far. Next stop - we get to the A-list celebrities of the subatomic world, Neutron and Proton. Usually they engage in three ways: With Electron and an unusual arrangement known as atoms.

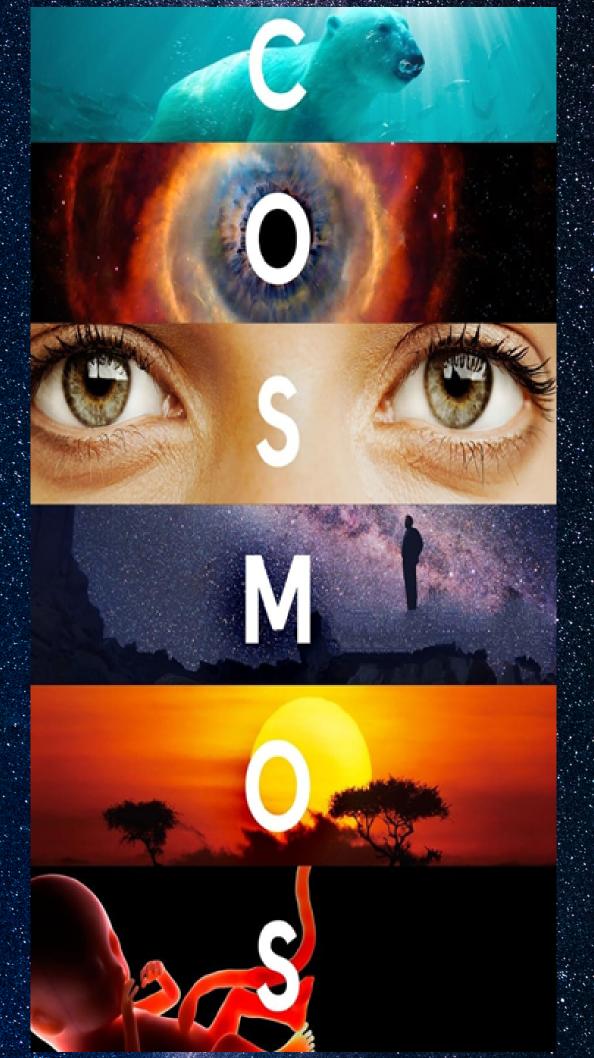
An amusing thing about subatomic particles: Sometimes they behave as waves, other times as particles. This brings us to some more celebrities you have heard of such as Helium, Hydrogen, Carbon and Cesium.

All this stuff so far and everything in the universe is controlled by 4 forces:

- 1. The Strong Force, which generally binds quarks, protons and neutrons together.
- 2. Weak force, which regulates radioactive decay.
- 3. The electromagnetic force, which holds atoms and molecules together.
- 4. Gravity. Regulates everything else like universes.

All the stuff is contained in a neat little package called The Standard Model and is about as close to a theory of everything we've managed to get so far. Generally, the little stuff comes under the title Quantum Physics and the big stuff is known as Relativistic Physics. Scientists are working very hard on getting the two of them together. Moving on, we get to the eight planets and 146 moons of our Solar system (which doesn't count Pluto). Then there's the Sun, which is a four and a half billionyear-old burning ball of Hydrogen and Helium. Several billion years from now the Sun will rage quit and turn into a red giant gobbling whatever is left of a planet by then.

Out again, we find the Milky Way. The Milky Way contains at least a 100 billion stars. Stars can be by themselves, orbiting each other called a Binary Star System or occasional group of three, which is called a Trinary/Ternary or Ménage a Star. And that's not all There's also Nebulae, which is a little starry womb where a lot of stars are born; moons, which either come from planets or are a random floating matter; comets, meteors and a million other types of astronomical bodies.

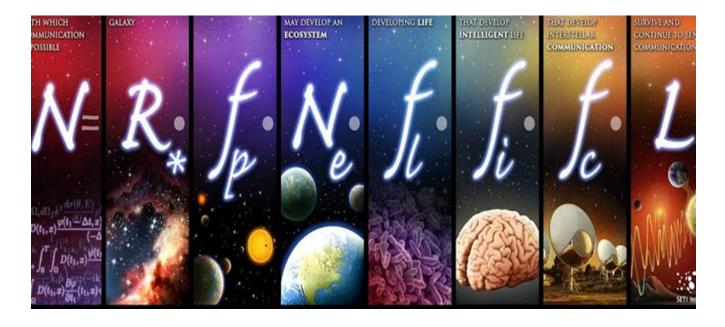


At the center of our galaxy and lots of other galaxies, are black holes. These are enormous wells of gravity that suck matter in and distort time. And then there's the rest of the Universe. The Milky Way, our galaxy, is one of a list of hundred billion galaxies (Each one prettier than the last). Since there are a 100 billion

galaxies with at least a 100 billion stars in them, that means there are at least 10 000 000 000 000 000 000 000 (umm, "a hundred billion trillion") stars in the Universe. The Universe itself, as far as we are aware, is about 95 billion lightyears across or to put it in another way. If you are traveling at the speed of light (300 000 kilometres per second), It would take you 95 000 000 000 years to get from one side to the other. Except for the fact that the Universe is expanding and the expansion is getting faster. (Oh! Except there might be Parallel universes and hidden dimensions of space)

And we completely forgot about time. The Universe began about 14 billion years ago. The first few galaxies turned up a few hundred million years later. A few hundred million after that we get the Milky Way.

Another few and you've got a very young Earth, then oceans, then life a bit later.Reptiles, Dinosaurs, Game over for dinosaurs. (Sorry), Evolution of hominids and finally all of us, here, reading this article.



WOMEN IN SCIENCE

D Sai Mahathi (MPCs 2)

hances are that you have used a quantum machine today. A cell phone, the camera, the projector, the laptop, any of them. We are indeed able to use these advanced pieces of machinery on the knowledge of quantum mechanics and quantum computation. But, after shifting focus from quantum physics' bizarre laws, what seems more bizarre is, at a macroscopic level, the recognition of talent, hard work, and progress of women in the field of technology and science. India is a developing nation. Holding the 5th position in the world's economy, 2nd largest population, and huge diversity; we have progressed and moved forward in the field of technology and science. The people working towards the growth of science and technology on a national and international level are still given less recognition. The recognition I barely even find is the recognition of women in this field. Women scientific breakthrough has often been overlooked and minimized









Like, let's suppose the incredible achievements of-

- 1. Dr. Archana Sharma. She is the senior scientist at the CERN lab, Geneva, Switzerland. She is the only Indian woman involved in the discovery of the Higgs boson particle in 2012, which could help us understand dark matter fully
- .2. Dr. Tessy Thomas. She was the project director for DRDO's Agni 4 and Agni 5. She was the first woman to head an Indian missile project. she is hailed as the Agni Putri.

3. Anandibai Joshi.
She was the first Indian woman physician and the first woman to have graduated with a two-year degree in Western Medicine in the United States. She studied at the Women's Medical College of Pennsylvania in 1886; this was the first women's medical program worldwide.

4. Dr. Aditi Pant. She was the first Indian woman to visit Antarctica in 1983 as a part of the Indian expedition to study Geology and Oceanography Or Janaki Ammal, Kamala Sohonie, Asima Chatterjee, Rajeshwari Chatterjee, Kalpana Chawla, and many more other women in science. So, let me go back to my first question by acknowledging women in the field of science; which is just as bizarre as those concepts of quantum physics. Women can think out of the box and put their heart and soul into any field of work. But, so bizarre right? To have them not recognized. How many other women in science did you know until now? Let's add this single seed of thought into our brain and ignite passion into our souls for a brighter future. This single seed of acknowledging, celebrating and empowering women in the field of science.



P - PASCAL'S LAW

H - HOOKE'S LAW

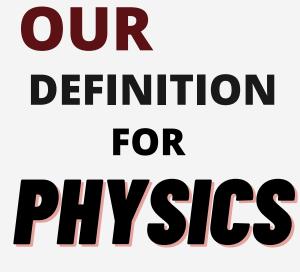
Y - Young's modulus

S - STEFAN'S LAW

l – IDEAL GAS LAW

C - CHARLIE'S LAW

S - SNELL'S LAW



- Akash (MECs 2)



- Pascal's law: Pascal's law says that pressure applied to an enclosed fluid will be transmitted without a change in magnitude to every point of the fluid and to the walls of the container.
- Hooke's law: Extension happens when an object increases in length and compression happens when it decreases in length. The extension of an elastic object, such as a spring, is described by Hooke's law: force spring constant x extension.



- Young's modulus: Young's modulus is a measure of the ability of a material to withstand changes in length when under lengthwise tension or compression. Sometimes referred to as the modulus of elasticity, Young's modulus is equal to the longitudinal stress divided by the strain.
- Stefan's law: Stefan-Boltzmann law, states that the total radiant heat power emitted from a surface is proportional to the fourth power of its absolute temperature... The law applies only to black bodies, theoretical surfaces that absorb all incident heat radiation.



- **Ideal gas law:** the law that the product of the pressure and the volume of a one-gram molecule of an ideal gas is equal to the product of the absolute temperature of the gas and the universal gas constant.
- Charles law: The physical principle known as Charles' law states that the volume of gas equals a constant value multiplied by its temperature as measured on the Kelvin scale (zero Kelvin corresponds to -273.15 degrees Celsius).
- Snell's law: In optics, a relationship between the path taken by a ray of light in crossing the boundary or surface of separation between two contacting substances and the refractive index of each.

AUDITORY ILLUSIONS

- Aryaman Gupta (MPCs 2)

In the 2008 film, 'The Dark Knight', we watch just another ordinary night in

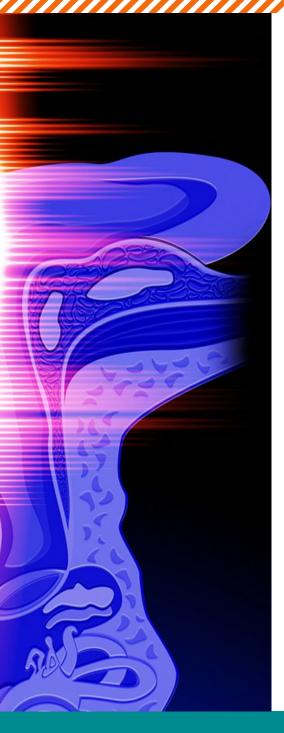
Gotham; the Joker kidnaps Harvey Dent and now it's the duty of the Bat vigilante to stop him. We are about to watch Batman chase the Joker on his Bat-pod. The noticeable fact about this chasing sequence is the sound of the Bat-pod. As Batman accelerates, the sound of this machine keeps rising in pitch, forever! This phenomenon is known as an 'Auditory Illusion'.

The Human brain identifies sound signals as received by the ear. In certain circumstance, it becomes difficult to perceive the basic characteristics of the signal- pitch, temporal pattern, and spatial phenomena (location of the sound source). Auditory illusions are false perceptions of a real sound by our ear that arise due to distortions in one of these phenomena.









The listeners hear either sounds which are not present in the stimulus, or sounds that should not be possible given the circumstance on how they were created. This shows that it is possible for a human being to hear something that is not there and be able to react to the sound they

supposedly heard. People with brain damage can be more susceptible to auditory illusions and they can become more common for that person. A very popular example is "Binaural Beat". It makes use of the fact that the right and left ear each receive a slightly different frequency tone (below 40 Hz), yet the brain perceives these as a single tone (a third frequency that actually will not exist in the given scenario). Binaural beat therapy is an emerging form of sound wave therapy as it increases focus and reduces anxiety, stress. In the bat-pod chase sequence, Hans-Zimmer takes advantage of another auditory illusion known as the Shepard Tones. A Shepard tone, named after Roger Shepard, is a sound consisting of a superposition of sine waves separated by octaves. When played with the bass pitch (lowest note: relative frequency=1) of the tone moving upward or downward, it is referred to as the Shepard scale. This creates the auditory illusion of a tone that continually ascends or descends in pitch, yet which ultimately seems to get no higher or lower.

WANT TO SEE YOUR GRAND KIDS?

-N Srinija (MPCs 3)

 $m{I}$ n science fiction, space and time warps are commonplace. They are used for rapid journeys around the galaxy or travel through time. But today's science fiction is often tomorrow's science fact, so should be with time travel as well! The idea that space and time can be curved or warped is fairly recent. For more than 2,000 years the axioms of Euclidean geometry were considered to be self-evident. As those of you who were forced to learn geometry at school may remember, one of the consequences of these axioms is that the angles of a triangle add up to 180. However, in the last century, people began to realize that other forms of geometry were possible in which the angles of a triangle need to add up to 180. Consider, for example, the surface of the earth. The nearest thing to a straight line on the surface of the Earth is what is called a "GREAT CIRCLE". Consider now the triangle on the surface of the Earth made up of the equator, the line of 00 longitudes through London and the line of 900. The 2 lines of longitude meet the equator at right angles and they also meet each other at the North Pole at 900. Thus one has a triangle with 3 right angles. The angles of this triangle add up to 2700 which is obviously greater than 180 on a flat surface. The surface of Earth is 2D space means we can move in 2 directions, at right angles to each other but the third angle is up and down.

