FIZIKA

E-MAGAZINE
OF DEPARTMENT OF PHYSICS, VICTORIA INSTITUTION (COLLEGE)

2nd VOLUME
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Teacher-In-Charge's Message

Dr. Uma Ray Srinivasan

Today Physics is exploring areas not familiar for most common people. While on the one hand the physicists are looking at the sky to find out the mystery of creation of the Universe, the Big Bang and the black holes; on the on the other hand, they are looking inside an atom to find the God particle. The days of cause and effect in Physics have given way to theories of uncertainties. Today sharing of current knowledge is absolutely essential to explore newer horizons.

This e-magazine will help teachers and students of the College to strengthen this knowledge base. I wish them all the best in this laudable effort.

Dr. Uma Ray Srinivasan

Message from the Department of Physics

We are proud to say that this year Physics Honours students of Victoria Institution (College) have published the 2nd volume of Annual Magazine "FIZIKA". The wide spectrum of articles in different sections of physics like Cosmology, Astrophysics, Mathematical Physics, Relativity, Nano-Technology, Quantum Physics and its applications, Nuclear Physics, Geophysics, various Cutting Edge Technologies etc gives us a sense of pride as they reflect the creative potential and talents of our students.

Each article is thought provoking, interesting and entertaining. We appreciate and thank everyone associated with "FIZIKA" for rendering their endearing love and support. Hope this creation will find a place in the heart of the readers.

Dr. Pratibha Pal

Dr. Gayatri Pal

Smt. Swarnalekha Bandyopadhyay

Dr. Subhendu Chandra

Dr. Shinjinee Das Gupta

Ms. Kathakali Biswas

Editorial

Dear Reader,
Greetings to You!
The first edition of, the Department of Physics, Victoria Institution (College), e-magazine "FIZIKA" was launched in 2020-21. It is a great pleasure to bring forth the second edition of "FIZIKA" for 2021-22.
Each issue of our e-magazine "FIZIKA" has turned into a milestone that marks the students' growth and showcases our willingness to present some interesting articles for our readers.
Our e-magazine is a collection of different exciting and knowledgeable articles on different concepts like BigBang, blackhole, time travel, modern and upcoming technologies etcetera. The articles of our young writers will surely draw our reader's attention.
We extend our warm greetings and acknowledgment to all the participants for making this e-magazine wonderful and worthy for all readers to spend their valuable time.
We would like to bow our heads to all our professors for their immense support and guidance and cooperation because of which we are able to publish our second volume of "FIZIKA" successfully.
With all due respect, we offer our sincere gratitude to our Teacher-In-Charge ma'am for having faith in us.
Lastly, we would like to extend our warm greetings to the readership of our magazine and wish all the readers a joyful reading experience.

Happy reading and viewing!

Editors: **Debarati Maity and Sweta Pal Majumder , VIth Sem, Ahana Dasgupta and Saptaki Chakrabarty, IVth Sem, Maitreyee Maiti and Sulagna Dey, IInd Sem**

Our Team

From Left: Nayema, Debarati, Riya, Sweta and Sima (VIth Sem)

From Left :Eshita, Solanki, Swastika, Sumona, Sayani, Ahana, Saptaki, Tanusree, Nandini and Chirantani (IVth Sem)

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Contents

Quantum Computers

Debarati Maity, VI[th] Sem

Quantum computers are such computers or machines that use the properties of quantum physics to store data and perform computation. Classical computers encode information in binary bits, whereas the basic unit of memory or information in quantum computers is a quantum bit, or qubit. While a bit can represent just one of two possibilities, such as 0 or 1, a qubit can represent more: 0 or 1, 1 and 0, the probability of any occurrence when combined with more qubits, and all that simultaneously.

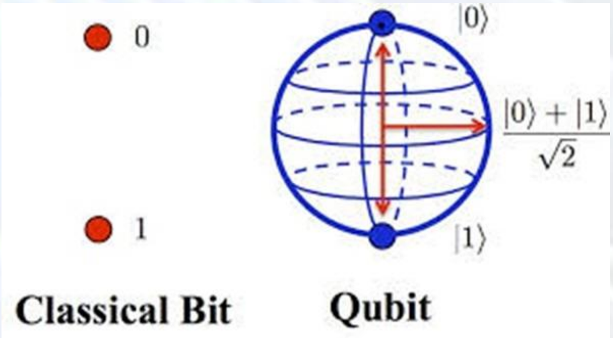
While a bit represents just 1 or 0, one qubit represents an array of possibilities, and all can be calculated simultaneously, taking probabilities into account. Qubits are made using physical systems; the spin of an electron or the orientation of a photon. The system can be in many different arrangements all at once, a property known as quantum superposition. The mathematical representation for superposition is:

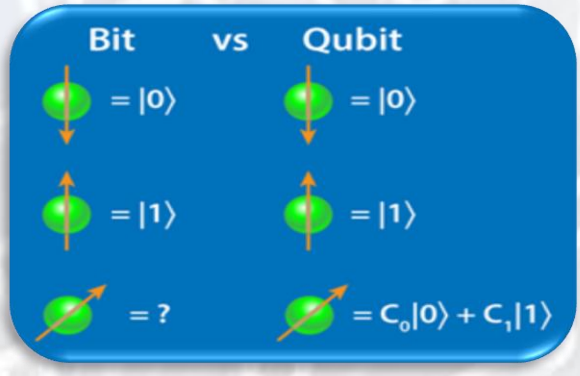
$$|\psi> = \alpha|0> + \beta|1>.$$

The symbol (psi) stands for the state of a superposition and the 1 and 0 just represent the qubits.

Qubits can be extensively linked together using a phenomenon called quantum entanglement. The result is that a series of qubits can represent different things simultaneously. The Qubit concept came from Quantum Mechanics, which deals with very small particles that are subatomic particles.

It has been proven that a subatomic particle can have different states simultaneously because this is simply because when the particle momentum (mass and velocity) is measured, the particle changes. This is evident for particles moving very fast, nearly to light velocity. A particle's momentum looks different to different observers, and the particle has several states simultaneously. For one observer, the probability of the particle momentum could be stated for that observer. This is the reason why one subatomic particle can have different states and probabilities at the same time.

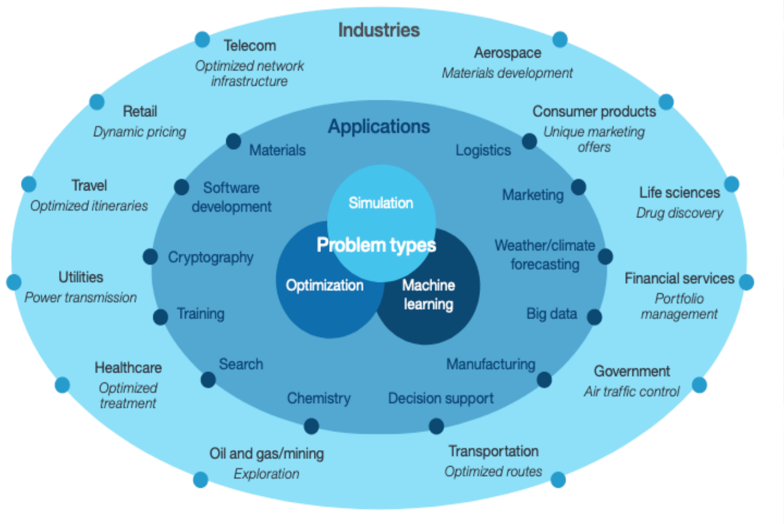




With the help of this property, we can replace bits and get better performance. When we combine qubits, that combination holds an exponentially larger amount of information than bits. Subatomic logic is much more powerful than binary logic because it allows us to process complicated information much more quickly.

Its main applications are encryption, decryption, databases, voice recognition, structure recognition, AI, and other applications. Simple computations like word processing would not improve their performance with quantum computing, but computations like image processing and artificial intelligence for diagnosing certainly will.

Applications of Quantum Computing in different Industries



NEW DRUGS DISCOVERY:

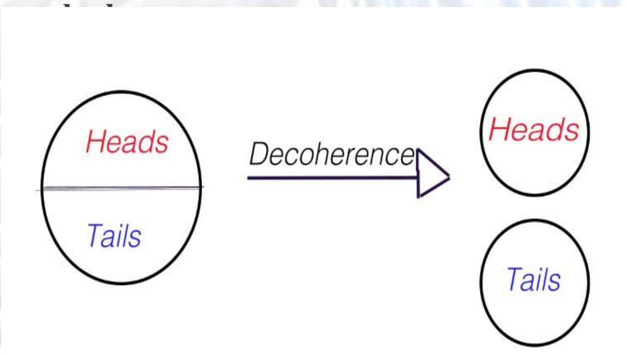
The discovery of new drugs lies mainly in part in a field of science known as molecular simulation, which is incredibly complex. This is why the discovery of new drugs takes so much time. One of the most common methods that scientists prefer is a trial-and-error approach, in which they test thousands of molecules against the target disease in the hope that a successful match will eventually be found. But quantum computers have the potential to resolve molecular simulation problems in minutes. This would mean that life-saving drugs, which currently take an average of 10 years to reach the market, could be designed much more quickly and cost-effectively.

CRYPTOGRAPHY:

Due to the increasing number of cyber-attacks occurring daily around the world, the online security environment has become rather vulnerable. Even though organizations are instituting the necessary security standards, traditional digital systems find the process challenging. Quantum computing, along with machine learning (ML), can contribute to developing various strategies to minimize these cyber threats. Additionally, quantum computing can also help in the development of encryption systems or quantum cryptography.

OPTIMIZATION:

Quantum computers have properties that make them potentially more effective at addressing complicated optimization issues. Quantum optimization methods, like quantum approximate optimization algorithms, promise to provide answers that improve on sub-optimal solutions without requiring exponentially longer computation durations. As a result, we can identify previously unthinkable solutions by using quantum-inspired optimization



The world's biggest companies are now launching quantum computing programs, and the government is also pouring money into quantum research. Quantum computers offer great promise for cryptography and optimization problems, and computers are racing to make them practical for business use. Besides stimulating new and more efficient materials, it also predicts how the stock market will change with greater precision. The ramifications for businesses are potentially huge.

Classical computers, in many cases, will still outperform quantum computers since they are highly sensitive to heat, electromagnetic fields, and air collisions; these cause Qubits to lose their quantum properties and thus lose data.

This process, known as quantum decoherence, causes the system to crash, and it happens more quickly with more particles involved. A completely fault-tolerant, genuine, and convenient quantum computer is still a long way off. Quantum computers are not necessarily meant to replace traditional computers; rather, they're supposed to be an additional tool for tackling specific challenges.

As a result, this computing has significantly increased in power and can now be utilized for large-scale data processing and simulations. Future computers may be a combination of classical and quantum computers.

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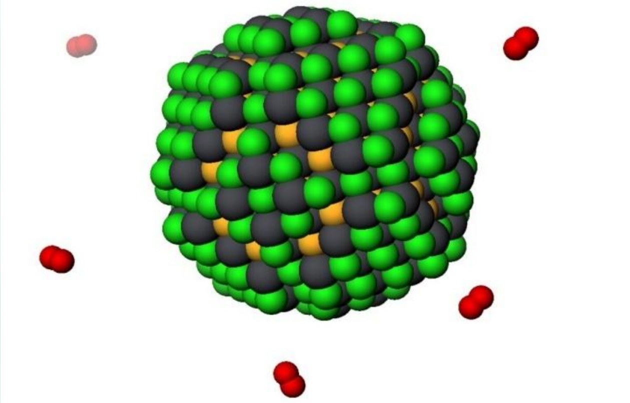
Did You Know?

The world's first dedicated quantum computing focused commercial business- 1Qbit- was established in Vancouver, British Columbia, in 2012

Quantum Dots

Nayema Khatun, VIth Sem

Quantum dots are semiconductor non-crystal particles exhibiting quantum behavior and ranging in size from 2 to 10 mm. Nowadays, quantum dots have become a central topic in nanotechnology. The optical and electronic properties shown by QDs differ from those of larger particles.



Due to their optical properties, QDs can produce different colours. When a QD is illuminated by UV light, an electron in the quantum dot can be excited to a state of higher energy and this process takes place between the conduction and the valance band. The excited electron can drop back into the valence band, releasing its energy by the emission of light. The colour of the light changes depending upon the bandgap or the intrinsic between discrete energy states when the band structure is no longer good in QDs.

The discrete energy levels are given by:

$$E_{n_x n_y n_z} = \frac{\hbar^2 \pi^2}{2m^*}\left\{\left(\frac{n_x}{L_x}\right)^2 + \left(\frac{n_y}{L_y}\right)^2 + \left(\frac{n_z}{L_z}\right)^2\right\}$$

The optical property of the QDs depends on the size of the particles. Various theoretical frameworks for QDs exist in different fields like quantum mechanics, semi-classical, and classical mechanics.

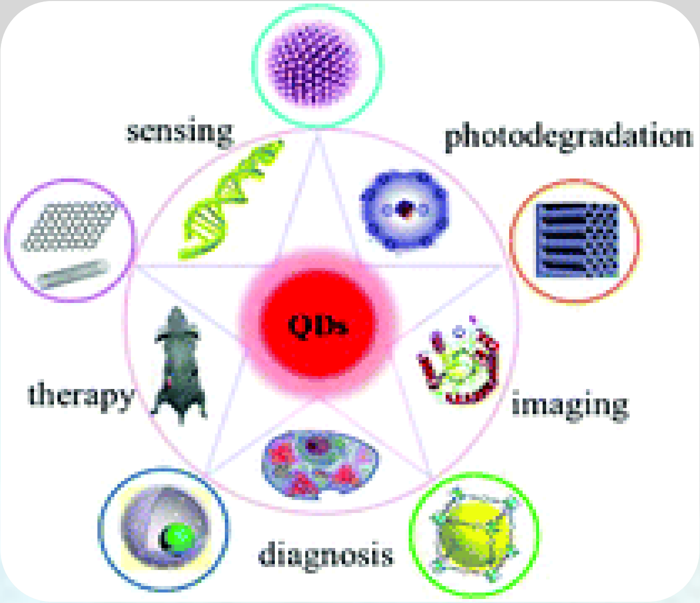
Quantum dots are a role model in modern research not only for their optical and electrical properties, but also for their use in a variety of research and commercial applications in various fields. Here are its applications in the medical field and in the modern physics field.