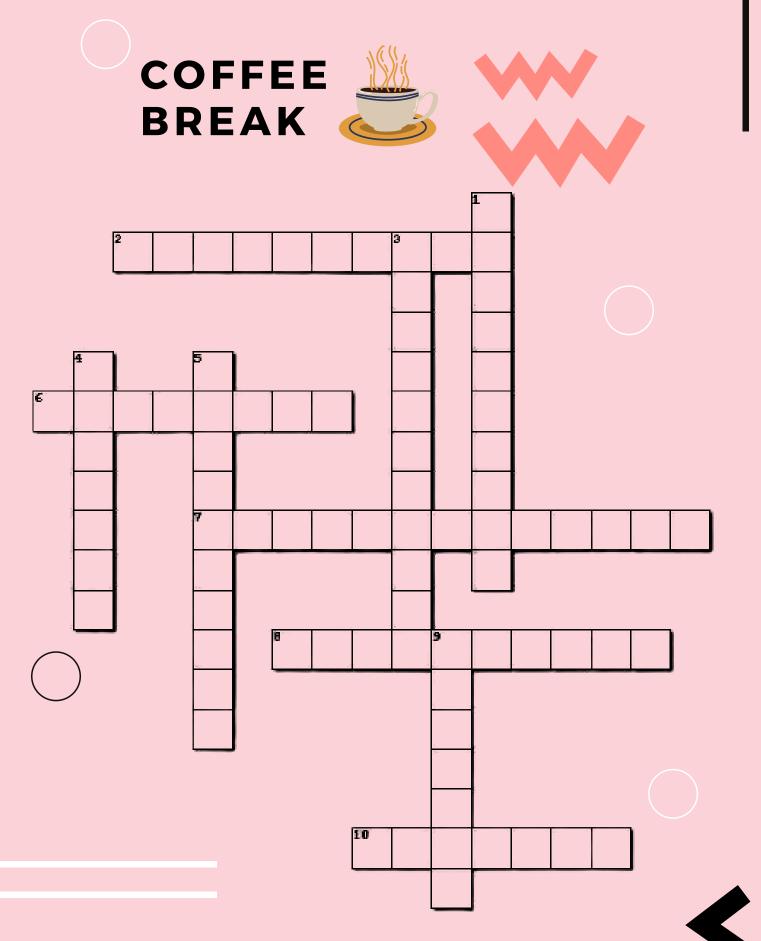


In other words, the Earth exists in 3D space, so that is to say that it obeys Euclidean geometry. We are 2D creatures who could move on Earth's surface but can't experience the 3D direction of up and down. The way to describe curved surfaces was developed by German Bernhard Riemann in 1854. It could describe curved spaces that existed in the abstract, but there seemed no reason why the physical space we lived in should be curved. This came in 1915 when Einstein put forward the "GENERAL THEORY OF RELATIVITY"- this is not only about the curved space but warped time as well. Einstein in 1905 released that space and time are intimately connected. Here is where "SPECIAL RELATIVITY" was born relating the space and time. It says that one can describe the location of an event by 4 numbers. Three numbers describe the position of the event; the 4th number is the time of the event.

Thus one can think of space and time together as a 4D entity called "SPACE-TIME". In 1905 he showed that time and space were inextricably bound up with each other. So we all need the spaceship for time travel that will go faster than light. Unfortunately in the same paper, Einstein showed that the rocket power needed to accelerate a spaceship gets greater and greater as it gets nearer to the speed of light. It also indicated that space travel to other stars was going to be a very slow and tedious business. If we can't go as fast as light it might take 8 years to go to the nearest star and 50,000 years to the center of the galaxy. In 1915 he showed that the effects of gravity could be described by supposing that "space-time" was warped or distorted by the matter and energy in it and known "GENERAL this theory is as RELATIVITY". In 1948 Kurt Gödel found a solution to Einstein's field equations of general relativity. It stated that "COSMIC STRINGS" are under such great tension one might have expected them to accelerate to almost the speed of light.

The only way to get to the other side of the galaxy is to create a "wormhole"; which would connect the 2 sides of the galaxy and act as a shortcut. We could even manage to travel back in time with the single wormhole if the two ends are relative to each other. But we need the matter with negative mass and energy density to make space-time warp in the way required. According to the unifying form of string theory known as M-theory, uniting general relativity, quantum theory, space-time. The idea is that we have 11 dimensions out of which 7 are curled up into small space that we don't notice them; the remaining 4 dimensions are fairly flat and are what we call space-time. If possible to arrange that the 4 dimensions get mixed up with 7 highly curved or warped directions. In conclusion, according to Stephen Hawking rapid space travel and travel back in time can't be ruled out according to our present understanding. But science-fiction fans need not lose heart. There's hope with Mtheory.





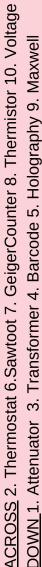
ACROSS

- **2.** Device that opens or closes a circuit in response to changes in temperature
- **6.** Repeating waveform that rises from zero to maximum value linearly drops back to zero and repeats
- 7. Device used to detect nuclear particles
- **8.** a resistive component that is designed to be temperature sensitive
- **10.** Term used to designate electric pressure

DOWN

- **1.** An electronic device that reduces the power of a signal without appreciably distorting its waveform
- **3.** Inductor with two or more windings.
- 4. ISO, UPC, GSI are the abbreviations of?
- **5.** The science dealing with three-dimensional optical recording.
- 9. Unit of magnetic flux





Questions provided by R Pravalika (MPCs 2)





MEMS represents a microelectromechanical system. It is likewise referred to by other subsidiary names, for example, microsystems technology (MST) or micromachines. MEMS is an umbrella term for a wide scope of microfabrication plans, techniques and instruments that includes acknowledging moving mechanical parts at minuscule scope. The basic physical elements of MEMS gadgets can shift from well under one micron on the lower end of the dimensional range, right to a few millimetres. Moreover, the kinds of MEMS gadgets can shift from generally basic structures having no moving components, to very perplexing electromechanical frameworks with numerous moving components heavily influenced by incorporated microelectronics. The one fundamental model of MEMS is that there are probably a few components having a type of mechanical usefulness whether these components can move. The term used to characterize MEMS shifts in various pieces of the world. In the United States, they are commonly called MEMS, while in some different pieces of the world they are classified "Microsystems Technology" or "micromachined gadgets".

MEMS

MEMS are utilized in a wide scope of sensors, actuators, generators, vitality sources, biochemical and biomedical frameworks, and oscillators. A few instances of MEMS applications include: Sensors, for example, MEMS accelerometers, MEMS gyrators, MEMS pressure sensors, MEMS tilt sensors, and different kinds of MEMS resounding sensors. Actuators, for example, MEMS switches, miniature siphons, miniature switches, and miniature grippers. Generators and vitality sources, for example, MEMS vibration vitality collectors, MEMS energy components, and MEMS radioisotope power generators. Biochemical and biomedical frameworks, for example, MEMS biosensors, lab-on-chips, and MEMS air microfluidic and particulate sensors. MEMS oscillators for exact timekeeping and recurrence control applications. At significantly littler nanometer scale, the manufacturing innovation transforms into nanoelectromechanical system (NEMS). Besides, where MEMS is coordinated with different advancements, different combinatory epitomes can take structure, for example, Bio-MEMS where biochemical and biomedical frameworks are acknowledged on microfabricated gadgets, miniature Opto-electro-mechanical system (MOEMS) or Opto-MEMS where optical systems, for example, miniature mirrors are incorporated to control or sense light at the minute scale, radio recurrence microelectromechanical system(RFMEMS) normally includes close reconciliation with semiconductor microelectronics to give RF transduction and exchanging abilities.

MEMS SENSORS & ACTUATORS: THE 5 SENSES AND MANY MORE



Points of interest of MEMS:

Incredibly versatile in assembling, bringing about exceptionally low unit costs when mass-created.

MEMS sensors have incredibly high affectability.

MEMS switches and actuators can accomplish high frequencies.

MEMS gadgets require exceptionally low force utilization.

MEMS can be promptly incorporated with microelectronics to accomplish inserted mechatronic frameworks.

Scaling impacts at infinitesimal levels can be utilized to accomplish plans and dynamic components.

Burdens of MEMS:

Pricey during the innovative work stage for any new MEMS plan or gadgets.

Pricey forthright arrangement cost for manufacturing cleanrooms and foundry offices.

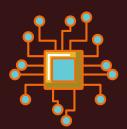
Creation and getting together unit expenses can be exceptionally high for low amounts.

Accordingly, MEMS are not reasonable for specialty applications, except if cost isn't an issue.

Testing hardware to describe the quality and execution can likewise be costly.

OUR DEFINITION FOR ELECTRONICS

- E ELECTRICAL TESTER
- L LIGHT EMITTING DEVICE
- E ENVIRONMENTAL TESTER
- C CAPACITOR
- T TRANSISTOR
- R RESISTOR
- **O OPTICAL DETECTOR**
- N NIOBIUM OXIDE CAPACITOR
- I INDUCTORS
- C CATHODE RAY OSCILLOSCOPE
- S SENSORS









Electrical tester: An electrical tester can measure a variety of electrical parameters, from current and voltage to resistance, continuity and beyond. An electrical tester is used by electrical contractors to assess everything from live wires and circuit breakers to electrical panels and power transformers.

Light Emitting device: A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

Environmental tester: Environmental testing is the measurement of the performance of equipment under specified environmental conditions, such as extremely high and low temperatures, large, swift variations in temperature, blown and settling sand and dust salt spray and salt fog, very high or low humidity etc.

Capacitor: A capacitor is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals. The effect of a capacitor is known as capacitance.

Transistor: A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit.

Resistor: A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.

Optical detector: Optical detectors convert incoming optical energy into electrical signals. The two main types of optical detectors are photon detectors and thermal detectors. Photon detectors produce one electron for each incoming photon of optical energy. The electron is then detected by the electronic circuitry.

Niobium oxide capacitor: A niobium electrolytic capacitor is a polarized capacitor whose anode electrode (+) is made of passivated niobium metal or niobium monoxide on which an insulating niobium pentoxide layer acts as the dielectric of the niobium capacitor. A solid electrolyte on the surface of the oxide layer serves as the second electrode (cathode) (-) of the capacitor.

Inductors: An inductor, also called a coil, choke, or reactor, is a passive two-terminal electrical component that stores energy in a magnetic field when electric current flows through it.1 An inductor typically consists of an insulated wire wound into a coil around a core.

Cathode ray oscilloscope: The Cathode Ray Oscilloscope or simply a CRO is an instrument that is used in the laboratory to display, measure and analyze waveforms of various electrical and electronic circuits. It is extremely useful and the most versatile instrument in the electronic industry. Basically, a cathode ray oscilloscope is a very fast X-Y plotter that can display an input signal as a function of time or another signal.

Sensors: a sensor is a device, module, machine, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. A sensor is always used with other electronics.

- Akash (MECs 2)



QUANTUM ENTAGLEMENT

-Sravani. V (MPCs 1)

A team of researchers at the Niels Bohr Institute, University of Copehagen, have succeeded in entangling two very different quantum objects. The result has several potential applications in ultra-precise sensing and quantum communication and is published in Nature Physics. Physicists create quantum entanglement, making two distant objects behave like one. Quantum entanglement involves linking 2 objects, making them behave like one at a distance.

Scientists entangle 2 large quantum objects, both at different locations from each other in quantum mechanics first. The feat is a step towards the practical application of a rather counterintuitive phenomenon and was accomplished by a team from Niels Bohr Institute at the University of Copenhagen. Entanglement is the magical sounding concept, dubbed as "spooky action at a distance "by Einstein. It involves a link that is made between two objects that can make them behave like one. This technique is of paramount importance to quantum communication and quantum sensing.

The researchers led by Prof. Eugene Polzik, used light particles, photons to create entanglement between a mechanical oscillator and a cloud of atoms with each acting like a tiny magnet or "spin". They picked these particular objects because atoms can be made to process quantum information while the membrane can store that information.

By entangling the systems, the scientists made them move in correlation with each other. If one object went left, so did the other. Prof. Eugene Polzik stated, "With this new technique we are en route to pushing the boundaries of the possibilities of entanglement. The bigger the objects, the further apart they are, the more desperate they are, the more interesting the entanglement becomes from both fundamental and applied perspectives. With the new result, entanglement between very different objects has become possible."

The achievement can pave the way to new sensing technologies. One example would be getting rid of noisy fluctuations currently affecting the Laser Interferometer Gravitational-wave Observatory (LIGO), which detects gravitational waves. If the researchers were able to take information from one system and apply it in another, they could get more precise readings.

Apr. 10, 2019, 9:15 AM

At last, we can see it: a black hole in the flesh. Astronomers today revealed a picture of the gargantuan black hole at the heart of the nearby galaxy Messier 87 (M87). The result—a ring of fire surrounding the blackest of shadows—is a powerful confirmation of Albert Einstein's theory of gravity, or general relativity, which was used to predict black holes 80 years ago. It is also a feat for the team of more than 200 scientists who toiled for years to produce the image by combining signals from eight separate radio observatories spanning the globe.

TIME FLIES

Mar. 26, 2021, 9:15 AM

This is an image of polarized light in the vicinity of the supermassive black hole at the centre of galaxy M87. The Event Horizon Telescope collaboration - a global network of radio dishes - observed it. The lines indicate the orientation of polarized light, which is directly related to the black hole's magnetic field lines. Thus, for the first time, we have an image showing the "signature" of magnetic fields around a black hole.

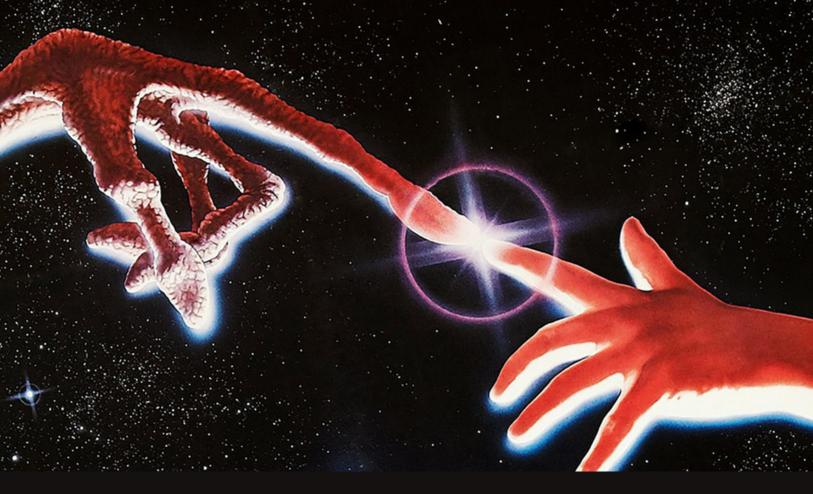
TETRA QUARK DISCOVERY

-D Sai Mahathi (MPCs 2)

The LHCb collaboration has watched a kind of four-quark particle that has never been seen. The revelation, introduced at an ongoing course at CERN and depicted in a paper posted on the arXiv preprint server, is probably going to be the first of a formerly unfamiliar class of particles. Quarks regularly consolidate together in gatherings of twos and threes to frame particles called hadrons. For quite a long time, nonetheless, scholars have anticipated the presence of four-quark and five-quark hadrons, which are now and then depicted as tetraquarks and pentaquarks. Late explorations including the LHCb have affirmed the presence of a few of these extraordinary hadrons. These particles made of unordinary mixes of quarks are an ideal "research center" for examining one of the four known major powers of nature, the solid connection that ties protons, neutrons and the nuclear cores that make up the issue. Itemized information on solid cooperation is likewise basic for deciding if new, startling cycles are an indication of new material science or simply standard material science. "Particles comprised of four quarks are now intriguing, and the one we have recently found is the first to be comprised of four weighty quarks of a similar sort, explicitly two appeal quarks and two appeal antiquarks," says the cordial representative of the LHCb coordinated effort, Giovanni Passaleva. "As of not long ago, the LHCb and different examinations had just watched tetraquarks with two hefty quarks all things considered and none with multiple quarks of a similar sort." "These outlandish substantial particles give outrageous but hypothetically genuinely straightforward cases with which to test models that would then be able to be utilized to clarify the idea of conventional issue particles, similar to protons or neutrons.

It is subsequently exceptionally energizing to see them show up in impacts at the LHC just because," says the approaching LHCb representative, Chris Parkes. Filtering through the full LHCb datasets from the first and second runs of the Large Hadron Collider, which occurred from 2009 to 2013 and from 2015 to 2018 individually, the specialists distinguished a knock in the mass appropriation of a couple of J/ ψ particles, which comprise of an appeal quark and an appeal antiquark. The knock has a factual importance of in excess of five standard deviations, the typical limit for guaranteeing the disclosure of another molecule, and it relates to a mass at which particles made out of four appeal quarks are anticipated to exist. Likewise with past tetraquark disclosures, it isn't totally evident whether the new molecule is a "genuine tetraquark"— that is, an arrangement of four quarks firmly bound together, or a couple of two-quark particles pitifully bound in an atom like structure. In any case, the new tetraquark will assist scholars with testing models of quantum chromodynamics, the hypothesis of solid cooperation.

"Tetra Quark is made up of four quarks of the same flavour and is likely, scientists say, to be the first of a previously undiscovered class of particles."



FERMI PARADOX (WHERE ARE THE ALIENS?)

"The paradox is the seed of truth. This germ just needs a fertile ground to flourish and bear a fruit", quoted the great botanist Leo Errera. In this world of incompleteness, paradoxes form a balance between knowledge and ignorance, until one takes over and a relative truth comes out. Yes, but this truth cannot be altered, always remains true. There are billions of stars in the Milky Way similar to the Sun. With high probability, at least a million of these stars may have Earth-like planets. In our 13.5 billion year aged galaxy, many stars, and hence their planets, would be much older than the Sun, aged 4.6 billion years. If the Earth is typical, some may have developed intelligent life long ago. Some of these civilizations may also have developed interstellar travel, a step we are investigating now. Even at the slow pace of currently envisioned interstellar travel, the Milky Way galaxy could be completely traversed in a few million years. However, there is no convincing evidence that this has happened. The Fermi paradox, named after Italian-American physicist Enrico Fermi, is this apparent contradiction between the lack of evidence for extraterrestrial civilizations and the high likeliness of their existence.

"Don't you ever wonder where everybody is?" was the radical question which sprouted from his mind, during a lunchtime conversation with fellow scientists. Given intelligent life's ability to overcome scarcity, and its tendency to expand and create new habitats, it seems possible that at least some civilizations would be technologically advanced to seek out new resources in space, explore and even colonize their own star system and subsequently, surrounding star systems. Even if such civilizations are rare, the scale argument indicates they should exist somewhere at some point during the history of the universe and since they could be detected from far away over a considerable amount of time, many more potential sites for their origin are within range of our observation.

So, it is unknown whether the paradox is stronger for our galaxy or for the universe as a whole.

SETI (Search for Extraterrestrial Intelligence) is an organization started in 1999, dedicated to listening for signals from other intelligent life. The discovery of habitable exoplanets from 2007 by self-replicating probes and attempts of devising the Bracewell probe to detect and communicate with aliens have come out as major advancements in this research. The greatest craving still remains to receive a signal in a foreign language regardless of the time constraints for such a conversation.

The question of the existence of intelligent beings rises. The Great Filter theory says that at some point in the evolutionary process, there's a wall that all or nearly all attempts at life hit and becomes impossible to go beyond it. For example, all life other than human life on Earth has reached the zenith of its evolution, with human intellect reaching a new level of evolution. That stage is The Great Filter. Human beings might be that single thread standing out as the greatest evolutions of the universe or we might be the leader of the pack of the earthly living beings whose evolution has come to a halt.

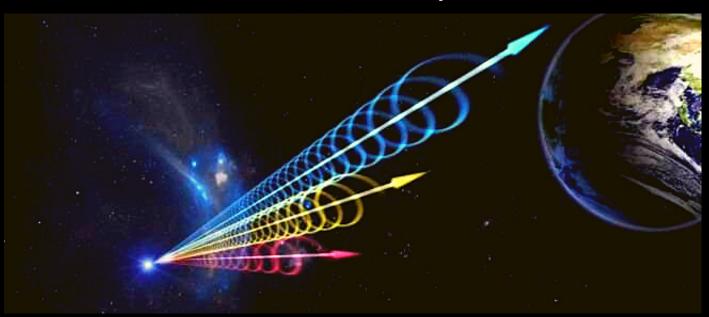


After 20 years of searching, some possible resolutions could be that intelligent life is rarer than we think. Perhaps, it's the nature of intelligent life to destroy itself, which we are also doing, or that our assumptions about the general development or behavior of intelligent species are flawed- extinction of them by certain natural factors, or them not really being intelligent. On the other hand, our current scientific understanding of the nature of the universe itself could be quite incomplete. Amongst all the uncertainty surrounding it, this seed of alien existence still in search of the fertile ground of suitable soil, lay a truthful path to finally seek it.



Fast radio bursts

-Kajal Yadav (MPCs 2)



Most of you would be thinking about "What are fast radio bursts?" and a couple of you would be having this question "Is it important to review fast radio bursts?". Firstly, let me provide you with brief information about FRBs (fast radio bursts). Fast radio bursts (FRBs) occur at an unprecedented rate, thousands per day over the entire sky with radiation energy densities at the source about ten billion times larger than those from Galactic pulsars. FRB phenomenology, source models and host galaxies, coherent radiation models, and thus the role of plasma propagation effects in burst detection.

While FRBs appear almost a bit like the individual pulses from pulsars, their large dispersive delays suggest that they originate from far outside the Milky Way and hence are many orders-of-magnitude more luminous. Scientists at the University of Manchester in England made this and told that the FRBs follow a cyclic pattern, which has radio bursts that last about 90 days. Those are then followed by a period of silence for 67 days. It's a discovery that provides an important clue that helps scientists to figure out where these frequency bursts are coming from. According to researchers, the frequency has the same start-stop pattern, which repeats every 157 days. The head of the study, Dr. Kaustubh Rajwade of the University of Manchester, told, "This is an exciting result as it is only the second system where it is believed that we see this modulation in burst activity. Detecting a periodicity provides an important constraint on the origin of the bursts and the activity cycles could argue against a processing neutron star. "For a while now, researchers have been studying the FRB, known as 121102, closely with the high powered, huge 76-meter Lovell Telescope, which has been used by scientists since the 1950s. Not only have the researchers been able to discover the interesting pattern of repeating FRBs, but the scientists' work has also highlighted the need for long-term monitoring of these frequencies. Fast radio bursts were only first discovered back in 2007. Then in 2016, it was finally discovered that some of the frequencies can repeat. This was the latest discovery by researchers in the United Kingdom. The very fact that 100 FRB sources were discovered within the last decade is essentially due to the tiny fields-of-view of current radio telescopes. A replacement generation of another set of wide-field instruments is now coming online. These are going to be capable of detecting multiple FRBs per day. We are thus on the brink of further breakthroughs within the short-duration radio transient space, which can be critical for differentiating between the various proposed theories for the origin of FRBs.



The Universe is a never - ending ocean full of surprises, mysteries and awe. It's a place where time and curiosity never find a dead end. Would you rather imagine yourself sitting in your backyard or travelling alone in space into the never-ending universe? Well no one has ever got their dream fulfilled even if it were an impossible dream. But two of NASA's spacecrafts are now travelling or simply freely floating or even time-travelling in the interstellar space aboard our solar system.

VOYAGER 1 and 2 are the fastest machines ever launched from earth. These spacecraft ever since their launch, had contributed much to astronomy. Voyager 1 & 2 were launched from earth in 1977 as a part of the Voyager Missions. Their mission was to explore Jupiter and Saturn and beyond to the outer planets. No human made object had ever attempted a journey before. These two spacecraft were the photographers of our distant planets Neptune, Jupiter and also took tens of thousands of pictures. They captured the structure of Saturn's rings and Jupiter's storms and moons .

THE INTERSTELLAR JOURNEY

VOYAGER 1&2

Since then, these spacecraft have continued their journey faithfully into the endless night away from home. Voyager 1 and 2 are now so far away that they are in the INTERSTELLAR space- the region between the stars. No other spacecraft have flown this far.

Both the spacecraft are still sending information back to earth. According to the scientists, they have enough fuel and power to operate till 2025. Sometime after this they will not be able to communicate with earth anymore. They will continue to travel on and on passing other stars until something stops them. They are now travelling at one ten-thousandth speed of light. They would need 40,000 years to reach the nearest star. They have continued to send information regarding the perilous and the intriguing interstellar space. Voyager 1&2 carry a message containing music and greetings from different languages so that if any alien life finds them, they might learn something about earth and us as well. We can do nothing but hope their journey into the eternal Universe will go on undisturbed. The Universe is never-ending and so is time. Our earth is a very minute part of its infinitesimally large territory.