Modern physics field

Potential applications of QDs include single-electron transistors, LEDs, lasers, single-photon sources, and quantum computing, which are very renowned.

Medical field

Detection-1. Quantum dots are used for imaging tumour vasculature, imaging tumor-specific membrane antigens, as well as imaging sentinel lymph nodes.
2. Multicolored fluorescence imaging of cancer cells may be achieved by systematic injection of QDs-based multifunctional nanoprobes.



Cure:

Not only for the detection of disease, now QDs are being used for the treatment of disease. Currently, scientists are trying to use them as an efficient drug carrier. Distinctive surface and structural properties have enabled their usage in targeted drug delivery. These things prove that QDs will become the dominant fluorescent reporters in biology and medicine over the next decade.

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Science Behind Touch Screen

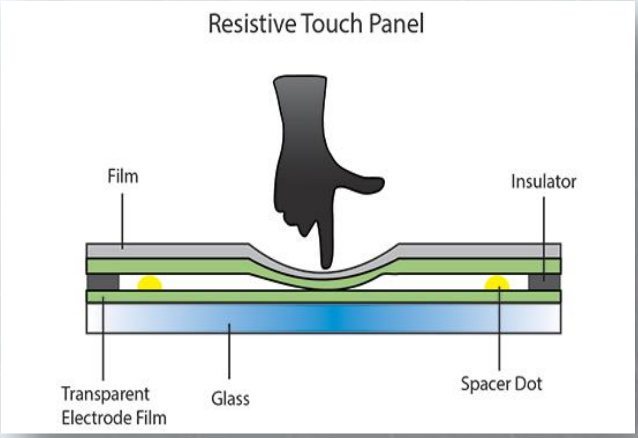
Riya Chowdhury, VIth Sem

Modern human lives are tightly integrated with the use of touch screens—it may be a smart phone or laptop or several public serving machines like an atm. E.A. Johnson first developed the human finger driven touch screen in the year 1965. In 1993, IBM released the IBM Simon, the first touch screen phone. Instead of many buttons, how a single touch can satisfy our desired work in many fascinating gadgets. Well, science and amazing technology are behind the mystery. Let's have a look at the science behind using touch screens in an easy and most understandable way.

There are mainly two types of touch screen:- RESISTIVE & CAPACITIVE

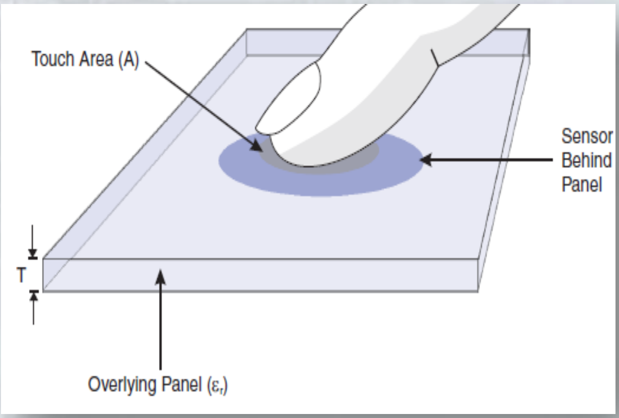
Resistive Touch Screen

These are the most basic and common touch screens, generally used at ATMs and super markets. These types of screens literally resist our touch. If one presses hard enough, he/she can feel the screen bend slightly. This is what makes resistive screens work- two electrically conductive.
The layers bend to touch one another.
One of the thin yellow layers is resistive; the other is conductive, separated by a gap of tiny dots called spacers to keep the thin layers apart until one touches an electrical current changes at the point of contact.
The software recognizes a change in current at those coordinates and carries out the function that corresponds with that spot.



Capacitive Touch Screen

There are two main types of capacitive touch screens-surface and projective. In surface capacitance, sensors are put at the corners and an evenly distributed thin film is set up across the surface. In case of Projective capacitive sensing is done by using a grid of rows as well as columns with a separate chip. But in both instances, when a finger strikes a screen, a little amount of electric charge strikes a screen, a little amount of electric charge is transferred to the finger to complete the circuit, which creates voltage drop on that point of screen.



Future

As technology never stops advancing, software engineers from Perspective Pixel, which designs multi-touch screen, is using a technology called frustrated total internal reflection for their larger screens as big as 82 inches. When one touch an FTRI screens, it scatters light and several cameras on the back of the screen detect this light as an optical change, just as a capacitive ouch screens detects a change in electrical current.

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Variational Method: Another Way to Deal Problems

Sima Dutta Semester - VI

0.1 Timeline

Consider the following three problems :

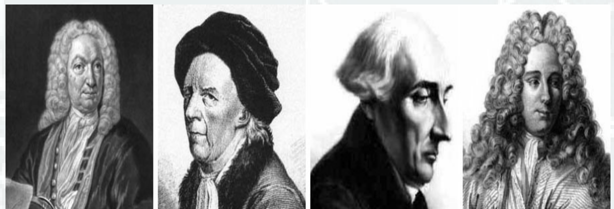
1. What plane curve connecting two given points has the shortest length?
2. Given two points A and B in a vertical plane, find the path AMB which the movable particle M will traverse in shortest time; assuming that its acceleration is due only to gravity.
3. Find the minimum surface of revolution passing through two given fixed points, (X_a,Y_a) and (X_b,Y_b).All three of these problems can be solved by the calculus of variations.

All three of these problems can be solved by the calculus of variations.

- Roundabout 1670: Calculus was invented by Newton/Leibniz
- 1686: Newton- Principia Mathematica - 1st book on classical mechanics
- 1696: Johann Bernoulli - Brachistochrone Problem
- 1733: Euler elaborated on Brachistochrone problem
- 1743: d'Alembert's principle
- 1755: Lagrange - Tautochrone problem
- 1756: Euler - Calculus of Variations
- 1788: Lagrange - Mechanique Analitique
- 1834: Hamilton's Principle

0.2 Why It Was Needed?

Where Newton's theory bases everything on two fundamental vectors : 'Momentum' and 'Force' ; the variational theory , founded by Euler and Lagrange bases everything upon two scalar quantities: 'Kinetic energy' and 'Work Function'.Many elementary problems of physics and engineering are solvable by vectorial mechanics and do not require the application of variational methods. But in all more complicated problems the superiority of the variational treatment becomes conspious. This superiority is due to the complete freedom we have in choosing the appropriate coordinates for our problem. The problems which are well suited to the vectorial treatment are essentially those which can be handled with a rectangular frame of reference.The mathematical and philosophical value of the variational method is finely anchored in the freedom of choice and the corresponding freedom of arbitrary coordinate transformations.



0.3 The Famous Problem : Brachistochrone

A particle of mass m is released in a uniform field of force $\vec{F}$=m$\vec{g}$, $\vec{g}$ being a constant vector. The time taken for the particle to move from point 1 to point 2 is given by

$t_{12} = \int_1^2 \frac{ds}{v} = \int_1^2 \sqrt{\frac{y^2}{2gx}}dx$

where $y' = \frac{dy}{dx}$, $ds = \sqrt{dx^2 + dy^2 and v} = \sqrt{2gx}$, x being measured in the downward direction (that is along $\vec{g}$) from point 1 and y in the horizontal direction to the right. The path is, by definition, a brachistochrone if the variation

$\delta t_{12} = 0$

$\delta \int_1^2 \sqrt{\frac{1+y^2}{2gx}}dx = 0$

Now, from the Euler-Lagrange theorem we know that for any given function f(y,$\frac{dy}{dx}$,x), the variation $\delta \int_1^2 f(y, \frac{dy}{dx}, x)$ dx= 0

if and only if the function f satisfies the following differential equation

$\frac{d}{dx}(\frac{\delta f}{\delta y'}) = \frac{\delta f}{\delta y} = 0$

Here f(y,y',x) replaces the Lagrangian L(q,$\frac{dq}{dt}$,t), x replaces the time t and y behaves as a coordinate and hence $y' = \frac{dy}{dx}$ is a velocity component in the usual Euler-Lagrange equation of motion

In the present case,

$f(y, y', x) = \frac{\sqrt{(1+y'^2)}}{x}$

disregarding the constant factor $\sqrt{2g}$, we thus have

$\frac{\delta f}{\delta y} = 0$ and $\frac{\delta f}{\delta y'} = \frac{y'}{\sqrt{x(1+y'^2)}}$

Therefore the Euler-Lagrange condition reduces to

$\frac{d}{dx}\frac{\delta f}{\delta y'} = 0$, $\frac{\delta f}{\delta y'}$ = constant(independent of x)

$\frac{y'}{\sqrt{x(1+y'^2)}} = \frac{1}{\sqrt{2a}}$

where a is a constant. Therefore,

$\frac{dy}{dx}$ =y$' = \sqrt{\frac{x}{2a-x}}$

Substituting

x =2$a \sin^2 \frac{\theta}{2}$

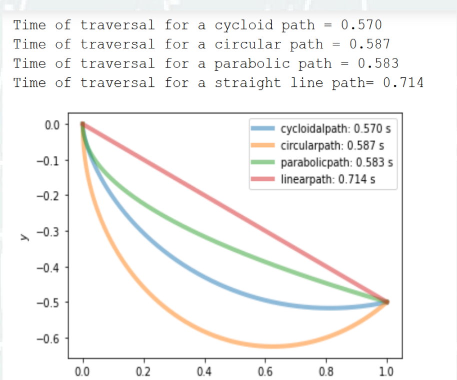
We get

y =a(θ - sinθ)

Therefore, a brachistochrone in a constant gravity field is given by the following parametric equations:

x= $a(1 - \cos\theta)$, and

y= $a(\theta - \sin\theta)$ It is called cycloid. A cycloid is a path traced by a point on the circumference of a disc rolling with a speed along a line.



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Nanotechnology in Textiles

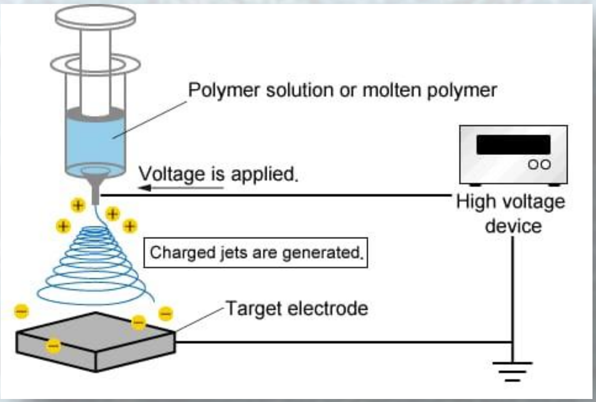
Sweta Pal Majumder, VIth Sem

In recent years, nanotechnology has brought massive improvement in the textile industry. The unique properties of nano materials are applied by engineers and scientists. In the commercial market, this technique has gained enormous attention. Nanoengineers created various methods for creating this type of textile. Sometimes synthetic nanoparticles are incorporated into the fibres or textiles. The surfaces of the finished products are also coated with nanoparticles. There are different types of coating techniques, like sol-gel and plasma polymerization. These techniques can enhance durability and are also capable of making the fabric resistant to extreme weather conditions.

Nanofibre Fabrication Techniques :-

Electro-spinning:

This is a well-known technique for manufacturing polymer fibers. The apparatus consists of a syringe with a capillary needle. A high voltage across the needle creates a charged jet of material, which is spun out into fibres collected on a charged plate. The textiles are used for medical use or for waterproof fabrics.



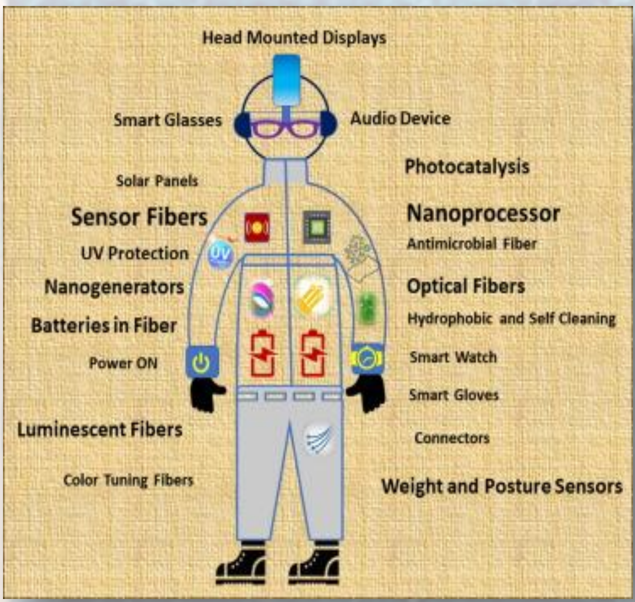
Split Spinning:

Split spinning is similar to electro-spinning but involves splitting the filament that would form the nanofiber into multiple smaller filaments.

Self-Assembly:

This is a biometric "bottom-up" nanofabrication technique that relies on the tendency of materials to assemble into nanoscale structures. By changing the conditions of the nanofiber environment, such as pH and temperature, different nanofibers can assemble together to make more fascinating materials with unique properties.