We hope in the next 100 years to come, humans would be able to travel through interstellar space successfully if they do not accidentally encounter a black hole.



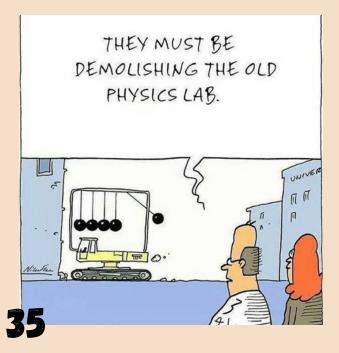
-MARYSLESSOR (MPCS 2)

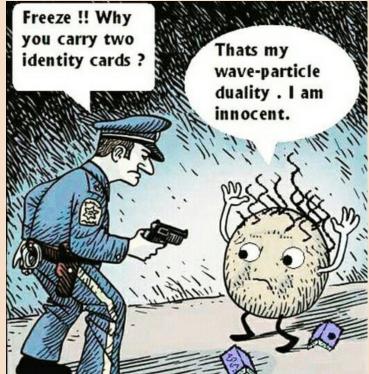
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physics students before viva:



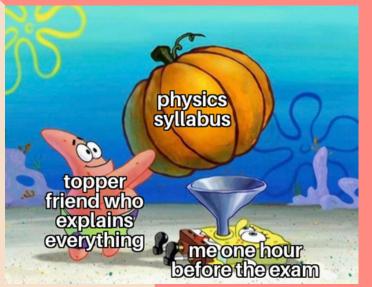






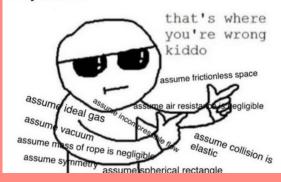
CREATED BY
TUSHAR SHAH (MPCS 2)

MEMES CORNER



Engineers: You can't just assume your way out of everything

Physicists:





Greek letters in Greek language



Greek letters in Mathematics



Greek letters in Physics when you finally are able to memorise a derivation after a week's effort:

the 30 other derivations in the syllabus:









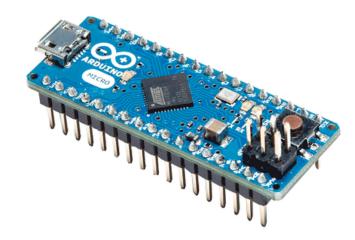




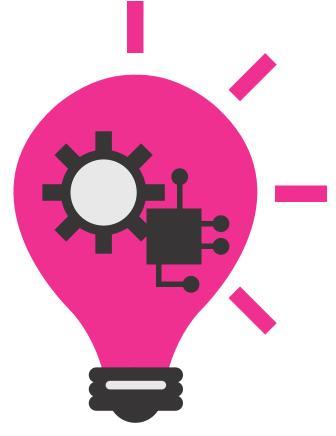




Arduino Corporation is a premier open-source development board and software development company. The Arduino Uno is highly regarded as one of the easiest microcontroller boards to use on the market. It also gives us a diverse environment to work on and also many helpful solutions present in spite of being an open source program. Their smallest creation is the Arduino Micro which is an incredibly condensed version of Arduino's Leonardo board who is also the founder of the arduino board. The Arduino Uno is another marvellous creation which gives us the same features as the micro but in an expanded version . The major difference between both of them are their microcontrollers .The Micro works based on Atmel ATmega32U4 microcontroller and the Uno works on ATMEGA328.









The Arduino Uno has 14 digital input/output pins in which 6 can be used as PWM outputs (Pulse Width Modulation), a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button. This contains all the required support needed for microcontrollers. In order to get started, they are simply connected to a computer with a USB cable or with a AC-to-DC adapter or battery. The operating voltage of the board is 5V, the given input voltage can vary from 7-12 V but the maximum limit which can be applied is between 6-20V. There are also 14 Digital input output pins which take in real time values and send it to the microcontroller for processing. It has a flash memory of 32 KB of which 0.5 KB used by the bootloader. There are also built in LED lights which light up every time we connect the board to the laptop which indicates the working of the board. The UNO developed over the years adding new features and more components, the latest is the UNO Rev 3 which works the best.

The Arduino Micro is based upon the Atmel ATmega32U4 microcontroller. With a 16 MHz crystal oscillator, the microcontroller has an 8-bit resolution with 32 KB of flash and 2.5 KB of RAM. The main feature of the board itself is the USB micro connector which allows it to be easily connected to your computer. It also contains a reset button, a 6-pin ISP reprogramming header and 20 digital I/O pins(Input and Output), 12 that can be used for analog inputs and seven that can be reconfigured to PWM outputs. While the Micro is the smallest of the Arduino boards, it comes with a minor setback. The Arduino shields are peripheral accessory boards that interface directly into the microcontroller board, some examples are ethernet shield, motor driver shield etc. Due to its tiny shape, the Micro is not compatible with any shields whereas in the Uno we can attach shields according to our requirements which help us to enhance the working of the board. The layout of the header I/Os, however, let the Micro fit directly into most any breadboard, so connecting the Micro to your system is a breeze. The micro USB in Arduino micro gives it an edge. You can easily power it with your smartphone. Make android apps to communicate with it. Use it as a virtual keyboard.

So which is better, the Uno or Micro? This again depends on the needs of the person who is working with the boards. If we want a compatible easy to carry and instant presentation the we could opt for the Micro and if we want to add special features and make our experiment more diverse then we may opt for the Uno board. It basically comes down to us. Which board is better is left for you to decide.

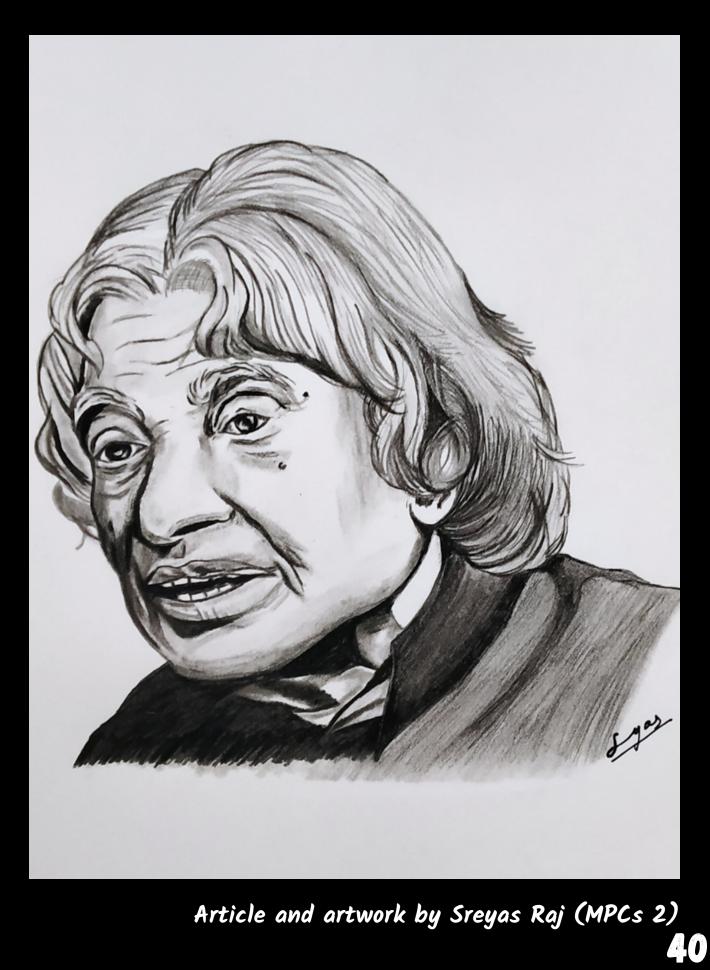
THE MISSILE MAN

We as Indians know very well about our very own Avul Pakir Jainulabdeen Abdul Kalam. He was a well-known scientist from our nation. He also served as the president of our nation from 2002 to 2007. He was born on 15th October 1931 in Rameshwaram, Tamil Nadu. He studied Aerospace engineering at Madras Institute of Technology and graduated from there.

Now let us know a bit more about the Missile man after he graduated and started his career.

After graduating from Madras Institute of Technology in 1960 Kalam joined the Aeronautical Development Establishment of the Defence Research and Development Organization as a scientist after becoming a member of the Defence Research & Development Service (DRDS). He started his passion to work by designing a small hovercraft. He was also part of the INCOSPAR committee working under another well-known Indian space scientist Vikram Sarabhai. In 1969, Kalam was transferred to the Indian Space Research Organisation (ISRO) where he was the project director of India's first Satellite Launch Vehicle (SLV-III). In 1969, Kalam received the government's approval and expanded the programme to include more engineers.

Between the 1970s and 1990s, Kalam made an effort to develop the Polar Satellite Launch Vehicle (PSLV) and SLV-III projects, both of which proved to be successful. In the 1970s, Kalam also directed two projects, Project Devil and Project Valiant, which sought to develop ballistic missiles from the technology of the successful SLV programme. His research and educational leadership brought him great laurels and prestige in the 1980s, which prompted the government to initiate an advanced missile programme under his directorship. Kalam and Dr. V S Arunachalam, metallurgist and scientific adviser to the Defence Minister, worked on the suggestion by the then Defence Minister, R. Venkataraman on a proposal for simultaneous development of a quiver of missiles instead of taking planned missiles one after another. Kalam played a major part in developing many missiles under the mission including Agni, an intermediate-range ballistic missile and Prithvi, the tactical surface-to-surface missile, although the projects have been criticized for mismanagement and cost and time overruns. Kalam served as the Chief Scientific Adviser to the Prime Minister and Secretary of the Defence Research and Development Organisation from July 1992 to December 1999.





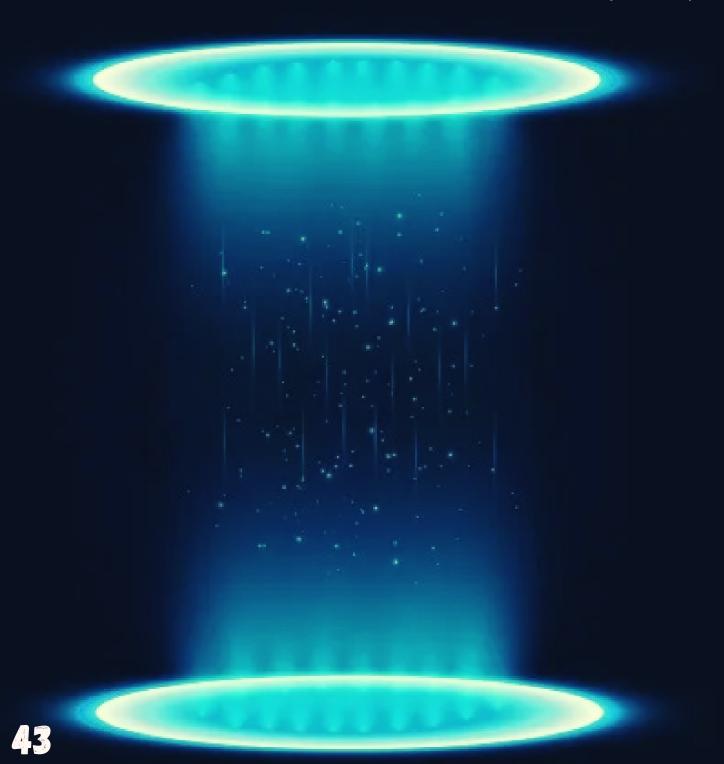
Kalam's career was filled with obstacles and hindrances to which he stood with great confidence and faced. Kalam received a great amount of criticism during his work on the missiles from the politics and the media but still, he had believed in himself and had completed what he had started. Kalam has to be that one person that has to be considered as a role model to every youth in India because there will never be a man like our very own Missile Man.