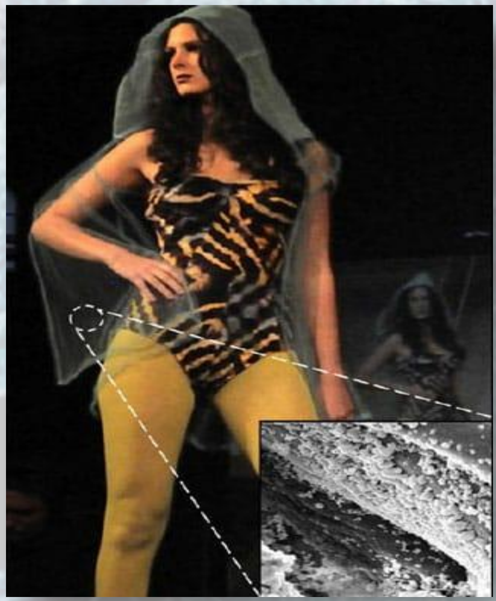
Nano-Textile Products:-



- **Sports fabrics with improved mechanical and odor-reducing anti-bacterial properties.**
- **Medical textiles such as antimicrobial wound dressing..**
- **PPE(Personal Protective Equipment) with improved chemical or heat resistance.**
- **Millitary textiles such as flexible body armor, radio shielding , camouflage.**
- **Wearable electronics, ranging from conducting fabrics to connect devices together to full portable computers.**

End Note

At present, researchers are interested in incorporating new fabrication and surface finishing methods. According to one study, textile dying caused 17–20% of water pollution. environmental controls need to be put in place. The general public must be made aware of this issue so that only safe, recyclable, and climate neutral nanotextiles are produced.



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History of the Michelson-Morley Experiment

Ahana Dasgupta, Sem IV

The Michelson-Morley experiment was an attempt to measure the motion of the Earth through the luminous ether . Although usually known as the Michelson-Morley experiment, it simply refers to a sequence of experiments performed by Albert Michelson in 1881 and again (with better equipment) at Case Western University in 1887 together with chemist Edward Morley. Though the end result was negative, the experiment was important as it it opened the door for an opportunity of rationalization of the wave nature of light.

How It Was Supposed to Work

If ether exists it should be possible to detect the motion of the earth through it and to determine the speed of the earth relative to ether. By the end of the 1800s, this is what Michelson and Morley tried to find out using an instrument called Michelson's interferometer. The problem is that a wave needed to circulate through a few type of medium. Something needs to be there to do the waving. Light was known to travel through outer space, which scientists believed was a vacuum. One may even create a vacuum chamber and shine a light through it. These evidences made it clear that light could move through a region without air . To get round this problem , physicists hypothesized that there is a substance which filled the whole universe. They called as this substance the luminous ether . The ether was believed to be stationary and static (except, of course, for the vibration), however the Earth moves through it with a high speed . Think about when you hang your hand out of the automobile window on a drive. Even if it is not windy, you feel the pressure of air on your hand . The same ought to be true for the ether. Even if it stood still, because of the Earth's movement, then light that is going in a same direction ought to be moving quicker together with the ether than light that is going with the opposite direction . Either way, as long as there is a relative movement between the ether and the Earth, it ought to have created an effective "ether wind" that could have both driven or hindered the movement of the light wave, similar to how a swimmer movements quicker or slower depending on whether or not he is moving along with or against to the current. To check this hypothesis, Michelson and Morley designed a tool that cut up a beam of light and bounced it off mirrors in order that it moved in different paths and in the end hit the identical target. The principle was that if two beams traveled the identical distance along different paths through the ether, they ought to move at different speeds and consequently once they hit the final target screen those light beams could be moderately out of phase with each other, which could create a recognizable interference pattern.

Result

The end result was disappointing due to the fact that they found no proof of the relative movement bias they had been searching for. No matter which path the beam took, light appeared to be moving at precisely the same speed. These results were published in 1887. One different manner to interpret the results at the time was to assume that the ether was somehow linked to the motion of the Earth, however no person came up with a model that explained this . In fact, in 1900 the British physicist Lord Kelvin famously indicated that this end result was one of the two "clouds" that marred an otherwise complete understanding of the universe, with a general expectation that it would be resolved in relatively short time . It took almost 20 years and the work of Albert Einstein theory of relativity to understand this conceptual difficulties and accept the theory in which light exhibits wave-particle duality.

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Dark Matter Filaments:
The Thread of the Cosmic Web

Chirantani Roy, IVth Sem

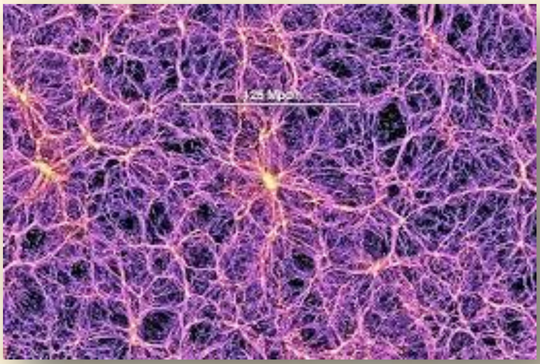
Dark matter makes up about 85% of the entire mass of the Universe. However, till date we do not understand it properly. Rest 15% matter is what we encounter in everyday life, which include protons, electrons and so on. This report will discover the character of dark matter filaments and the cosmic web. Also, it's going to examine the techniques that may be used to analyze those phenomena.

The distinction among the matter we observe and the dark matter is that ordinary matter emits electromagnetic wave but dark matter does not.

Therefore, as dark matter does not interact with light and as light is a result of electromagnetic interaction, hence it is called "dark matter". This poses demanding situations in detecting dark matter because it can not be at once observed. We have most effective implication of its existence through measuring its gravitational effects on galaxies. What we do understand is that the dark matter within the early universe shaped filamentary (thread-like) systems and this allowed the formation of the cosmic web.

Just after the big bang, the temperature and density of ordinary matter was too high because of the universe being very compact. The particles that represents the ordinary matter collided very often through the electromagnetic force. Thus regions of higher density would be pushed apart by this force, which prevents the regions from growing in mass. This is much like how distinctly pressurized fueloline will disperse while in a area of low pressure.

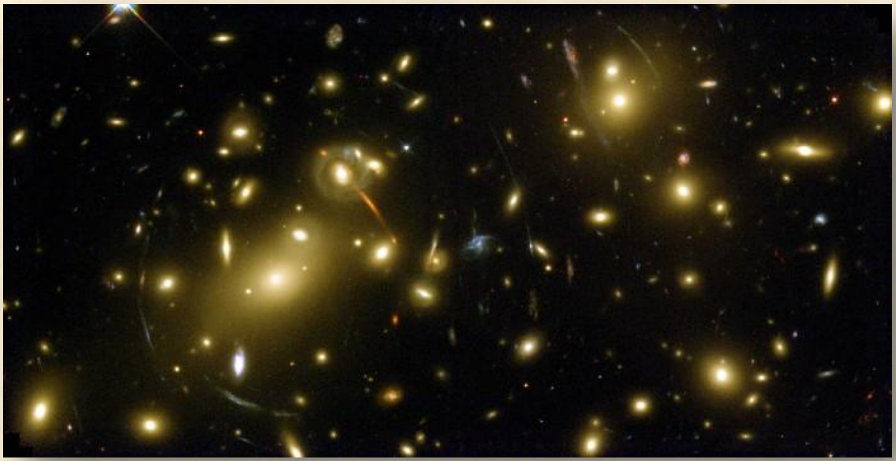
Also, Dark matter, which does not deal with the electromagnetic force, can have areas of higher density.



[https://newatlas.com/dark-matter-filaments-found/23281/]

These areas may grow by pulling in more dark matter using gravitational force. As a result, this causes the dark matter to form large structures with various densities throughout the space. Consequently, this created a enormous community of thread-like systems that consisted of dark matter .

Once ordinary matter had cooled because the universe expanded, particles, which include protons and electrons, may want to shape in neutral atoms forming high density regions. Additionally, Ordinary matter can get heated and emit radiation, causing it to fall further into regions of high density. As a result this created a highly filament structure of ordinary and dark matter which is called the cosmic web.



Gravitational Lensing: Distortion of shape of the Galaxies from which the total mass inside the galaxies causing the lensing can be determined.
Image credits: NASA

Due to the interactions of this structure, where the matter is most dense, stars and galaxies were created to give rise to the universe we see today. Simulations of the evolution of universe tell us about the process regarding the formation of the cosmic web. Once the simulations were completed, they may be in comparison in opposition to observational records to decide their accuracy.

The Millennium Simulation Project is an instance of a simulation which informs us about the physical processes involved in the creation of universe and cosmic web. Specifically, it's been essential in predicting the situations required for the cold dark matter version to be true. This is simply one instance of the way we are able to check out the cosmic web and decide a few features of dark matter.

Another instance of the way the cosmic web and dark matter filaments may be researched is measuring gravitational lensing as a result of those filaments. Gravitational lensing is the phenomenon which takes place when light bends because of the gravitational force on it. This incident is explained by general relativity. It may be used to measure the Mass of a celestial body. Also, as lensing takes place due to the gravitational force, it can be used to suggest the existence of dark matter filaments and cosmic web. This is due to the fact that the filaments are large enough to have an effect on the light passing close to it to a measurable degree. Thus, gravitational lensing may be used to map the cosmic web and display us the distribution of dark matter all over the universe.

Looking to the future, greater research, which include the projects like the Millennium Simulation Project is needed to develop the theories and models that would provide an explanation for our universe, especially the character of the dark matter and the cosmic web.

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Black holes : A Review

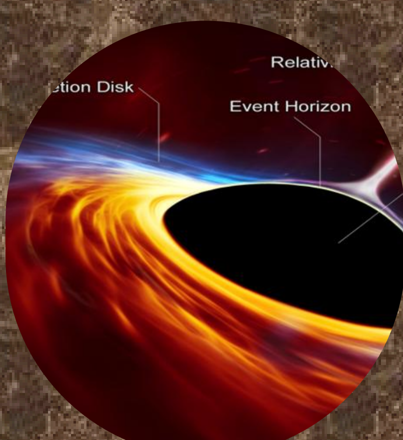
Eshita Biswas, Sem IV

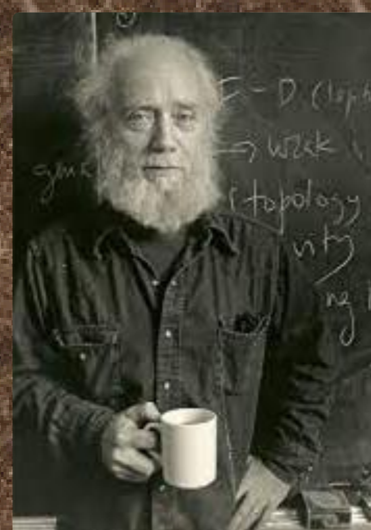
Blackhole is basically an area of space-time with a gravitational field which is very very intense such that its escape velocity is equal to or exceeds the speed of light. The important thing of blackhole is that this area can be of any size.

Event Horizon

The event horizon of a black hole is linked to the object's escape velocity, the speed that one would need to exceed to escape the black hole's gravitational pull. The closer someone came to a black hole, the greater the speed they would need to escape that massive gravity. The event horizon is like a threshold around the black hole where the escape velocity surpasses the speed of light.

According to Einstein's theory of special relativity, nothing can travel faster through space than the speed of light which means event horizon of a blackhole is essentially the point from where nothing can return. The name refers to the impossibility of witnessing any event taking place inside that border, the horizon beyond which one cannot see.

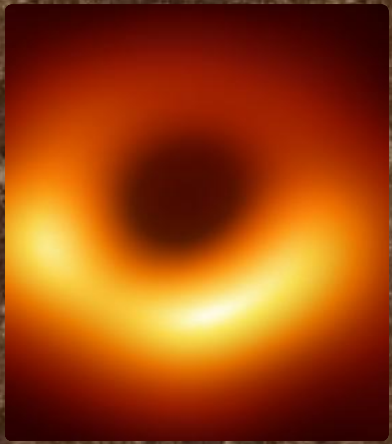




David Finkelstein, in 1958, first published the interpretation of "black hole" as a region of space from which nothing can escape. Black holes were long considered a mathematical curiosity; it was not until the 1960s that theoretical work showed they were a generic prediction of general relativity. The discovery of neutron stars by Jocelyn Bell Burnell in 1967 sparked interest in gravitationally collapsed compact objects as a possible astrophysical reality. The first black hole was known as Cygnus X-1,which was identified by several researchers independently aroound 1971.

Black holes of stellar mass form when massive stars collapse at the end of their life span. After a black hole has made it can grow by absorbing mass from its surroundings. Super massive black holes of millions of solar masses may be generated by absorbing other stars and overlapping with other black holes.

The presence of a black hole can be deduced through its interaction with other matter and with electromagnetic radiation such as visible light. Any matter that gets in on a black hole can form an external accretion disk heated by friction, forming quasars, some of the brightest objects in the universe. Stars passing too close to a super massive black hole can be shredded into streamers that shine very brightly before being "swallowed." If the other stars are orbiting a black hole in that case their orbits can determine the it's mass as well as location. Such observations can be used to exclude possible alternatives such as neutron stars. In this way, astronomers have identified numerous stellar black hole candidates in binary systems and established that the radio source known as Sagittarius A*, at the core of the Milky Way galaxy, contains a super massive black hole of about 4.3 million solar masses.



For the first time, astrophysicists and astronomers have captured an image of the super massive black hole at the center of our galaxy.

It's the first direct observation confirming the presence of the black hole, known as Sagittarius A*, as the beating heart of the Milky Way.

Black holes don't emit light, but the image shows the shadow of the black hole surrounded by a bright ring, which is light bent by the gravity of the black hole. Astronomers and astrophysicists say that the black hole is 4 million times more massive than our sun.

"For decades, astronomers have wondered what lies at the heart of our galaxy, pulling stars into tight orbits through its immense gravity," Michael Johnson, astrophysicist at the Center for Astrophysics | Harvard & Smithsonian, said in a statement.