HERE ARE 10 INTERESTING FACTS ABOUT ABOUL KALAM

- 1. He was born at Rameswaram, Tamil Nadu to an impoverished family of seven whose sole source of income was a boat. To contribute to their dwindling finances, he started selling newspapers at a very young age.
- 2. Kalam missed an opportunity to become a fighter pilot for the Indian Air force. His dreams were shattered when he was ranked 9th when there were only 8 openings.
- 3. Dr. Kalam held the distinction of holding doctorates from over 40 universities across the world.
- 4. On the occasion of his birthday, the United Nations (UN) in 2015 had declared to observe it as World Student's Day.
- 5. Kalam's visit to Switzerland is commemorated as Science Day in the country. This declaration was made in his honor by the Swiss government after the sad demise of this great personality.
- 6. Kalam wrote a great deal of poetry in Tamil and was very fond of playing the stringed instrument Veena. He has also published several books such as Wings of Fire, Ignited Minds, Inspiring Thoughts, and Turning Points among others.
- 7. Researchers at the Jet Propulsion Laboratory (JPL), NASA, discovered a new radiation-resistant bacterium in 2017 and named it 'Solibacillus Kalamii' to honor the late President.
- 8. Kalam was known as the 'Missile Man' of India due to his continued, successful work with ballistic missiles and launch vehicle technology.
- 9. Kalam also made significant contributions to the nuclear capabilities of India. The Pokhran -2 nuclear tests (in 1998) were successful thanks to his organizational and technical support.
- 10. Throughout his life, he supported the abolition of the death penalty saying that as President of India he felt pain in deciding mercy petitions of death row convicts

TELEPORTATION: A GIANT LEAP, IF MADE POSSIBLE

~V S N K MAHALAKSHMI (MPCs 2A)



Imagine a day comes when you can move wherever you want around the world and across the universe in a few seconds or minutes. Travel across the universe, through galaxies, watch stars, planets and then perform an experiment on some other planet. Seems like magic, right? Is it really possible? The answer is yes. May not be yes for now but might be yes, in the later generations. This can be made possible with quantum teleportation.

Quantum teleportation is the process of transferring matter or energy without it being travelled through the intervening space. This includes converting the matter into energy and traversing it through the space and then reconverting it into its original dimensions. This process requires the collection of its quantum information like its position, momentum, spin, polarization.

So, to teleport an object we need its every minute dimension and quantum information. To know the properties and dimensions of it we need to disintegrate it first. Then we will be able to know all the quantum information we require. Now we need to reintegrate the object in the place we wanted. So, we need something which perfectly reintegrates it into its original dimensions. And then arises the other issue. As we know according to the uncertainty principle it isn't possible to measure momentum and position at the same time. So, the information we get will be uncertain. Quantum teleportation is not the matter being traversed but the information. It is based on the hypothesis of EPR paradox (Einstein-Podolsk-Rosen paradox) by Albert Einstein in 1935. This demonstrates the idea of quantum entanglement. Quantum entanglement is the link between two particles how far they are apart, they share the information between them faster than the speed of light. This was called "spooky action at a distance" by Einstein. To understand the concept of entanglement imagine you have two similar boxes containing sugar in one and salt in the other. Now one of the boxes is with you and the other with your friend. When you open the box and find sugar the other box surely contains salt. This means if we know one of the outputs the other thing is certain that it happens. Similar to this is the quantum entanglement. Many scientists performed experiments on the entanglement and proved the correlations between the intermediate stages of entangled particles are real.

44

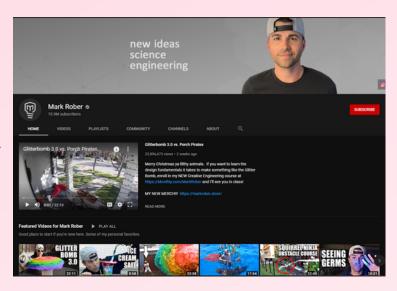
A NEW REGIME

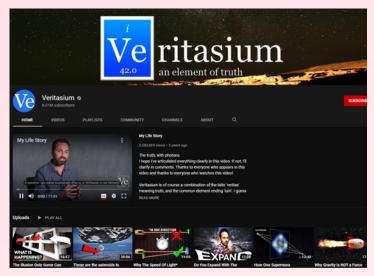
by A Sai Anirudh (MSCs 2)

As our current understanding of physics says "Time is always moving forward" which simply implies that time is limited for us and we cannot bring back the lost time. Social media and Netflix can swallow up a lot of our time, so, why not try to put it to a better use. Watching entertaining yet informative videos on YouTube is one of the best ways of doing it. YouTube has many great channels that can teach anyone practically anything. Hence, here are some of the best science channels on YouTube which not only gives you your daily dose of science but a lot of entertaining content.

1. Mark Rober

Mark is a former NASA and Apple engineer. Mark's channel is one of the biggest and highly popular channels out which 14 million there has over subscribers. His videos average a whopping 20 million views per video. His videos are very exciting and fun to watch yet Mark manages to put in a good dose of theory in his videos.



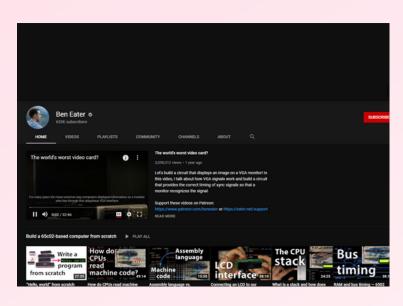


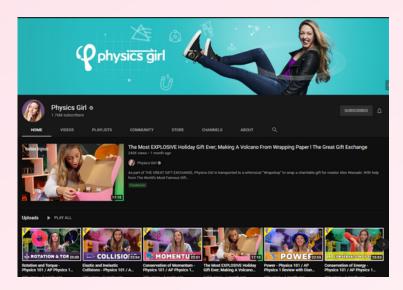
2. Veritasium

"Is veritasium a real element? It is, at least for me". said Derek Muller, founder of veritasium. Veritasium tries to answer those questions which no one would even care to ask. The videos Derek makes have fairly simple titles to them, but the complexity behind those are what the videos try to explore and explain. These videos are so good that they will most likely glue you to the chair while watching it. You can find a wide range of videos which include astronomy, robotics and mechanics.

3. Ben Eater

Ben is all about electronics and computer architecture. Ben's videos are one of the finest you will find related to electronics. Ben's videos are filled with real life demonstrations and a lot of trial and error experiments which in turn helps the viewer understand better. Ben's videos range from explaining how circuits, semiconductors work to building our own LEDs and transistors.



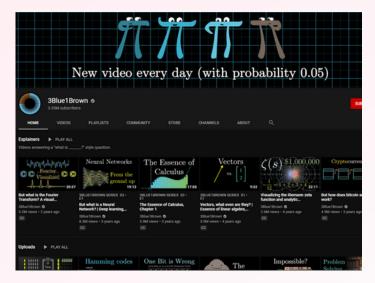


4. Physics girl

Dianna, founder of Physics girl is a graduate from the very famous MIT. She covers a wide variety of videos which range from kinematics, semiconductors to special relativity. You can find a lot of humor and awe gazing experiments in her videos.

5. 3Blue1Brown

3Blue1Brown is an odd one to the list, but it is so good that you cannot help but mention. 3Blue1Brown is predominantly a math channel but it regularly emphasizes on topics of science in our daily lives. You can find videos on **Fourier** transformations, quantum mechanics and hamming codes with verv detailed explanations.





PHYSICS NOBLE PRIZE WINNERS 2019

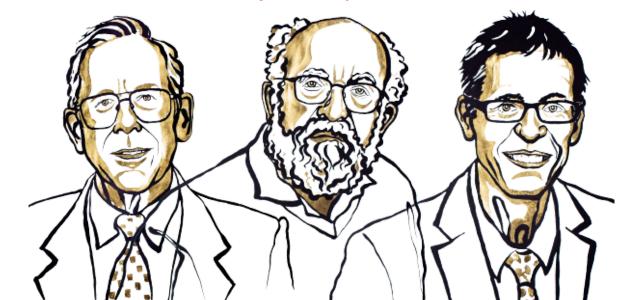
by Shafi (MPCs 3)

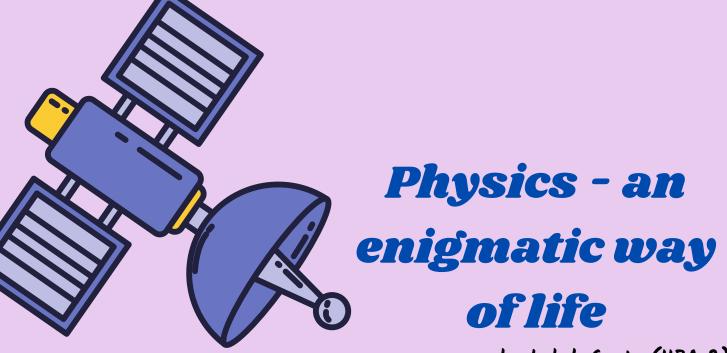
In the year 2019, noble prize in physics is to be divided between James Feebles, Micheal Mayor and Didier Queloz for their work in further understanding the universe.

Peebles was rewarded for laying a foundation for modern cosmology, including his realization that faint microwave radiation that filled the cosmos 400,000 years after the big bang contains crucial clues to what the universe looked like at this primitive stage and how it has evolved over the subsequent 13bn years.

Peebles is credited with developing the theoretical tools that allowed scientists to perform a cosmic inventory of what the universe is made from, showing that ordinary matter makes up just 5% of its known contents, with the rest being dark matter and dark energy.

Mayor and Queloz have been recognized for their joint discovery in 1995 of the first exoplanet, 50 light years away in the constellation of Pegasus. The planet, 51 Pegasi B, is a gaseous ball about 150 times more massive than earth and has a scorching surface temperature of about 1,000c. Queloz, who holds posts at the University of Geneva and the University of Cambridge, told a press briefing at London that he had been expecting a call about a grant he was working on when the news came through. The pair discovered the exoplanet using a sophisticated technique known as doppler spectroscopy, which measures the tiny wobble of a star that occurs as the star-planet pair move around a common center of gravity. This wobbling movement alternates blueshifts and redshifts the light from the star. When Queloz and Mayor set up the search it was with low expectations of finding anything because any planets massive enough to create a measurable doppler shift were expected to have such long orbits that the wobble would take years to detect. Surprisingly, though, they found a huge planet sitting extremely close to its host star, with an orbit of just four days.





by Laksh Gupta (HBA 2)

It's time for students to know that physics is not just a subject which is studied in school, colleges or even universities.

At the beginning of our existence when humanity was just developing, we observed different things like the night and the light, the trees and the fire, the stone and the shadows. We got very curious about what is this world and what are these things we are surrounded by.

For instance, let's say we are trapped in a dark empty room and all we know is we have to survive. We try to find out what is in the darkroom other than us, when we are fed up and can't find anything, we investigate why the room is dark. When we find that out, we can probably shed the darkness away and now we know things. THIS IS PHYSICS!

God created this world the way we see it but we don't know in what way. We always try to learn, investigate and apply. Physicists are the masterminds who reveal these rules of gods to the humans like why does apple have to fall down the tree? Well, that's gravity! We are trying to get on a running bus, that's inertia. Light travels in a straight line, but why? We are still not completely sure. But one day we will find that out and once we do maybe we can control the nature of the light. Physics comes with endless possibilities; we just need to know how to apply it in everyday life.

PHYSICS SLANG

by D Sai Mahathi (MPCs 2)

Flavor

In particle physics, the flavor has nothing to do with your taste buds. Instead, the term signifies different kinds of particles. There are six "flavors," or varieties, of quark: up, down, top, bottom, strange, and charm. There are also six flavors of leptons: the electron, muon and tau, and their corresponding neutrinos (the electron, muon and tau neutrinos).





Color

Put away your box of crayons. Color, much like flavor, is another way of differentiating subatomic particles, but it isn't based on hue. Quarks can be designated as red, blue, but the colorful green or naming scheme represents of abstract characteristic the particles' charge related to the strong (instead of electric) force rather than an actual color.

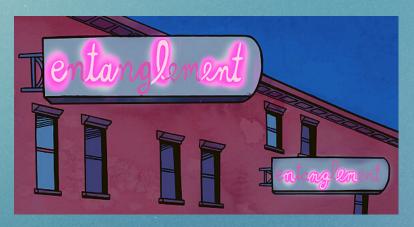


Entanglement

When most of us deal with something entangled, it's usually something like the cables of a pair of headphones. But for particle physicists, entanglement refers to what Einstein called "spooky action at a distance": the way that two particles can be separated by great distances but "connected" in such a way that influencing one seems to affect the other instantaneously.

Fields

Physical fields can be dotted with crops or laden with grass and flowers. **Fields** in physics, however, are more monotone, and usually extend to infinity. They permeate the universe, becoming only when apparent encounter something that can interact with them. Electrically charged particles can interact with the electromagnetic field; particles with mass can interact with the gravitational field, and part of what gives those particle mass is the Higgs field.





A DIFFERENT APPROACH TO LEARNING

by A Sai Anirudh (MSCs 2)

Let's face it, learning science can be difficult. Especially when we consider highly practical and experimental based subjects like physics and electronics. These require a lot of practical understanding and just the traditional lectures might not seem sufficient. On top of that online classes can sometimes seem to go over the head. Considering all these, it would be a boon if we could listen to the explanation multiple times and learn with more practical examples. To address this very problem, a new wave of free online learning websites was born in the last decade. Now, a student can access millions of courses with just a few clicks. This article will inform you about some very popular and free websites that a student can access anytime and from anywhere for their learning.

1. edX

Founded by Harvard and MIT, edX is a global non-profit that seeks to remove three barriers of traditional education: cost, location and access. You can find videos of well-made animations and practical experiments attached in the courses which enhances the quality of the content being taught. In addition to free courses, edX also offers online bachelor/masters programs but with a fee.

Some of the popular courses on edX are

- Mechanics: Kinematics and Dynamics
- Circuits and Electronics
- Electricity and magnetism
- CS50: Introduction to computer science



2. Coursera

Coursera was founded by a Stanford professor named Andrew Ng. Coursera has more than 35 million learners, 150 university partners, 2,700 courses, 250 specializations and four degrees. Course instructors include experts from the world's top colleges and universities, and courses include recorded video lectures, community discussion forums and both graded and peer-reviewed coursework. Coursera also provides certificates on completion of the course successfully.

Some of the popular courses on Coursera are



- Statistical Molecular Thermodynamics
- Understanding Einstein: Theory of special relativity

3. Khan academy

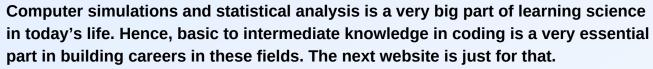
Khan academy was founded by the very famous Sal Khan who is of an Indian origin. Khan Academy is a non-profit whose mission is "to provide a free, world-class education for anyone, anywhere." Khan Academy is free for both learners and teachers, and offers lessons for students from kindergarten through early college, with topics including math and science. Khan academy was also endorsed by Bill Gates.

4. NPTEL

NPTEL is an Indian startup and was jointly founded by the very popular IIT's. NPTEL offers free courses in Indian English which is a popular option for many of us who find it difficult to understand American English. NPTEL mainly focuses on subjects taught in engineering courses such as physics, math, electronics etc. It also offers certificates once the student completes the course successfully.

Some of the popular courses on NPTEL are

- Sr. Secondary Physics
- Physics and Electronics





<u>5. Udemy</u>

Udemy is one of the largest companies which primarily offers courses in computer science. It has 30 million students, 100,000 courses in 50 languages, 42,000 instructors and 22 million minutes of video instruction. Unlike other online education platforms driven by content from colleges and universities, Udemy allows content creators to curate their own courses and teach them online.

Some of the popular courses on Udemy are Introduction to Python Programming.



COFFEE BREAK

ACROSS

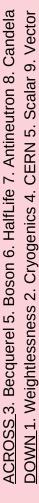
- 3. The SI unit of radioactivity
- **5.** A particle that follows Bose-Einstein statistics
- **6.** The time required for something to fall to half its initial value
- **7.** Anti particle of a neutron **10.** The basic unit of luminous intensity

DOWN

- 1. No force of gravity on an object
- **2.** The branch of physics that studies the phenomena that occur at very low temperatures
- **4.** An European Organization for Nuclear Research
- **8.** A quantity that has a size or magnitude only
- **9.** Any physical quantity that is defined by size and direction









WIGIG Tech by T Sujith Lenard (MECs 2)

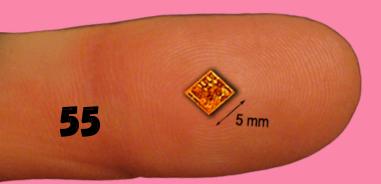
owadays the technology has been changed and the mode of development in the field of technology is very vast. Many problems have also been raised in this process to overcome them and move wireless technology into next level Gi-Fi technology. This helps in development of new generation devices. It is much faster, low cost, low power consumption technology than Wi-Fi.

Gi-Fi (Gigabit wireless fidelity) is the world's first transceiver which operates at 60GHz. Its range of frequency is 5Gbps of 10 range; its main features are its ease for deployment, small form factor, high speed data transfer, whereas in Wi-Fi we can only transmit up to 2.4GHz whereas in Gi-Fi it's 10 times more'.

the benefits of Gi-Fi technology are it eliminates the mode of cables and wiring system and uses wireless data transmission .it is low cost than wi-fi where the chip is almost \$10 or even less and has low mass adoption .it produces the simplicity in the connection, it even won't have any interference of other band of frequency up to 60Hz.It provides high security i.e. open international strands (OIs) which is basically top security systems.

In this the time

division duplex (TDD) technology is used for transmitting and receiving data. Which consist of the antennas, power amplifiers. Basically, the data files get converted from IF (infrared form) range to RF 60GHz range, which then later gets fed into a power amplifier, this incoming RF signal is first converted into an IF signal again at 5GHz then to normal data ranges. The whole data is transferred with in few seconds, this then achieves the high data rates in 60GHz which has no co-channel interference, high security and frequency reuse. After comparing Gi-Fi with other wireless technology we have come to the conclusion that it solves the problem of low data transfer, high power consumption, cost efficient, low frequency range of early technology which can be used to transfer the data in a single go due to single chip technique.







n 20 March 2020, the Solar Wind Anisotropies (SWAN) imaged a comet aboard the Solar Heliosphere Observer (SOHO) spacecraft. It is an Oort Cloud comet that was found in the theoretical region Oort cloud, predominant with icy small solar system bodies that lie at a distance of 2000 to 20000 AU from the sun. Although it appeared at a distance visible to the human eye with a simple binocular, scientists have predicted that it could not be viewed by inexperienced viewers. Comets are icy solar system bodies that outgas due to the heat of the sun and produce a visible tail. C/2020 might have disintegrated at a larger distance from the earth.

It is at 0.8 AU (120 million km; 310 LD) from Earth in the constellation of Perseus and less than 25 degrees from the Sun. It has an apparent magnitude of 7 and is too diffuse to be visible to the naked eye even from a dark site.

One of the reasons for an inexperienced eye to have failed to observe the C/2020 is that the comet is hidden by natural phenomena like Twilight and Zodiacal light (a faint triangular light region in the night sky). Both phenomena result in the sky being neither light nor dark and thus aids in missing the comet.

The comet had supposedly passed the celestial equator on the 7th of May and headed northward.

PHYSICS NOBLE PRIZE WINNERS 2020

by Shafi (MPCs 3)

he Nobel Prize in Physics 2020 was divided, one half awarded to Roger Penrose "for the discovery that black hole formation is a robust prediction of the general theory of relativity", the other half jointly to Reinhard Genzel and Andrea Ghez, "for the discovery of a supermassive compact object at the center of our galaxy."

Roger Penrose used ingenious mathematical methods in his proof that black holes are a direct consequence of Albert Einstein's general theory of relativity.

His groundbreaking article is still regarded as the most important contribution to the general theory of relativity since Einstein.

Reinhard Genzel and Andrea Ghez each lead a group of astronomers that, since the early 1990s, has focused on a region called Sagittarius A* at the center of our galaxy. The orbits of the brightest stars closest to the middle of the Milky Way have been mapped with increasing precision. The measurements of these two groups agree, with both finding an extremely heavy, invisible object that pulls on the jumble of stars, causing them to rush around at dizzying speeds. Around four million solar masses are packed together in a region no larger than our solar system. Expanding the limits of technology, they refined new techniques to compensate for distortions caused by the Earth's atmosphere, building unique instruments and committing themselves to long-term research. Using the world's largest telescopes, Genzel and Ghez developed methods to see through the huge clouds of interstellar gas and dust to the center of the Milky Way. Their pioneering work has given us the most convincing evidence yet of a supermassive black hole at the centre of the Milky Way.





HOW TO SEE WITHOUT GLASSES

by D Sai Mahathi (MPCs 2)

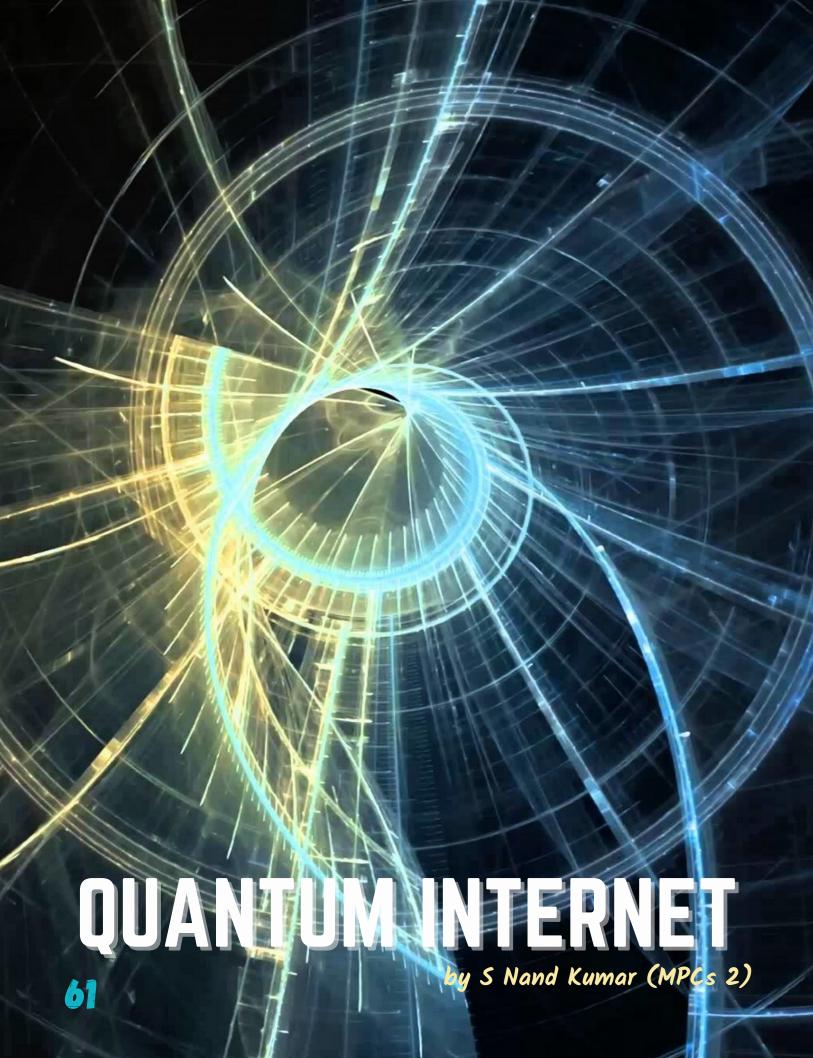
Vision is arguably the most compelling human sense. Words and stories and sounds allow us to imagine strange beasts and far-off worlds, but seeing makes us truly believe they exist. And that's why we place so much effort into correcting the optics of our eyes when they don't work - whether with glasses or contact lenses or surgery. But if you're in a pinch, bleary-eyed, or missing your glasses, there's a simple trick that will allow you to see clearly - just make a tiny, tiny hole using your fingers, look through it, and the world will become clear again. This works no matter how blurry your vision is - take off your glasses and give it a try! But to explain this wizardry, we just need to remember how seeing works. Light travels outwards from a source, bounces off of objects in its path, travels into your eye, and onto your retina, where it forms an image.

If your eye had no lens, light from a single source would hit your retina in lots of places and result in a smeared-out mess - which is exactly what happens when I take the lens off of my camera. A lens focuses that spread-out light back into a single point, corralling it into a crisp image on your retina. And after a little excitation of light-sensitive nerves and interpretation from your brain, you see.

When we look at an object, the background and foreground are usually blurry, because a lens can only focus light coming from one distance away. If an object is too near or too far, its light will again be spread out on your retina leaving you with a blur. Fortunately, muscles in our eyes allow us to accommodate by squeezing the lens, which changes its focal length so we can see at different distances - except when we can't, or when our lenses become damaged - in which case we need glasses. Unlike a lens, a pinhole or other small opening can focus light coming from ANY distance: because it's such a small opening, it only allows light to come through in one place, and thus in only one direction from any particular source. So, there's no blur, and everything is in focus!

If you're familiar with photography, this is why using smaller and smaller apertures makes everything in your photo come into focus. Of course, small openings like pinholes and camera apertures create crisp images by blocking rather than focusing light, so the images are much darker - which is a major reason why we use lenses rather than pinholes for glasses, telescopes - and eyes.

Now do you *see* why? (pun intended)



The subject of quantum mechanics with its abstract theory of probability has been of limited use, but with theories like quantum entanglement, quantum technology is in the crisp of a Quantum Revolution 2.0, with a small opening- called the Quantum Internet - and a lot of promise.

In our everyday lives, we experience the world according to the rules of classical physics. However, at much smaller scales, the scales of atoms and electrons, we enter the weird world of quantum mechanics the theory of uncertainty. Since we don't experience this in our everyday lives, it's really hard to imagine quantum mechanics. Similar to classical bits in the present-day internet, the quantum internet works with quantum bits or qubits made of quanta or photons. A qubit unlike a normal bit doesn't take a fixed value of 0 or 1. It is rather the superposition of both the states 0 and 1 at the same time identical to that Schrodinger's Cat! It's more like a spinning coin if you look from above its heads and tails at the same time.