"With the (Event Horizon Telescope or EHT) image, we have zoomed in a thousand times closer than these orbits, where the gravity grows a million times stronger. At this close range, the black hole accelerates matter to close to the speed of light and bends the paths of photons in the warped (space-time)."

The black hole is about 27,000 light-years away from Earth. Our solar system is located in one of the spiral arms of the Milky Way galaxy, that's why we are so distant from the galactic center. If we could be able to see this in our night sky, the black hole would appear to be the same size as a doughnut sitting on the moon.

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What is Renewable Energy?

Nandini Mukhopadhyay, Sem IV

Renewable Energy is energy that has been derived from earth's natural resources that are not finite , such that wind and sunlight .Renewable energy is an alternative to the traditional energy that depends on fossil fuels , and it cause less harm to the environment.

SOLAR ENERGY :

Solar energy is the conversion of energy that is present in the sun and is one of the common renewable energy . Once the sunlight passes through the our earth's atmosphere , most of it is in the form of visible light and infrared radiation . Plant uses it to convert into sugar and starches and this process of this conversion is known as photosynthesis .

Solar energy can be categorized into several types depending upon the mode of conversion and the type of energy it is converted into :- Passive solar energy , Active solar energy , Solar thermal energy , Photovoltaic solar power and Concentrating solar power .

ADVANTAGES:

- It is considered to be the cleanest form of energy as there is no emission of carbon dioxide .
- Reduces electricity bills
- Low maintenance costs
- Saving water
- Saving money

DISADVANTAGES:

- High initial cost
- Time consuming
- Weather dependent
- Associated with pollution
- Uses a lot of space

WIND ENERGY:

Wind farms capture the energy of wind flow by using turbines and converting it into electricity . There are various forms of systems used to convert wind energy. Commercial grade wind powered generating systems can power several organizations . Technically, wind energy is form of solar energy . The phenomenon we call "wind" is caused by the discrimination in temperature in the atmosphere combined with the rotation of earth and the geography of the planet.

ADVANTAGES:

- It's a clean fuel source.
- domestic source of energy.
- It is a Cost effective.
- Wind energy can be used in sports (sailing, kite flying)
- Reduces our dependence of Fossil fuels.
- The wind energy industry creates job.
- Wind power can be used to pump water

DISADVANTAGES:

- Dangerous to some wildlife
- Wind Turbines create noise and visual pollution
- Expensive to set up.
- Safety of people at risk.

GEOTHERMAL ENERGY:

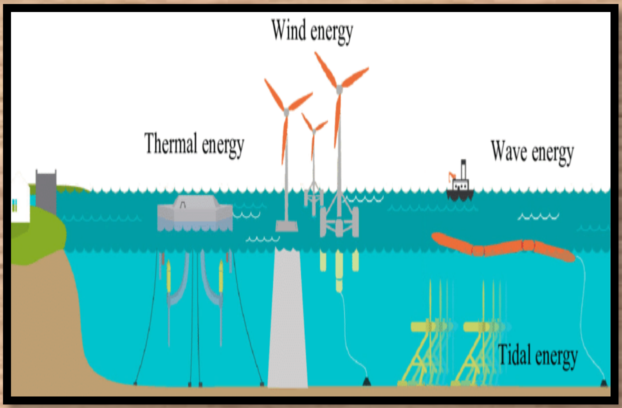
Geothermal heat is heat that is trapped beneath the earths crust from the formation of the Earth 4.5 billion years ago and from radioactive decay . Sometimes large amounts of this heat escapes naturally , but all at once ,resulting in familiar occurrences , such as volcanic eruptions and geysers .This heat can be captured and used to produce geothermal energy by using steam that comes from the heated water pumping below the surface , which then rises to the top and can be used to operate a turbine.

ADVANTAGES:

- It is renewable.
- Low emissions.
- No fuel is required.
- Environmentally friendly.
- It's good for the economy.
- Job creation.

DISADVANTAGES:

- High investment costs.
- Land requirements for the geothermal system to be installed .
- High temperature needed.
- Geothermal energy emits sulphur dioxide and hydrogen sulphide.



OCEAN (MARINE) ENERGY:

The oceans represent a major source of renewable energy . Different technologies employ different strategies for harvesting that energy . The main sources of ocean energy are :- Tidal stream ,waves , Tidal range(rise and fall), Ocean currents etc. The ocean can produce two types of energy :thermal and mechanical .Ocean thermal energy relies on warm water surface temperatures to generate energy through a variety of different systems . Ocean mechanical energy uses the ebbs and flows of the tides to generate energy , which is created by the earth's rotation and gravity from the moon .

ADVANTAGES:

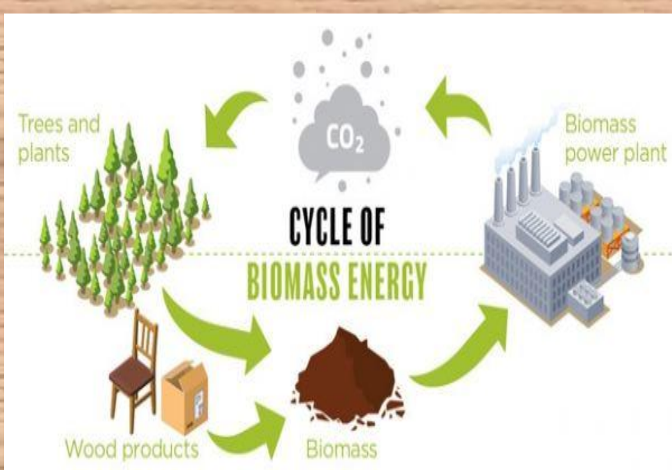
- Zero emission during generation.
- It causes no damage to the land.
- High energy potential.
- Less dependency on fossil fuels.
- Environment friendly.
- Huge amount of energy can be produced.

DISADVANTAGES:

- Effects on marine ecosystem.
- Noise and visual pollution.
- Low performance in unfavorable weather.
- High maintenance costs.

BIOMASS ENERGY:

Biomass energy is a renewable energy derived from biomass . Biomass is an organic matter that comes from living plants and organisms . Using wood in your fireplace is an example of biomass that most people are familiar with . There are various methods used to generate energy through the use of biomass . This can be done by burning biomass, or harnessing methane gas which is produced by the natural decomposition of organic materials in ponds or even landfills . Woody biomass harvested directly for energy consists mainly of trees and bushes harvested for traditional cooking and heating purposes .

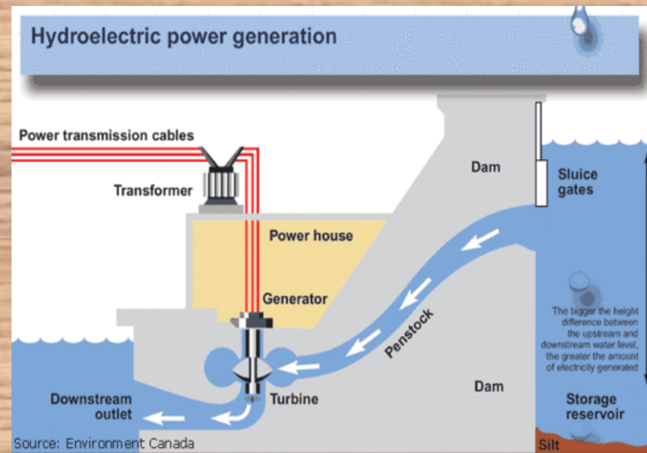


ADVANTAGES:

- **It is renewable.**
- **Less dependency on fossil fuels.**
- **It reduces waste.**
- **Low cost.**
- **Domestic production.**
- **Carbon neutral.**
- **Availability.**

DISADVANTAGES:

- **It is not entirely clean.**
- **A large amount of space is needed.**
- **It requires water.**
- **Can lead to deforestation.**



HYDROELECTRIC POWER:

Hydroelectricity power electricity produced from generators driven by turbines that convert the potential energy of falling or fast-flowing water into mechanical energy . In the generation of hydroelectric power, water is collected and reserved at a high elevation and led downward through large pipes or tunnels to a lower elevation . At the end of its passage down the pipes , the falling water causes turbines to rotate . The turbines in turn drive generators , which transmutes the turbines mechanical energy into electricity .

ADVANTAGES:

- **Hydropower is renewable source of energy.**
- **Emission free**
- **It is a clean energy .**
- **Reliable energy source .**
- **Create lakes**

DISADVANTAGES:

- **Destroy habitats**
- **Higher initial costs**
- **Flood risk**
- **Impact on fish**

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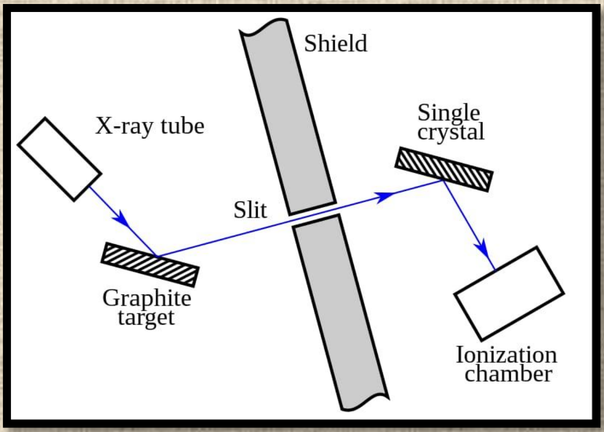
A Brief History Of Compton Effect

Saptaki Chakrabarty, Sem IV

What Is The Compton Effect?

The Compton Effect is simply an effect of a collision among an high energy photon and a target (matter), usually an electron. As an end result of this collision, there's a reduction in the energy of the photon. Or I can say that the wavelength of the scattered photon is increased. This phenomenon is referred to as Compton scattering.



The Compton Effect is a perfect example of an inelastic collision because due to the shift in the wavelength of the photon, the initial kinetic energy of the photon is not the same as the final kinetic energy of the photon. And the amount by which the wavelength of the photon changes is known as Compton shift.

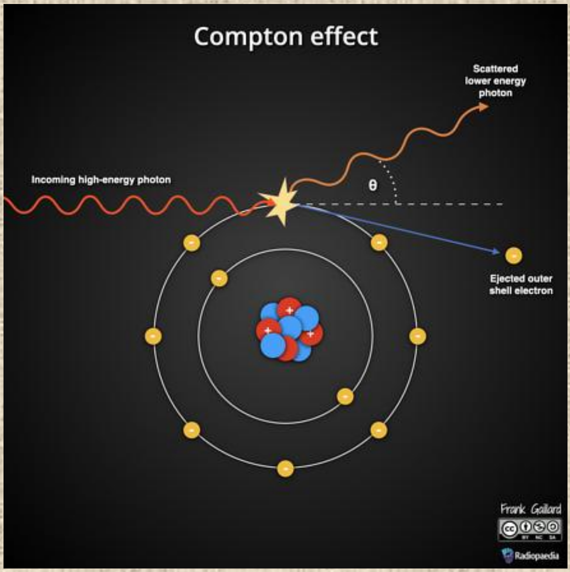
Significance Of Compton Effect

According to the Classical Wave Theory, Electromagnetic Radiation scattered by charged particles can't undergo any kind of shift in wavelength or frequency on scattering . Compton effect confirmed that light can't be defined on the basic of a wave phenomenon. In easy terms, the Compton Effect indicates the particle nature of light.

Who Discovered Compton Effect?

As the name suggests, this effect was discovered by an American physicist named Arthur Holly Compton (September 10, 1892 – March 15, 1962) at Washington University in 1923. Four years after this discovery, 1927, Arthur Compton received his Nobel prize in physics. His discovery of Compton shift was later established through one of his graduate Chinese student named Wu Youxun.

Compton Scattering not only confirmed the law of conservation of energy which was verified by Photoelectric Effect but also explained the law of conservation of Linear Momentum. Although, it was changed by Max Planck and Albert Einstein who hypothesized that light may want to behave as each a wave or particle (Dual Nature). But, it was Arthur Compton who proved that this was possible..



Applications Of Compton Scattering

It's been nearly a century since the discovery of the Compton Effect. Over the year ,the use of Compton Scattering has becomes wider and wider in nearly all of the fields of science like physics, chemistry, biology, etc. Compton Scattering has a use in Radiobiology and Radiation Therapy simply because of its ability to interact with high energy X- rays with the atoms of the living beings.

It also can be implemented to provide an explanation for the wave function of an electron in terms of momentum representation. Compton Scattering is likewise used in the field of Astronomy and Astrophysics, because it enables astronomers and astrophysicists to recognize the evolution of the Black Hole. In the field of chemistry, Compton Scattering is used to understand the chemical bonds and structure of the scattered matter by analyzing its Compton Profile.

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Black Hole : The one way Door Of Universe

Sayani Das, Sem IV

Introduction:

A black hole is a region of space-time where gravity is so strong that no *particles* ***or not even electromagnetic radiation can escape from it. The theory of general relativity says that a sufficiently compact mass can deform space-time to form a blackhole. In many ways, a black hole acts like an ideal black body because it does not reflect any light.***

Discovery of black Hole:

Albert Einstein first predicted the presence of black hole in 1916, with his general theory of relativity . The term 'BLACK HOLE' was coined by American astronomer John Wheeler. The first black hole ever discovered was Cygus X-1, located within the Milky Way in the constellation of Cygnus, the Swan. Astronomers observed the signs of black hole in 1964 when a sounding rocket detected celestial sources of X-rays. In 1971, astronomers determined that the X-rays were coming from a bright star orbiting a strange black object. It was suggested that the X-rays were a result of stellar material being stripped away from the bright star and gobbled up by the dark object – a black hole.

The very first image of a black hole was captured in 2019 by the Event Horizon Telescope (EHT) Collaboration .

How many Black Holes are there?

There are a huge number of black holes in the Universe that it is impossible to count them. The Milky Way contains some 100 billions stars. Approximately one star out of every thousands stars are massive enough to become a black hole. Therefore our galaxy must harbor some 100 million stellar mass black holes.

What happens at the center of a Black Hole?

The singularity at the middle of a black hole is the last no man's land, an area where enormous mass is compressed downward to an infinitely tiny point and all conceptions of time and area absolutely ruin down.
It can be as deep as an internal black hollow. This is known as Planck Star and it's theoretical opportunity is predicted with the aid of loop quantum gravity, that is itself a surprisingly hypothetical proposal for a quantum model of gravity .
Another way to remove the singularity, which doesn't rely upon the untested theories of quantum gravity is referred to as the Gravastar, an alternate of the Black hole theory.

What happens if a human goes into Black Hole ?

What takes place whilst one fall right into a black hole depends on how massive is the black hole.
If one has been free-floating close to a stellar-mass black hole, one would be stretched in a direction and squished in others, a method that scientists named as "spaghettification". This is due to the fact the black hole's gravity may compresses one's body in horizontal direction while at the same time pulling it strongly in the vertical direction.

Conclusion:

The gravitational force of a black hole is so sturdy that even light can no longer escape from it. As a result, Black Holes are One Way Doors of the Universe. None is aware of what is going on inside. Besides the problem is compressed to an exceedingly excessive density .

The dialogue of black holes is one which nevertheless confuses and stumps scientists. Black holes bend time and space, which leaves scientists with unanswered questions on what occurs in them. In fact, physicists have debates on paradoxes and unanswered questions that black holes present .

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Exploration of Geophysics
(Principle , Applications and Emerging Technologies)

Solanki Roy, IVth Sem

Physics is an integral part of our daily life. We studied physics from school days and also applied it in many field here and there. We know there are many branches of physics. Geophysics is one of the most popular part of it and is connected with natural science.
I would like to discuss about it in a nut shell.

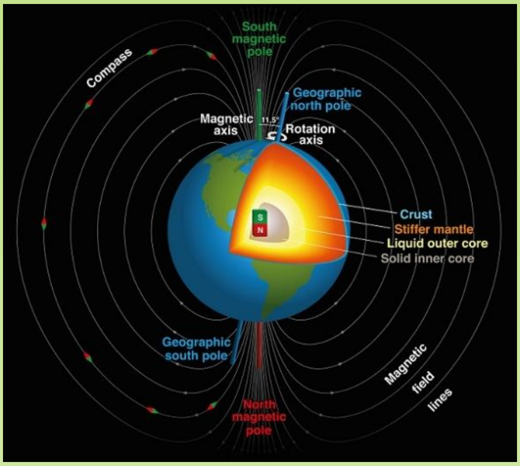
Definition

Geophysics is a field of study which focuses on the physical processes and physical properties of earth and its environment. The use of quantitative methods to analysis these processes are also a part of this subject. Here through geophysics we can know solid earth shape, its gravitational and magnetic fields, its internal structure and composition, its dynamics and their surface expression in plate tectonics, the generation of magmas, volcanism and rock formation. However our modern physics and scientist also includes in this definition that the water cycle, snow and ice, fluid dynamics of the oceans and the atmosphere, electricity and the magnetosphere, solar-terrestrial physics and analogous problem associated with the Moon and other planets.

Beginning of Geophysics

William Gilbert's De Magnetic, a report of a series of meticulous experiments in magnetism is one of the publication that marked the beginning of modern physics. Gilbert deduced that compass points north because the earth itself is a magnet. In 1687, Isaac Newton published his Principia, which is a foundation of classical mechanics and gravity.

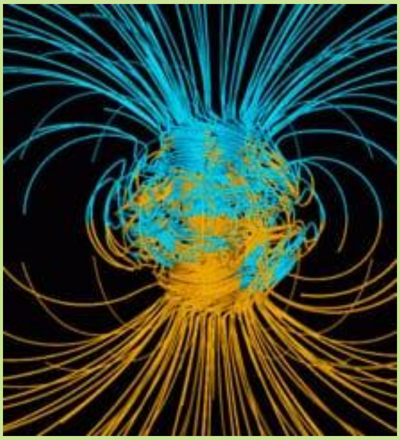
But many types of geophysical phenomena such as the tides and the precession of the equinox are also explained. The first seismometer, an instrument capable of keeping a continuous record of seismic activity, was built by James Forbes in 1844.



Important Physical Phenomena

Geophysics is highly essential subject and geophysicists contribute to every nook and corner of earth science. One should have a clear concept about geophysics. So, this section describes the phenomena that are studied in physics and how it's related to the earth and its surroundings.

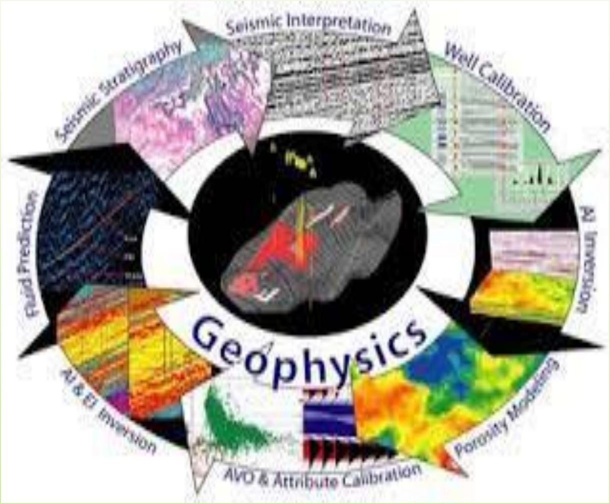
Mainly, the principal of geophysics are applied to the " interior" of the earth. There are some unavoidable problem in this study e.g. scientists has to decide which method should be applied in which problem. For example, for ground water survey electrical method is helpful, for mineral deposits one can adopt gravity/ magnetic survey, for oil and natural gas one has to carry out gravity, magnetic survey to get rough idea about structure of rock formations. If the desired structure is existing, for detailed study of rock formation one has to carry out magneto telluric surveys and so on.



Applications and Emerging Technologies

It is applied in many field such as mineral resources, mitigation of natural hazards and environmental protection. In exploration geophysics, geophysical survey data are used to analyze potential petroleum reservoirs and mineral deposits, locate groundwater, find archaeological relics, determine the thickness of glaciers and soils, and assess sites for environmental remediation.

The complexities and the variations in time and position, geophysical research places demand on a wide range of technological capabilities including instrumentation, transportation, communication and computation.



[http://www.msrblog.com/science/geography/geophysics.html]

We can determine our accurate position in three dimensional place using signals/ messages from four or more satellites. Those satellites not only collect data from visible light region but also from the entire electromagnetic spectrum. The planets can be recognized by their force fields, gravity and their magnetic field which are studied through geophysics and space physics.

Dedicated organizations, use of standard rules as well as practice will assist us a great deal in communicating in the language of geophysics. We should learn, spread and relate it to other fields more and more so that geophysics will be needed in our future progress.

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THE BEGINNING OF EVERYTHING – THE BIG BANG

Sumona Sarkar, Sem IV

Billions of years ago, more than 13 billion years, there was no matter, no energy, no space. Scientists wanted a way to explain how everything began? Where it occurred from? What happened? Although there are numerous theories about the origin of the universe , the Big Bang theory is most accepted one because no other model is as good at explaining everything in the universe. Recent observations even seem to suggest that the expansion of the universe is accelerating. But how did this Big Bang work? Before the moment when the universe began, there was nothing before but during and after that moment, there was something: Our Universe.

How can something come from nothing? Let's explore what we know

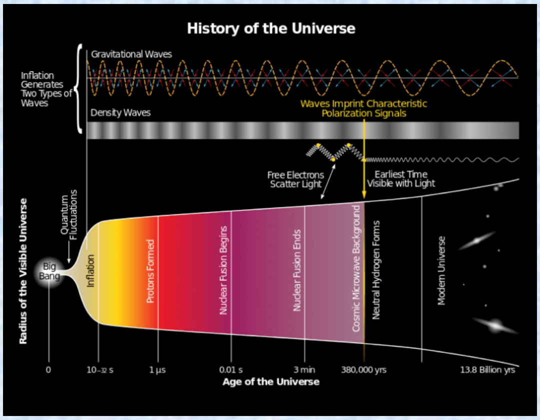
What is BIG BANG:

The Big Bang Theory is the way we explain what happened for the creation of universe. It is the model that describes the early discovery of it.

According to the Big Bang Theory, the universe was together at one singularity (Primary Nebula). There was a "BIG BANG" which resulted in formation of galaxies. These galaxies divided to form stars, planets etc. The origin of universe is unique and the probability of its occurrence by chance is zero.

Timeline of the Big Bang Theory

According to the Big Bang theory, the universe at the beginning was very hot and compact, and since then it has been expanding and cooling down.



Singularity Epoch:

Also known as the Planck Epoch, this was the earliest known period of the Universe. At this time, all matter was condensed on a single point of infinite density and extreme heat. During this period, it is believed that the quantum effects of gravity dominated physical interactions. No other physical forces were of equal strength to gravitation. This Planck period of time was from point 0 to approximately 10^{-43} seconds, and is so named because it can only be measured in Planck time. Due to the extreme heat and density of matter, the state of the universe was highly unstable. It thus began to expand and cool, leading to the manifestation of the fundamental forces of physics.

From approximately 10^{-43} second and 10^{-36}, the universe began to cross transition temperatures. It is here that the fundamental forces are believed to have began separating from each other. The force of gravitation separating from gauge forces, which account for strong and weak forces and electromagnetic force.

Then, from 10^{-36} to 10^{-32} seconds after the Big Bang, the temperature of the universe was low enough that the strong nuclear force separates from the electroweak force. Finally about 10^{-10} seconds after the Big Bang, electroweak force was able to separate as well, giving birth to two distinct forces (weak and electromagnetic force).

Inflation Epoch

With the creation of the first fundamental forces of the universe, the Inflation Epoch began, lasting from 10^{-32} seconds in Planck time to an unknown point. Most cosmological models suggest that the Universe at this point was filled homogeneously with a high-energy density, and that the incredibly high temperatures and pressure gave rise to rapid expansion and cooling down.

This began at 10^{-37} seconds, where the phase transition that caused for the separation of forces also led to a period where the universe grew exponentially. It was also at this point in time that baryogenesis appeared, which refers to a hypothetical event where temperatures were so high that the random motions of particles appeared at relativistic speeds.

As a result, particle–antiparticle pairs of all kinds were being continuously created and destroyed in collisions, that is believed to have led to the predominance of matter over antimatter in the present universe. After inflation stopped, the universe consisted of a quark–gluon plasma, as well as all other elementary particles. After this point , the Universe began to cool and matter coalesced and formed.

Cooling Epoch

As the universe continued to decrease in density and temperature, the energy of each particle began to decrease and phase transitions continued until the fundamental forces of physics and elementary particles changed into their present form.

As particle energies would have dropped to values that can be obtained by particle physics experiments, this period onward is subject to less speculation.

Like, scientists believe that about 10^{-11} seconds after the Big Bang, particle energies dropped considerably. Near about 10^{-6} seconds, quarks and gluons combined to form baryons such as protons , neutrons, and a small excess of quarks over antiquarks led to a small excess of baryons over antibaryons.

Since temperatures were not high enough to form new proton-antiproton pairs (or neutron-anitneutron pairs), mass annihilation immediately followed, leaving just one in 10^{10} of the original protons and neutrons and none of their antiparticles. A similar process occurred at about 1 second after the Big Bang for electrons and positrons. After these annihilations, the rest of the protons, neutrons and electrons were no longer moving relativistically and the energy density of the universe was dominated by photons – and to a lesser extent, neutrinos.

A few minutes into the expansion, the period known as Big Bang nucleosynthesis also started. Thanks to temperatures dropping to 1 billion Kelvin and the energy densities dropping to about the equivalent of air, neutrons and protons began to combine to create the universe's first deuterium (a stable isotope of Hydrogen) and helium atoms. However, most of the Universe's protons stayed uncombined as hydrogen nuclei.

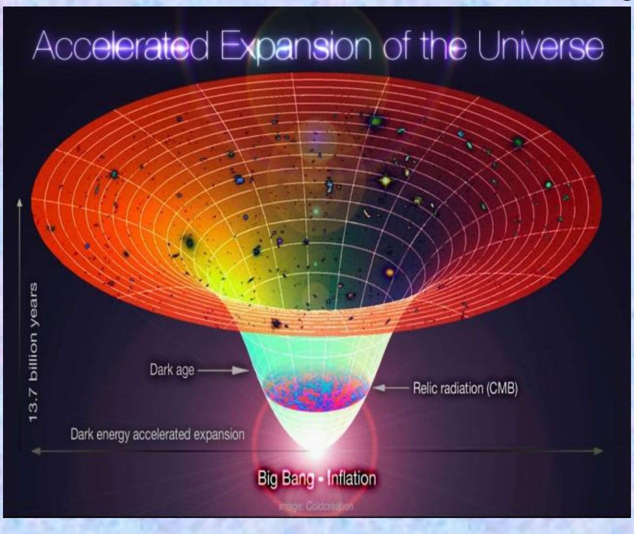
Structure Epoch

Over the course of the several billion years that followed, the slightly denser regions of the almost uniformly distributed matter of the Universe began to become gravitationally attracted to each other. They therefore grew even denser, forming gas clouds, stars, galaxies, and the other astronomical structures that we regularly observe today.

This is what is known as the Structure Epoch, since it was during this time that the modern Universe began to take shape. This consists of visible matter distributed in structures of various sizes, ranging from stars and planets to galaxies, galaxy clusters, and super clusters – where matter is concentrated – that are separated by enormous gulfs containing few galaxies.

The details of this process depend on the amount and type of matter in the universe, with cold dark matter, warm dark matter, hot dark matter, and baryonic matter being the four suggested types. However, the Lambda-Cold Dark Matter model (Lambda-CDM), in which the dark matter particles moved slowly compared to the speed of light, is the considered to be the standard model of Big Bang cosmology, as it best fits the available data.