The second strange thing about quantum mechanics is when you measure/detect it: If you look at a quantum superposition of an object – the object which is in two states at the same time – the object itself will 'jump' to one state or the other. The fact that you have acquired knowledge about the object has changed its state. In the analogy of the spinning coin, looking at the coin can be compared to slapping the spinning coin on the table where the coin is forced to choose aside. Thus, qubits cannot be measured without being disturbed. This is a big advantage for the security of the quantum internet.

The third concept is that of quantum entanglement: two qubits can have an extremely strong connection.

If two qubits are entangled, and both qubits are measured, the outcome for each qubit will look random. But, upon comparison, both sets match up in ways that are simply impossible to achieve with classical bits. The outcomes can only be explained if the measurement on one qubit has somehow influenced the other qubit.

QUANTUM REPEATERS

This entanglement exists till a distance of 100 km where the two qubits are sent far apart in an optical fibre. In a bid to create a worldwide quantum network, the signals generated by the entangled qubits need to be repeated in between the qubits e. g. located at Delft and Leiden.

QUANTUM TELEPORTATION

Yup, the decades-old sci-fi of Star Trek are true with quanta. The Quantum Repeaters use quantum teleportation where the quantum state disappears/teleports on one side and then reappears again at the other side. First, entanglement is generated between the end node in Delft and the quantum repeater in The Hague and similarly with the repeater and the other end node in Leiden. Once both links succeed in generating entanglement, the quantum repeater can employ the following trick: it can use the qubit that is entangled with Leiden to teleport one qubit from The Hague to Leiden. In particular, it can teleport the qubit that is entangled with Delft. Hence, after performing the teleportation protocol Leiden obtains a qubit that is entangled with Delft. This procedure is known as entanglement swapping. Though in its development stage, with the latest tests going on in the Netherlands, quantum internet can act as a completely secure means of communication, with the qubit's inherent uncertainty in detection by hackers.

Microbots

by Sivali Rayaprolu (MECs 2B)

Microbotics or micro-robotics is a field of miniature robotics, in particular mobile robots having dimensions less than 1mm. When we think of microbots, as the name suggests, is a miniaturized machine designed to perform specific tasks with precision. Their dimensions range from a fraction of a millimeter up to several millimeters. A microbot just like a robot and a nanorobot can either be autonomous or insect-like. autonomous Microbot consists of its on-board computer, which controls the machine and allows it to operate independently, whereas in an insectlike microbot the machine is one of a fleet of several, or many, identical units that are all controlled by a single, central computer. This type is more common for microbots. Microbots are used in real day applications. Due to their small size microbots are potentially very cheap and could be used in large numbers to explore environments that are too small or too dangerous for people or larger robots. It is expected that microbots will be useful in applications such as looking for survivors in collapsed buildings after an earthquake or crawling through the digestive tract. But, one of the major challenges of developing a microbot is to achieve a machine using a very limited power supply. Microbots can use small lightweight battery sources like coin cells or can search and take energy from the surrounding environment in the form of vibration or light energy. Though this idea of microbots originated from a movie in big hero 6, the research of microbots is still in progress. A few of the research work done in this field is seen in other forms too. For example, Harvard's Ambulatory Microrobot (HAMR): A robotic cockroach. The HAMR weighs in under an ounce and can run, jump, and can carry small items about twice its length It is fast and can move at a speed of almost 19 inches per second. Robotic bees: RoboBees



The RoboBee by Harvard has improved over time; it can also fly and swim It gained the ability to "perch" on surfaces using static electricity. This allows the RoboBee to save power for longer flights. The 80-milligram robot can take a swim, leap up from the water, and then land. µRobotex: microbots from France Scientists from the Femto-ST Institute in France have built the µ Robotex platform. It is a new, extremely small microrobot system. This system has been able to build the smallest house in the world inside a vacuum chamber. The robot used an ion beam to cut a silica membrane into tiny pieces for assembly. The micro house is 0.015 mm high and 0.020 mm broad. In comparison, a grain of sand is anywhere from 0.05 mm to 2 mm in diameter. The completed house was kept on the tip of an optical fiber piece.

Machines this small tend to stick to everything they touch, the way sand sticks to your feet after a day at the beach. So, we built these microrobots without any wheels or hinged joints, which must slide smoothly on their bearings. Instead, these robots move by bending their bodies like caterpillars. At very small scales, this machine is surprisingly fast.





by S Nand Kumar (MPCs 2)

A. Achyut is a Bhavans Vivekananda college, Sainikpuri alumni. He is a physical science student. He completed his graduation with flying colours in 2019 to pursue Astronomy as his field of interest. He cleared JAM recently with a good rank and currently is in 2nd year at Osmania University.

Apart from the childhood fantasies that we all have had and have, what was the main driving force towards Astronomy? Any special motivation during your schooling and any concept or experiment in your BSc here, to go ahead with it?

Just like an undergraduate physics major, Astronomical concepts seem to consist of these very different branches of physics, Mechanics, E&M Theory, and Optics. In Astrophysics we use all the branches that you study in undergrad unlike most other parts of Physics.

What kind of a subject is Astrophysics? Is there any theoretical and experimental ratio associated with it?

When you do coursework you need to study theory. There is no ratio as such. Research in Astrophysics can be broadly divided into

Theoretical and Experimental

*Theory:

- A) In pure theoretical Astrophysics use do not take any observations rather build theories to explain phenomena that cannot be readily explained by existing theoretical models by purely theoretical arguments (just pen and paper).
- B) Computational Astrophysics: For a lot of problems the equations that we get from the theory do not have any closed form solutions. A lot of these equations are coupled partial differential equations. We use numerical techniques/simulations to solve these problems.

*Experimental

Since astronomy is an observational science you observe celestial objects and spend some time analyzing the data and drawing conclusions from them.

*Instrumentation: You can work on designing the next generation telescopes, detectors etc.

What is the most fascinating and the most boring thing in Astrophysics? How do you still stick to the subject?

If you have a goal, you need to make it your field only when everything in it is fascinating you or you think will be fascinating to you. If you find that something is boring then you should not be doing that. Don't choose a field just because you think the end is great. The journey matters too.

Can you talk to us more about your preparation during BSc? Any must-do/ specialized courses and internships you opted for? Is the internship necessary?

I did a bunch of courses and explored to see what Astrophysics has to offer. Doing courses and doing research is very different. By doing internships you'll get to experience first hand what research all about. You can always approach your seniors or teachers. They always help you seek resources.

How was your JAM preparation? For how long did you prepare? Did you opt for any coaching?

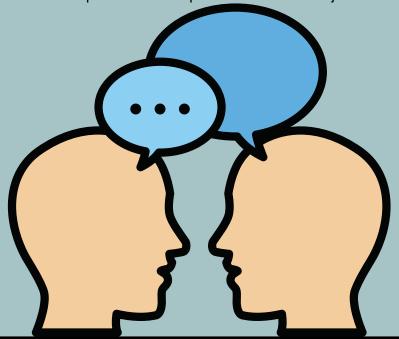
I didn't do much preparation for JAM. Neither did I go for any coaching. If you want to know more about exam preparation tips and stuff, I can recommend a blog available on the internet. It's called "Physics after Engineering". It has information regarding JAM, How to go through college, How to prepare for other Physics related exams, JEST, Internship names. Do check it out!

Did you participate in any external competitions? If so, How did they help you?

I didn't. But, I would like my juniors to participate. Actively participate in Inter-departmental or events either on campus or outside. Go to outreach programmes, quizzes and all of them. Improve your CV, talk to people. Take the notice board in your department seriously. You'll find posters of all workshops, seminars and even fests. Have conversations with the students of those departments about their subject, they can boil it down to you so that you'll get the gist of it.

Any Final words to us from your academic experience in college?

Build a good physics background. Learn to code. Get to know the current research and get involved in research as early as possible. While you're learning and exploring, see if you find any specific topic interesting in your field. If you find any such, Try to pursue it. This will be extremely helpful in building your profile if you're aspiring to go abroad for Higher Studies. Attend events, do an internship or do online courses related to that. If you can show that you've been consistently interested in a particular subject for a long time, you can get admission to top schools that specialize in those subjects. GOOD LUCK!



INTERVIEW WITH A SCIENTIST SHOHINI GHOSE

D Sai Mahathi and S Nand Kumar (MPCs 2)

Shohini Ghose is a multi-award-winning quantum physicist and Professor of Physics and Computer Science at Wilfrid Laurier University. Ms. Shohini presented a paper on the Quantum Moment panel at the 3rd annual Q Symposium. This interview was taken during a webinar on Quantum Revolution organized by 'And Three Dots' on 27th August 2020.

Why did you choose quantum physics? Why not some other branch of Physics?

Well I think it's a mystery. The mystery of the universe. I have been a big fan of mysteries since I was a kid. I love this idea of problem solving and finding out things. This is the ultimate mystery to solve. You know the question of how the universe works and the fact that it's even possible to solve that mystery is just amazing. Though we haven't solved that mystery, access to that beautiful information is really great.

What's your view on the universe and learning about it?

The one thing I know about the universe is the more we actually learn about the universe, the more amazing it becomes and the more there is to learn. So, it's just a never ending process of learning.

Why does exploring something really mean a lot to you?

I will tell you another story. When I was a little girl In India growing up. This one very important event that stands out in my mind, and that was when Rakesh Sharma became the first Indian to go to space. So this was very inspiring, and I remember I ran outside and I wanted to see him out there In the spaceship but of course I couldn't. But I was dreaming about that and I wanted to become an Explorer, to do something that is literally out there.

Why is it important to talk about quantum technology?

The first thing that comes to my mind when I think of quantum technology is quantum computers. The immense power of quantum computers also raises ethical questions. On the one hand, they currently consume a great deal of electricity because their chips have to be laboriously cooled down with liquid helium to -273.13° Celsius in what are known as dilution refrigerators. On the other hand, there is a risk that this technology could fall into the wrong hands — should criminals succeed in building a quantum computer, they could use it for the purpose of launching cyber-attacks. I think that there is an enormous potential of the quantum revolution to be put on the right track.

Is there any way quantum physics can be used to transfer information in a much faster and easier way?

There is indeed a way to find a way to transfer information. I don't know if you guys know about this phenomenon, "Quantum Entanglement". Assume that there's a box that has a cat in it(yes, the Schrodinger's cat). If i have another box like that, with another cat and magically both of these boxes are entangled, there's a transfer of information between these two boxes. If one cat is dead, the other cat isn't. This happens at a speed that seems to appear faster than speed of light. This is used as a base to quantum teleportation, as you would have seen in sci-fi movies. This is used as a base in transferring information, at a faster rate.

Can I see quantum physics around? Or is it just a theoretical concept?

No, it is absolutely not a theoretical concept. We use concepts of quantum physics almost everywhere. Our Sun follows the concept of quantum tunnelling. We can see communication going on using these concepts. The quantum bit computers in technological fields, quantum microscopy, GPS, lasers; almost many things around. It has much more scope and much more added mystery.

Any suggestions/tips you would want to give the audience?

Quantum revolution or not, humans grew. We discovered, expanded our horizons of learning, explored, explored and kept exploring. This is what I hope humans continue to do. Keep asking questions, keep exploring, keep discovering. So, choose something you like, learn it and keep learning. And run behind it. Happy learning.









1.1 measure relative numidity
2.I measure wind speed and direction
3.I am a type of actinometer used for measuring solar irradiance on a plane
within 0.3-0.4 μm of wavelength
4. I measure altitude of any object in atmosphere
5.I measure direct beam of solar irradiance
6.I measure growth in plants
7.I measure depth of seas and oceans
8.I am used to measure torque
9. I measure gas pressure
10. I measure flow of a liquid
11.I measure presence of magnetic field in a current
12.I have given the 'Atomic theory of matter'
13.I discovered X-rays
14.I measure density
15.I discovered the latest structure of an atom

NIKOLA TESLA (1856-1943) Artwork by Shyam Sharma (MPCs 2)

Hyderabad Central University (HCU)

31st January 2020, Bhavan's Vivekananda College: Bhavans Vivekananda College organized a Field trip to Hyderabad Central University, on 31st January 2020. Around 50 students from BSc. Physical Sciences were a part of the trip, which was intended to broaden student learning through a new experience. The students gathered at Bhavans College at 7:30 am and boarded the bus at 8:30 am, which reached the HCU at 10:00 am. The events that were lined up started immediately. The introduction speech was given by a Mathematics & Statistics Faculty to greet us. Professor of Mathematics, Mrs. Padmavathy, followed this by giving an outreach session, which included details of the college facilities, courses offered by the University and the achievements by the research scholars and the university as a whole. That was followed by a brief by the placement cell manager and a student union leader who highlighted the various placement opportunities available and also the role of the student union body in the welfare of the university. And then a math professor talked about the various research projects that are going on in the university presently and also gave us a brief introduction over the topic "Number theory and its various Applications".