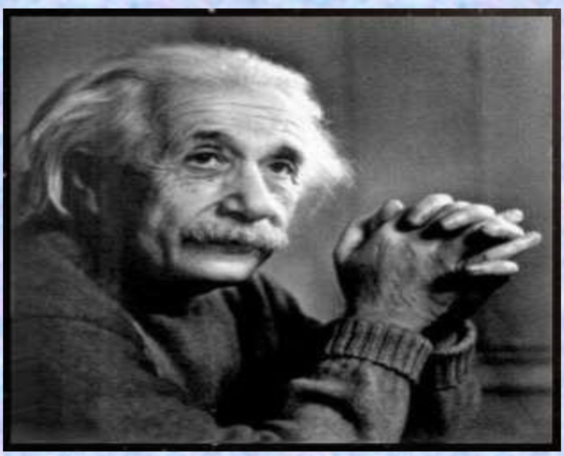
In this model, cold dark matter is estimated to make up about 23% of the matter/energy of the universe, while baryonic matter makes up about 4.6%. The Lambda refers to the Cosmological Constant, a theory originally proposed by Albert Einstein that attempted to show that the balance of mass-energy in the universe was static. In this case, it is associated with Dark Energy, which served to accelerate the expansion of the universe and keep its large-scale structure largely uniform.



After 379,000 years, electrons combined with these nuclei to form atoms (again, mostly hydrogen), while the radiation decoupled from matter and continued to expand through space. This radiation is now known to be what constitutes the Cosmic Microwave Background (CMB), which today is the oldest light in the Universe.

As the CMB expanded, it gradually lost density and energy, and is currently estimated to have a temperature of 2.7260 ± 0.0013 K (-270.424 °C/ -454.763 °F) and an energy density of 0.25 eV/cm^3 (or 4.005×10^{-14} J/m^3; 400–500 photons/cm^3). The CMB can be seen in all directions at a distance of roughly 13.8 billion light years, but estimates of its actual distance place it at about 46 billion light years from the center of the Universe..

Development By Albert Einstein

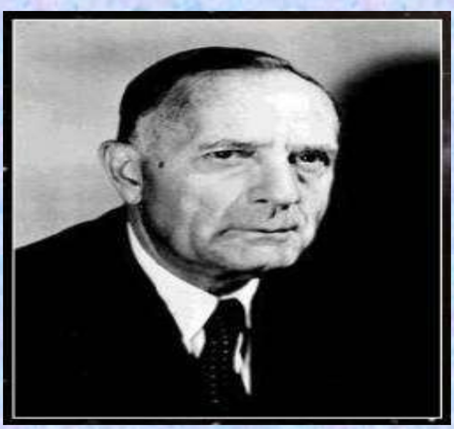


- In 1915 , Einstein predicted that the universe is expanding and he came up with ten field equations to support his general theory of relativity.
- However since Einstein believed in a static universe, he modified his equations and put in a cosmological constant to make the universe static.

Development By Alexander Friedman

- 10 years later, Alexander Friedman, a Russian cosmologist and mathematician, read Einstein's work but thought that cosmological constant was wrong. So he tried to solve Einstein's equations.
- CLOSED UNIVERSE: According to Alexander, time and space have a beginning and an end. They both began with a big bang and will end when gravity stops the universe and pulls everything back into one point. The universe is finite and the expanding universe is due to space expanding.
- OPEN UNIVERSE: According to this part of the theory, the universe began with a bigbang and will continue to expand forever. Time and space have no end.

Development By Edwin Hubble



- In 1924, Edwin Hubble discovered that galaxies appeared to be moving away from us at speeds proportional to their distance . This is known as Hubble's law.
- Hubble developed a series of distance indicators with the use of the 100-inch Hooker telescope.
- This helped him to estimate distances to galaxies whose red shifts had already been measured. In 1929, Hubble discovered the correlation between distance and recession velocity, known as Hubble's law.
- Hubble's law explained the rate at which the universe is expanding and the Hubble's constant is used to estimate the size of the universe.

As with any theory, a number of mysteries and problems have arisen as a consequence of the development of the Big Bang theory. Some of these mysteries and problems have been resolved while others are still outstanding. Proposed solutions to some of the problems in the Big Bang model even have revealed new mysteries of their own.

But this leaves us with numerous unanswered questions. Were there universes before our own? Is this the first and only universe? What started the Big Bang or did it just occur naturally. We don't understand these yet. We don't know and may be never will. But what we do know is that the universe as we know it started here and gave birth to particles, galaxies, stars and earth and us. As we are made of dead stars, we are not separate from the universe, we are part of it. We could even say that we are the universe's way of experiencing itself. So, let's keep on experiencing it until there are no more questions to ask.

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What is Modern Technology & How it is Changing

Swastika Mondal, Sem IV

Modern technology is all about proficiency and quickness ; it is about assuring face-to-face communication, connecting you to your healthcare provider, and empowering you by giving you more and more access and control to the kind of care and service you get as well as fastest mobility and various information you receive. Technological progression such as the Internet , computers, cell phones and many apps have opened up a whole new world for you to learn and choose what is best for your health and knowledge.

Benefits of Technology & Its Change:

Connectivity

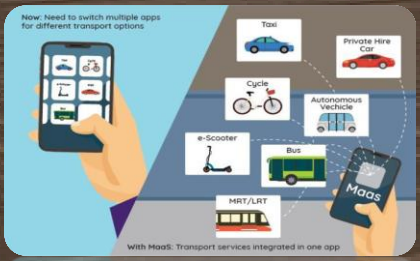
Apps like Skype , WhatsApp , Instagram and Facebook have made it easier for everyone to stay connected and communicate with their friends and family who lives far away. Instant messaging and sharing of images, files and videos have never been easier.

Health Management

Thanks to the wearable technology , doctors and health workers can now keep closer track of your health through the data recorded and stored by your devices. There are apps that can keep you hydrated and avoid taking the wrong type and also keep track of your pills. It also track your medicine schedule and send reminders if you miss a dose.

Ease of Access to Information

The *World Wide Web*, shortened as *www* has made world a social village. Since unlimited information from all around the earth is available on the internet one get whatever information he wants sitting in his room . Several no of e-books and documents are available on the internet for this motive. The modern technology has replaced telephones with smart phones and radios with televisions, and now even televisions have been digitized to "LCD's", LED's" and "Smart Television ".

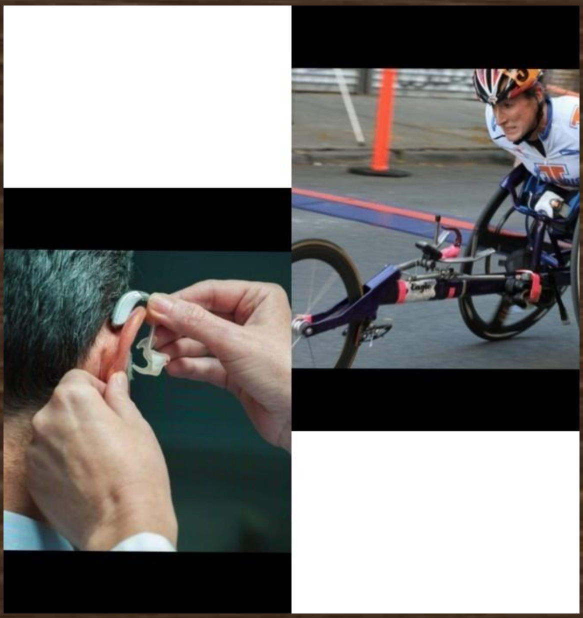


Ease of Mobility

Today, people can no longer imagine their lives without cars and motorcycles. Technology has given us these things. The power of technology in vehicles can be guessed easily from the fact that the distance between United States of America and Australia is about 15185 kms but you can cover the distance just in 16-17 hours.

Artificial Intelligence

The new concept of artificial intelligence is rising up fast, and it is gaining much popularity. The purpose behind this that it might bring a entire new era of revolution. Human wouldn't have to think anymore because there are huge possibilities that an AI System would be able to think about those process to improve technology. This would give a break to human generation and it is most probably one of the greatest favor of the modern technology on us.



Disable-d , Are Now Able-d

Modern science and technology have now made almost everything possible. Brails which works on the electronic pulses have been invented recently. Artificial foot, smart sticks , hearing devices and what not is invented. There are not much stoppage for disabled now. They are obviously in the lifelong run of success along with other normal human beings.

Conclusion:

Technology made life easier and luxurious, while also generating revenue for businesses. people and the industry started to depend on technology because it was faster, but this dependency has now grown to the point that we are turning as slaves to the very technologies we invented. Technology has led us to the farthest reaches of space and the deepest reaches of the ocean and it aided us in the construction of huge cities and proficient transportation systems. On the other hand, it made the construction of the nuclear and the hydrogen weapons feasible. It is responsible for increasing pollution and the thriving of deathlike diseases. In conclusion , we can say it's become a part of daily life for all people to use a computer or a smart phone. However, usage of technology must not be overmuch. Excessive usage of technological devices can cause all sorts of problems; socially and physically.

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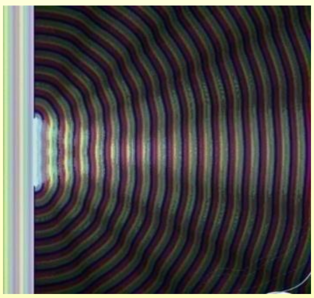
Single Slit Diffraction and Heisenberg's Uncertainty Principle

Tanusri Santra, IVth Sem

Diffraction of Light



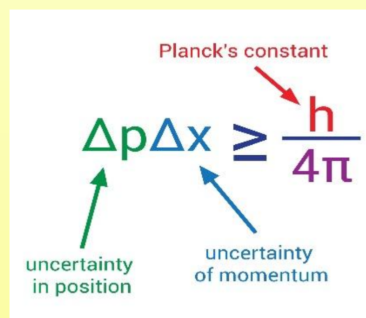
Diffraction of light occurs when a light wave passes by a corner or through an opening or slit that is physically the approximate size of, or even smaller than that light's wavelength.

These effects also occur when a light wave travels through a medium with a varying refractive index or when a sound wave travels through a medium with varying acoustic impedance. All types of waves including gravitational waves, water waves and other electromagnetic waves such as X-rays and radio waves shows diffraction.

Furthermore, quantum mechanics also demonstrates that matter possesses wave-like properties, and hence undergoes diffraction (measurable at subatomic to molecular level).

Uncertainty Principle

In quantum mechanics, the uncertainty principle(also known as Heisenberg's uncertainty principle) is one out of a variety of mathematical inequalities asserting a fundamental limit to the accuracy with which the values for certain pairs of physical quantities (canonical variables) of a particle such as position x, and momentum p, can be predicted from initial conditions.



It is impossible to measure precisely two canonical conjugate quantities simultaneously in one direction.

$$\sigma_Q \sigma_R \geq \left|\frac{1}{2i}\langle[\hat{Q},\hat{R}]\right|$$

Task

The distribution of intensity in the Fraunhofer diffraction pattern of a slit is measured. The results are evaluated both from the wave pattern viewpoint by comparison with Kirchhoff's diffraction formula, and from the quantum mechanics standpoint to confirm Heisenberg's uncertainty principle.

Pathways

1. To measure the intensity distribution of the Fraunhofer diffraction pattern of a single slit (e.g. 0.1 mm). The heights of the maxima and the positions of the maxima and minima are calculated according to Kirchhoff's diffraction formula and compared with the measured values.

2. To calculate the uncertainty of momentum from the diffraction patterns of single slits of differing widths and to confirm Heisenberg's uncertainty principle.

Fig. 1: Experimental set-up

Equipment Set-up and procedure

The different slits (0.1 mm, 0.2 mm and 0.05 mm) of the diaphragm are placed in the laser beam one after the other. The distribution of the intensity in the diffraction pattern is measured with the photo-cell as far behind the slit as possible. A slit (0.3 mm wide) is fitted in front of the photocell. The voltage drop at the resistor attached parallel to the input of the universal measuring amplifier is measured and found to be approximately proportional to the intensity of the incident light.

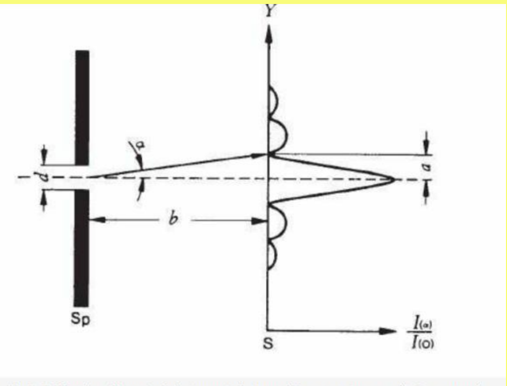


Fig. 2: Diffraction (Fraunhofer) at great distance (Sp = aperture or slit, S = screen).

In order to ensure that the intensity of the light from the laser beam is constant, the laser beam should be switched on about half an hour before the experiment is due to start. The measurements should be taken in a darkened room or in constant natural light. If this is not possible, a longish tube about 4 cm in diameter and blackened on the inside (such as a cardboard tube used to protect postal packages) can be placed in front of the photocell.

The principal maximum, and the first secondary maximum on one side, of the symmetrical diffraction pattern of a slit 0.1 mm wide (for example) are recorded. For the other slits, it is sufficient to record the two minima to the right and left of the principal maximum, in order to determine α (Fig. 2).

Theory and evaluation

❖ Observation from the wave pattern point

When a parallel, monochromatic and coherent light beam of wave-length passes through a single slit of width *d*, a diffraction pattern with a principal maximum and several secondary maxima appears on the screen (Fig. 2). The intensity, as a function of the angle of deviation, in accordance with Kirchhoff's diffraction formula is given by

$$I = I_0 \frac{\sin^2\beta}{\beta^2}\ , \quad where, \beta = {\pi d \sin\theta}/{\lambda}$$

❖ Quantum Mechanical Treatment

The Heisenberg uncertainty principle states that two canonically conjugate quantities such as position and momentum cannot be determined accurately at the same time. Let us consider, for example, a totality of photons whose residence probability is described by the function and whose momentum by the function . The uncertainty of location and of momentum are defined by the standard deviations as follows:

$$\Delta y \cdot \Delta p \geq \frac{h}{2\pi},$$

where *h* is the Planck's constant ("constant of action"), the equals sign applying to variables with a Gaussian distribution. For a photon train passing through a slit of width *d* , the expression is

$$\Delta y = d,$$

whereas the photons in front of the slit move only in the direction perpendicular to the plane of the slit (x-direction), after passing through the slit they have also a component in the direction y. The probability density for the velocity component v_y is given by the intensity distribution in the diffraction pattern.

HUP VERIFICATION

Gaussian wave packet of Laser beam

Assume Laser beam wavefunction flows as a Gaussian wave of narrow peak because laser beam is localized in a certain region. Then the uncertainty in position is simply the standard deviation between both peaks.

Total uncertainty in momentum is the vector addition of single slit momentum and angle between both momentum is being zero.

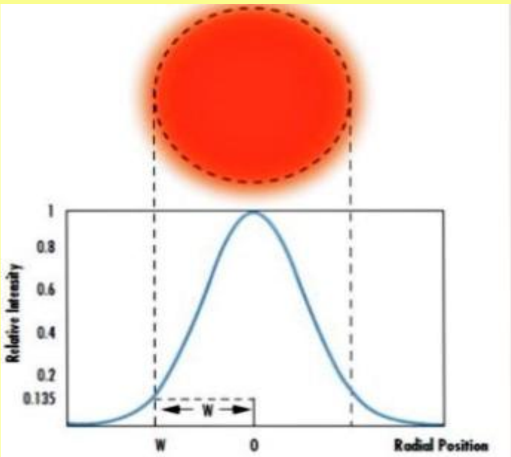


Figure 1: The waist of a Gaussian beam is defined as the location where the irradiance is 1/e² (13.5%) of its maximum value

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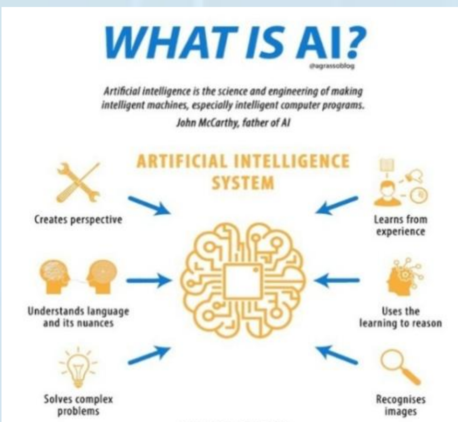
JOURNAL OF MODERN OPTICS, 1993, VOL. 40, NO.6, 1073-1080(M FRANANDEZ GUASTI and M. DE LA CRUZ HEREDIA)

Introduction to Artificial Intelligence

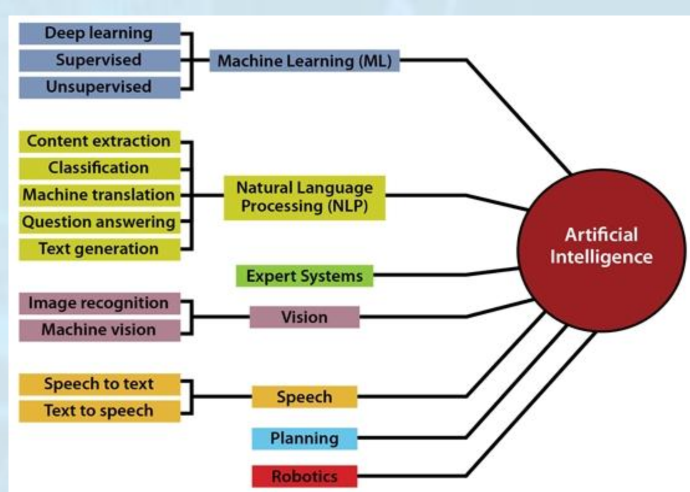
Dhriti Nath and Prerana Saha, IInd Sem

The term "artificial intelligence" clearly describes that it is basically a computer based technology which mimic and display "human" cognitive skills that requires human intelligence.
In 1955,An Allen Newell and Herbert A. Simon created the first artificial intelligence program which was named as "Logic Theorist". This program had proved 38 of 52 Mathematics theorems, and found new and more elegant proofs for some theorems. In 1956, the word "Artificial Intelligence" was first adopted by American Computer scientist John McCarthy at the Dartmouth Conference. For the first time, AI was coined as an academic field.



According to this system of classification, mainly AI can be divided into four types: (i)Reactive machines, (ii) Limited memory machines, (iii)Theory of mind, (iv)Self-aware. AI can also be classified based on technology into three types: (i)Artificial Narrow Intelligence (ANI), (ii)Artificial General Intelligence (AGI), (iii)Artificial Super Intelligence (ASI)
The various sub-fields of AI research are centered around particular goals and the use of particular tools. The traditional goals of AI research include reasoning, knowledge representation, planning, learning, natural language processing, perception and the ability to move and manipulate objects. General intelligence (the ability to solve an arbitrary problem) is among the field's long-term goals.

To solve these problems, AI researchers have adapted and integrated a wide range of problem-solving techniques—including search and mathematical optimization, formal logic, artificial neural networks and methods based on statistics, probability and economics. AI is also being widely used in the fields of computer science, psychology, linguistics, philosophy, and many others field.
"Artificial Intelligence (AI) is the part of computer science concerned with designing intelligent computer systems, that is, systems that exhibit characteristics we associate with intelligence in human behavior – understanding language, learning, reasoning, solving problems, and so on."



➢Scientific Goal is to determine which ideas about knowledge representation, learning, rule systems, search, and so on, can explain various sorts of real intelligence.

➢Traditionally, computer scientists and engineers have been more interested in the engineering goal while psychologists, philosophers and cognitive scientists have been more interested in the scientific goal.

➢The Roots - Artificial Intelligence has identifiable roots in a number of older disciplines, particularly Philosophy , Logic / Mathematics, Computation, Psychology / Cognitive Science, Biology / Neuroscience, Evolution etc.

AI's also used in fields such as Game Playing, Speech Recognition, Computer Vision, Expert Systems- a. Diagnostic Systems, b. System Configuration, c. Financial Decision Making, d. Classification Systems, Mathematical Theorem Proving, Natural Language Understanding, Scheduling and Planning, Artificial Neural Networks, Machine Learning.

AI is also used in everyday life like Online Shopping, Digital personal assistants, Machine Translations, Cyber Security. Artificial Intelligence in Healthcare is used to analyze the treatment techniques of various diseases and to prevent them. AI is used in various areas of healthcare such as diagnosis processes, drug research sector, medicine, patient monitoring care centre, etc.

Artificial intelligence is becoming responsible for everything from medical breakthroughs in cancer research to cutting-edge climate change research. In the case of Covid-19, AI has been used in identifying outbreaks, processing healthcare claims, and tracking the spread of the disease.

There are also ill effects of AI like:

❖Automation spurred job loss.

❖Privacy violations.

❖Deep fakes.

❖Algorithmic bias caused by bad data.

❖Socioeconomic inequality.

❖Market volatility.

❖Weapons automatization.

❖Digital Addiction.

The Future of AI:

Artificial intelligence is impacting the future of virtually every industry and every human being. It has acted as the main driver of emerging technologies like big data, robotics and IoT and it will continue to act as a technological innovator for the foreseeable future. In just a few years, AI has become a reality from fantasy. Machines that help humans with intelligence are not just in sci-fi movies but also in the real world. At this time, we live in a world of Artificial Intelligence that was just a story though for some years.

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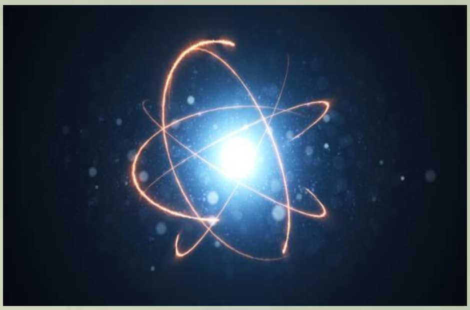
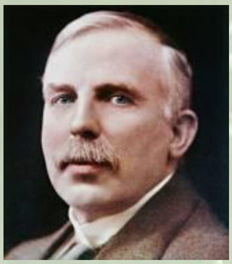
Nuclear Physics : A Field Of Physics

Madhusree Mukherjee, IInd Sem

Nuclear physics is the field of physics that studies atomic nuclei and their constituents and interactions, in addition to the study of other forms of nuclear matter. Nuclei consist of positively charged protons and electrically neutral neutrons held together by the so-called strong or nuclear force.



Pioneers in the filed of Nuclear Physics



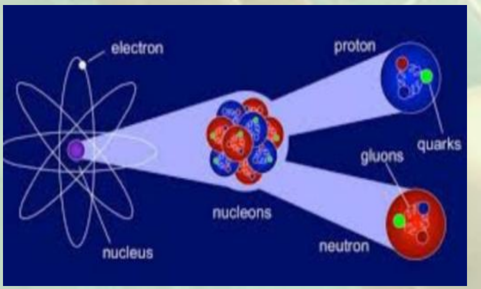
Sir Ernest Rutherford : Father of Nuclear Physics

Lise Meitner: Discovered Fission

Enrico Fermi : Developed 1st Reactor

Otto Hahn : Father of Nuclear Chemistry

Nuclear physics is an important pursuit because the study of the nucleus of the atom is at the heart of our ability to understand the Universe.



Branches of Nuclear Physics are Nuclear Decay, Nuclear Fusion, Nuclear Fission, Production of "Heavy Elements" to name a few.

Versatile Applications of Nuclear Physics:

- **Various kind of Accelerator Technology such as Cyclotron, Synchrotron, Medical Cylcotron, LINAC etc.**
- **Testing and Treating Cancer.**
- **Monitor cargo for contraband.**
- **Use of radio carbon dating technique in Archaeology .**

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Big Bang : Origin of Cosmos

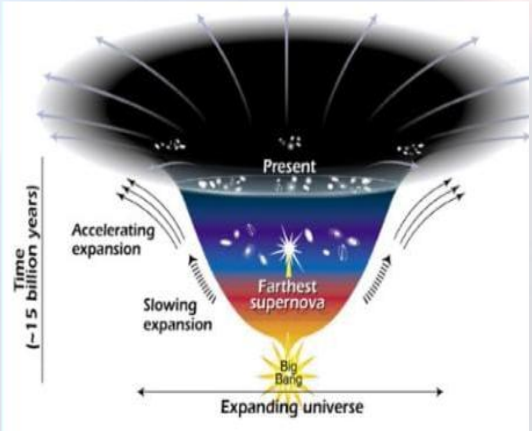
Maitreyee Maiti, IInd Sem

The origin of cosmos, well known as the Big Bang theory is an explanation of the early development of the Universe. According to this theory the Universe increased in size from an extremely small, hot and dense state. Since then it has been expanding and becoming less denser and cooler. The Big Bang is the best model which is used by cosmologists to explain the creation of matter, space and time 13.7 billion years ago.

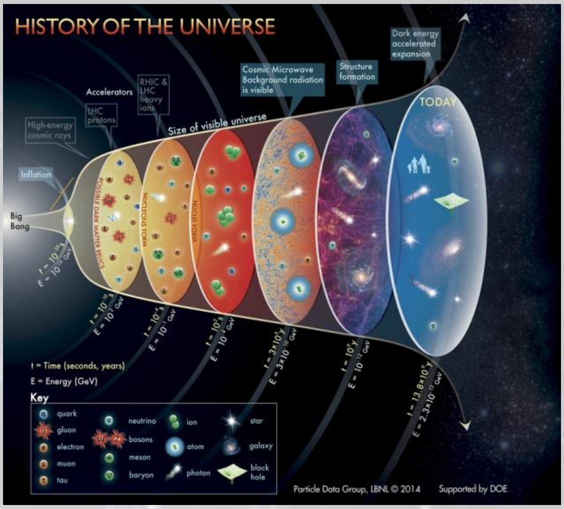
The Big Bang not just happened 13.7 billion years ago but it's still happening until now. This means the Universe is still expanding, celestial bodies are moving further away from us and the hidden signature of the event is in the year all around us.

Above all a question also arises in our mind that from nothing how the Big Bang happened? We'll get a multiple number of answers. One of the most common one is "a singularity," which refers to an instant where all the matter and energy in the Universe was concentrated into a single point. The temperatures, energies, and densities of Universe would be arbitrarily, infinitely huge and could even coincide with the birth of time and space itself. When we look out at the Universe today which is homogeneous as well as isotropic, we see that it's full of galaxies in all directions at a wide variety of distances. Usually, we find that the more distant is a galaxy , the faster it appears to be retreating from us. This isn't due to the actual motions of the individual galaxies through space, rather; it is due to the fact that the fabric of space itself is expanding. This was a prediction that was first came out of General Relativity in 1922 by Alexander Friedmann, which was observationally confirmed by the work of Edwin Hubble and others in the 1920s. It means that, as time goes on, the matter within it expands out and becomes less dense, since the volume of the Universe increases. It also means that, if we look to the past, the Universe was more denser, hotter, and uniform.

Before astronomer Edwin Hubble, in 1915 the German scientist Albert Einstein published the General Theory of Relativity. Application of this theory to the universe implied an expansion of space and a beginning of the universe. Einstein believed in a static universe and in 1917 he modified the equations (added the cosmological constant) to ensure a static Universe. Einstein later said that this was the greatest mistake he made in his life.