The students then headed to the University library where the Head of Library described about the various facilities that the library offered. They then took a tour of the fabulous three-storied building that is recognized as one of the best libraries in the Asia Pacific region, had a magnificent collection of books of various streams and also a well-equipped digital library. Then they proceeded to have their working lunch at the university canteen. They were then taken to the department of Physics and Electronics departments that constituted various experimental laboratories. The X-ray diffraction lab, UV visible MIR lab and the 3D printing lab were the significant ones that explained about thorough concepts of NaCl sample elements, elementary concepts like diffraction of a Prism and the Most fascinating one- the 3D printer and its wide range of applications. This was followed by an interactive session by Professor Prem who had the students involved by asking them questions about various concepts in the course of the session.

This session included topics like Heat and Thermodynamics, Quantum Physics, Electromagnetism and Cosmology. Towards the end, they were given an opportunity to experience the University Physics laboratory and witness a few fascinating experiments done by the research scholars themselves. The trip thus ended by giving all the students an experience so Informative and Inspirational in many ways.





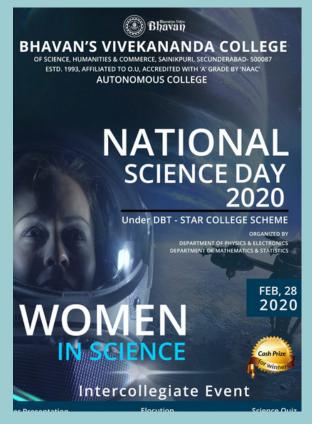
DEPARTMENTAL EVENTS

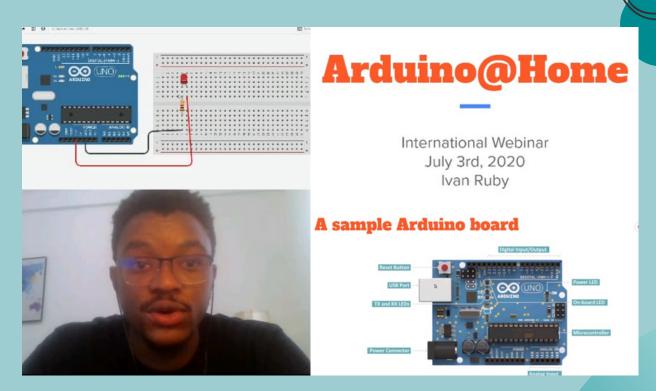


28th February 2020, Bhavan's Vivekananda The Department **Physics** College: of Electronics organized an intercollegiate event under the DBT Star Scheme on the occasion of National Science Day with "Women in Science" being the main theme. Dr Aparna, M.Sc., PhD in Physics from Osmania University was the chief guest of the event. The guest lecture was her research area, materials science, dealing with Acoustic Emission studies from PZT ceramics. Over seven colleges participated in the Elocution, Quiz, and Poster Presentation competitions organized. The day ended with the announcement of results for the competition and the students enjoyed the day.

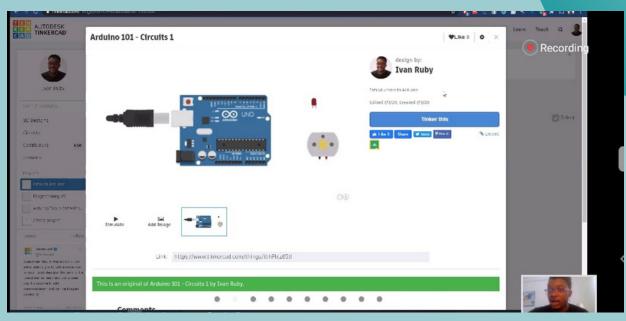








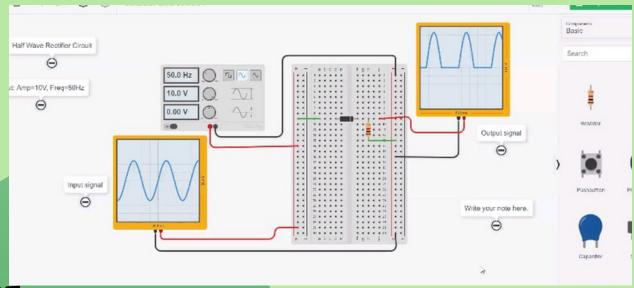
3rd July 2020, Bhavan's Vivekananda College: The Department of Physics and Electronics an international webinar on "Arduino@home - Hands-on learning of Electronics and Programming". The resource person for the webinar was Ivan Ruby, an alumnus of the college and a PhD student, Web developer. Many students from different colleges attended the webinar. They expressed their gratitude for learning something new. Mr Ivan explained Arduino basics onTinkerCad. The students learnt to code and experimenting with Arduino online. It was a very informative and interactive session.



DEPARTMENTAL EVENTS



29th - 30th July 2020, Bhavan's Vivekananda College: The Department of Physics and Electronics organized a workshop on "Virtual Labs" from 29th to 30th of July. The physical science students of the college attended the workshop and returned with a lot of knowledge on online experimentation. The 2 day workshop was organised on the topics RLC Circuits, Diode and Transistor circuits, Rectifier and Filter Circuits, Combinational Logical Circuits by the faculty of electronics. Websites like Phet simulations, Tesla mulitmeter, Tinkercad were introduced to the students. The students gave a very positive feedback and spent two days having fun while learning.





Bhavan's Vivekananda College Sainikpuri, Secunderabad - 500 094.

e-Poster Presentation

SENSORS IN BIOMEDICAL APPLICATIONS

Concept of Physics behind the Applications

An Intercollegiate Event

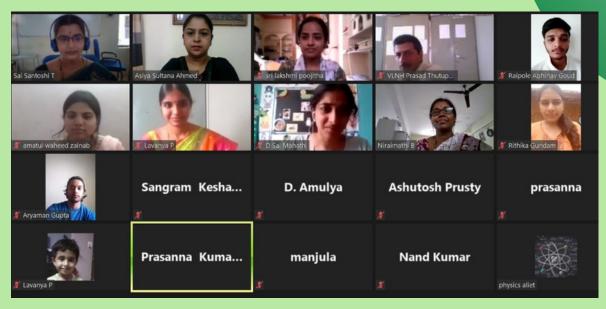
21 - 09 - 2020

Organized by

Department of Physics & Electronics

Under DBT-Star College Scheme

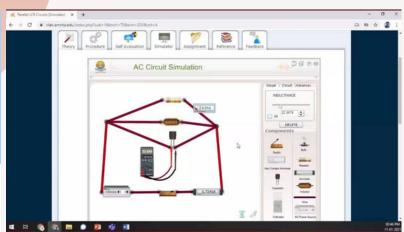
21th September 2020, Bhavan's Vivekananda College: The department of Physics and Electronics organised an intercollegiate E poster presentation competition on the topic, "Sensors in biomedical applications and concepts of physics behind the application". This competition was organised under DBT Star College Scheme. The judge of this educational event was Dr S Bharadwaj, Assistant professor, Department of physics and electronics, GITAM university, Visakhapatnam, AP. Many students showed their interest in scientific writing, presentation and answered the questions posed by the judge. The event was very fruitful, educational and interactive.



DEPARTMENTAL EVENTS



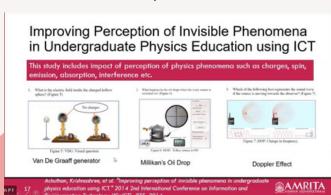
RESOURCE PERSON
Mr. Saneesh P F
Project Manager,
VALUE Virtual Labs
Amrita Vishwa Vidyapeetham,
Kollam

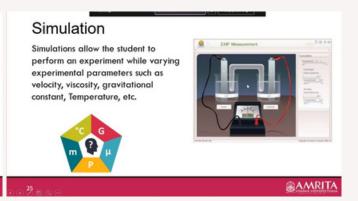


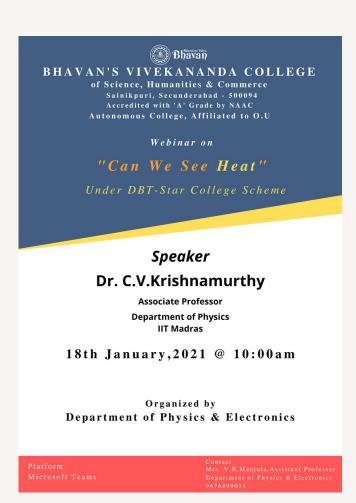


11th January 2021, Bhavan's Vivekananda College: The Department of Physics and Electronics arranged for a one day Workshop for students and faculty of Physics on Virtual Labs on 11th January 2021 on account of its newly attained status of Nodal Centre, Amrita Virtual Labs. The project is an initiative of Ministry of Human Recourse Department under National Mission on Education through ICT (NME-ICT).

Mr. P.F. Saneesh, Project Manager, Technical Lead of Physical Sciences, Virtual Labs, Amrita Vishwa Vidyapeetham has provided a Hands on training session in using virtual labs website and working with Simulations or remotely triggered experiments. He also demonstrated the use of LMS required by the faculty to assign projects to the students and monitor their performance.





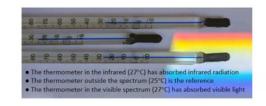




18th January 2021, Bhavan's Vivekananda College: The department of Physics and Electronics organised a webinar on "Can We See Heat", Under DBT Star College Scheme. Prof. C.V.Krishnamurthy from the Department of Physics, IIT Madras was the resource person. The lecture emphasized on the need to change perspective from feeling heat to see heat. Fundamental concepts related to absorption, emission transmission of heat, and energy balances in these processes were introduced. Then, Mr. Krishnamurthy underlined the importance of see heat through various types of imaging techniques and their applications. The talk also has thrown light in understanding concepts of heat through simple experiments. The webinar was highly informative and gave an overview of thermography and its wide variety of applications.

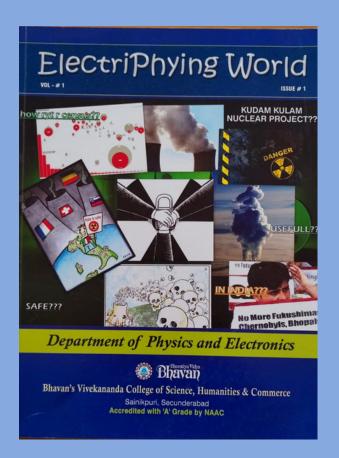


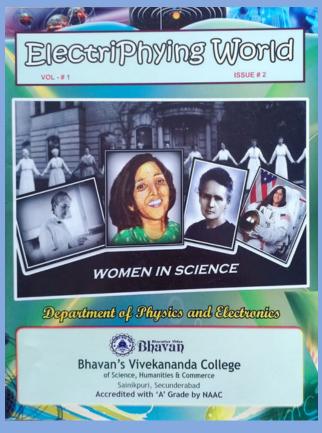
Do-it-Yourself

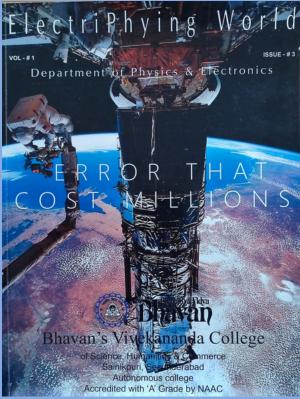


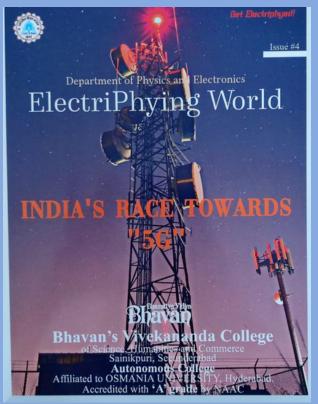
there is invisible radiant energy arriving in the infrared zone.











"The Science of today, is the Technology of tomorrow."

SCIENCE HAS ISSUED FROM A NEW AUDACITY OF THE IMAGINATION.

John Dewey





BHAVAN'S VIVEKANANDA COLLEGE

OF SCIENCE, HUMANITIES AND COMMERCE, SAINIKPURI, SECUNDERABAD ESTD - 1993. ACCREDITED WITH 'A' GRADE BY NAAC. AFFILIATED TO OSMANIA UNIVERISTY, AUTONOMOUS COLLEGE