Initially the universe was so hot that the four fundamental forces were united as one force and all existed as high-energy radiations (photons) comparable to gamma rays. At these temperatures, when two photons collided with each other, a particle and antiparticle would be created. They would immediately annihilate each other to produce two more photons. At these temperatures, no particle would be stable. Expansion quickly yielded a temperature cool enough for gravitational force to separate, followed soon by the separation of strong nuclear force.



The separation of these two forces released enough energy for a certain inflation in the size of the universe. Before the inflationary period, photons had enough energy to make particle-antiparticle pairs. After the inflationary period, the temperature was low enough that the photons no longer had enough energy to make particle-anti-particle pairs. Since the inflationary period, the universe had went through three different stages: particle stage, radiation stage and matter stage.

The particle stage lasted about ten seconds. The temperature was low enough for quarks and leptons to be stable. As the temperature fell, quarks begin to combine to form protons and neutrons. Finally protons and neutrons combined to form the nuclei of hydrogen and helium which initiated the radiation stage.

The radiation stage lasted about five hundred thousand years. During this stage the universe was the plasma of nuclei and electrons. A plasma is a mixture of positive ions and electrons. During the radiation stage, the universe might have been opaque. The radiation stage ended when the temperature became lower enough for the electrons to bind to newly form atoms.

The matter stage has lasted for less than 15 billion years.

Gravity gradually collected matter into large clouds, which would be the beginning of galaxies. From those huge clouds, first-generation stars were formed. The first generation star's life cycles synthesized all the known elements. From the remains of the first-generation stars, second generation stars would form. In the gaseous cloud around these condemnation stars would be the elements needed to form planets. Thus after about ten billion years of the big bang planets began to form. After about another two billion years, life appeared.

At the end of 20^{th} century, scientists have proposed that the universe began with Big Bang about 13.7 billion years ago and has been expanding since then. The universe should continue expanding forever, becoming colder and darker. Finally, it should be emphasized that scientists' view of the universe is dynamic. Considering the changes in the last 100 years, one can speculate that scientists' model of the universe will continue to change as new discoveries are made.

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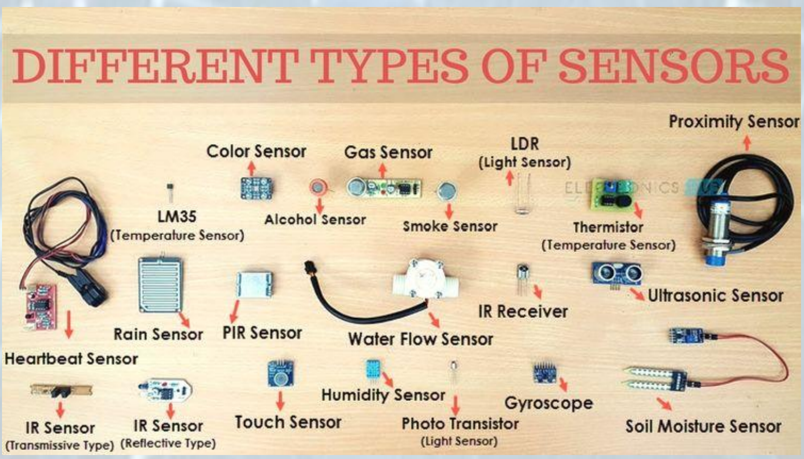
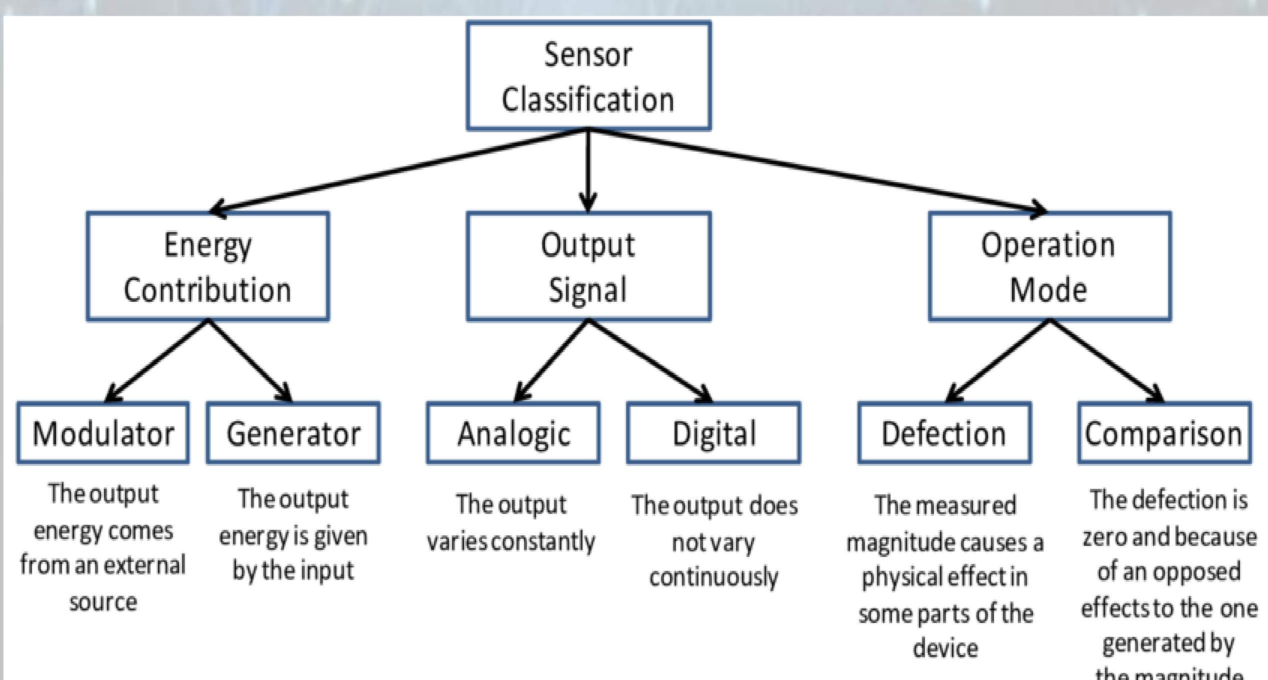
Sensors in a Nutshell

Srijani Banerjee, IInd Sem

- ❖ **Human-beings collect information of the surroundings using their sensors, namely eyes, ears, nose, skin etc.**
- ❖ **A sensor is used to take measurement of physical variable.**
- ❖ **A sensor requires calibration.**
- ❖ **Sensors are used to build intelligent robots.**
- ❖ **Basically sensors are devices that perform input function in a system as they 'sense' the changes in a quantity. The best example of a sensor is mercury thermometer. Here the quantity that is being measured is heat or temperature. The measured temperature is converted to a readable value on the calibrated glass tube based on the expansion and contraction of liquid mercury.**





Characteristics of sensor

❖ Range: Difference between the maximum and minimum values of the input that can be measured. It is the difference between the smallest and the largest outputs that a sensor can provide, or the difference between the smallest and largest inputs with which it can operate properly.

❖ Response: Should be capable of responding to the changes in minimum time. It is also defined as the time required to observe the change in output as a result of change in input for example, ordinary mercury thermometer response time and digital thermometer response time.

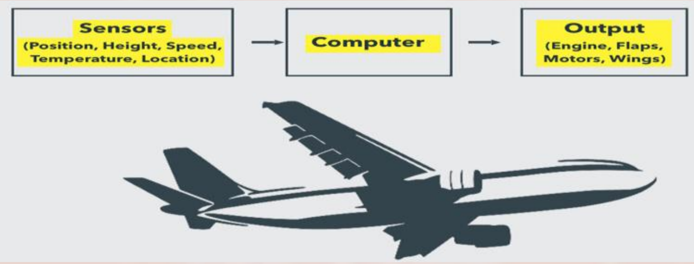
❖ Accuracy: Deviation from exact quantity. For a given input, certain expected output value is related to how close the sensor's output value is to this value.

❖ Sensitivity: Change in input/change in output. highly sensitive sensors show larger fluctuations in output as a result of fluctuations in input.

❖Linearity: Constant sensitivity. It represents the relationship between input variations and output variations.

❖ Repeatability: Deviation from reading to reading when these are taken for a number of times under identical conditions.

❖ Resolution.



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Different types of sensor

1.Temperature.

2.Optical.

3. Pressure.

4.Acoustic.

5.Mechanical.

6.Motion.

7.Position.

8.Electromagnetic.

9. Chemical.

10.Humidity.

11.Radiation.

Applications of sensor:

1. Braking and Traction control:

Antilock Braking System (ABS) Sensors connected to the wheel, measures the speed of the wheel and braking pressure and keeps sending them to ABS controlling When the driver applies the sudden brake, ABS system with breaking pressure and speed data received from the sensors, releases the braking pressure to avoid skidding/locking of wheels. It is one of the critical safety aspects of vehicles.

2.Air Bags

Anti Cushion Restraint System (ACRS): Crush sensors and accelerometers placed in the vehicle measures the force and sends the data to the sensor. During accidents on sensing the force exceeds the limit, ACRS will activate the Airbag and save the life of the passengers.

3.Comfort and Convenience:

Many sensors provide inputs and warnings to drivers on Vehicle Speed, Engine Speed, Fuel level, Tire pressure, Door/deck, light bulbs for driving comfort and convenience.

TIME TRAVEL: A Paradox or else?

Sulagna Dey, IInd Sem

"In space, you can go wherever you want, so maybe in time you can similarly go anywhere you want," says Nikk Effingham, a philosopher at the University of Birmingham in the United Kingdom. "From there, it's a short step to time machines."

Time travel has been a fantasy for at least 125 years. H.G. Wells penned his groundbreaking novel, The Time Machine, in 1895, and it's something that physicists and philosophers have been writing serious papers about for almost a century.

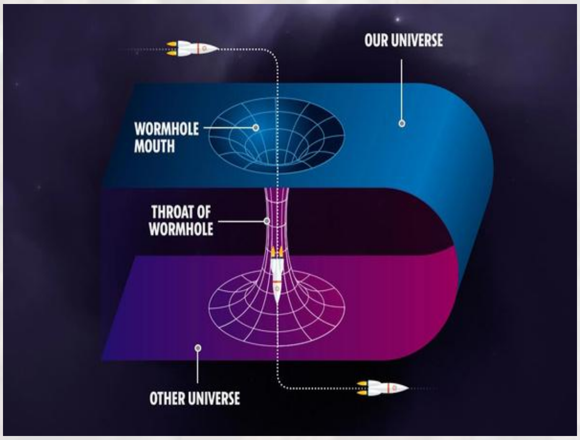
Time travel is commonly defined with David Lewis' definition: An object time travels if and only if the difference between its departure and arrival times as measured in the surrounding world does not equal the duration of the journey undergone by the object. More precisely, the quicker you travel, the slower you 'enjoy' time. For instance, assuming Time travel is possible. For example, an object traveling at high speed ages more slowly than a stationary object. This means that if you were to travel into outer space and return, moving close to light speed, you can journey heaps of years into the Earth's destiny.

Albert Einstein, in his concept of special relativity, decided that the laws of physics are the equal for all non-accelerating observers, and he confirmed that the rate of speed of light inside a vacuum is equal irrespective of the rate at which an observer travels.

As a result, he discovered that space and time have been interwoven right into a single continuum called Space-time. And events that occur at the same time for one observer ought to arise at one-of-a-kind instances for another. Moreover, time dilation, in the theory of special relativity, the "slowing down" of a clock as decided via way of means of an observer who's in relative movement with respect to that clock.

In special relativity, an observer in inertial (i.e., non-accelerating) motion has a well-described manner of determining which activities arise concurrently with a given event.

Hypothetically so far, every body can travel in time. One can do it whether he/she desires to or not, at a steady rate of one second per second. He/she might imagine that there may be no similarity to traveling in one of the three spatial dimensions at, say, one foot per second. But in keeping with Einstein's concept of relativity, we stay in a four-dimensional continuum, space-time, wherein area and time are interchangeable.



A Black Hole is a region of space-time in which gravity is so robust that nothing (even light) can escape. It is a point of intense density into which the entirety is scrunched up which results in a Space Time Singularity (SPS). But black holes are simply the beginning.

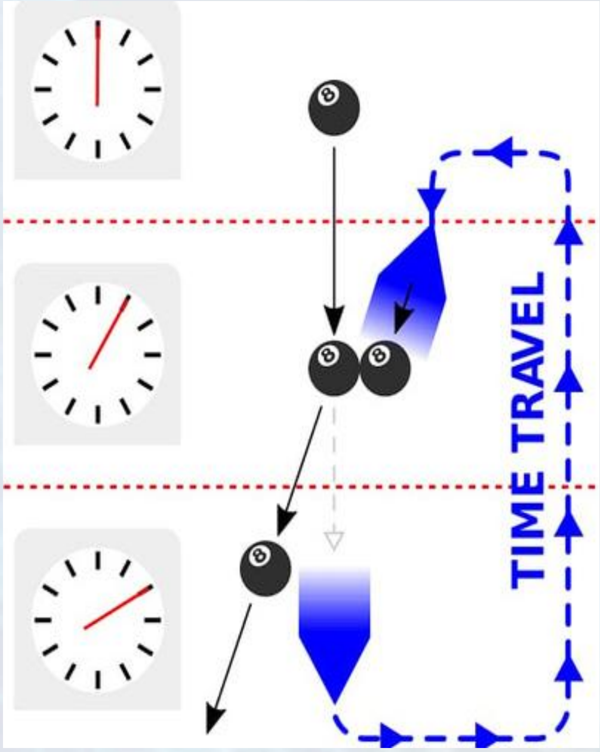
Physicists have additionally peculated approximately the results of miles extra exceptional shape called a wormhole. Wormholes, if they exist, ought to join one region in space-time with another. An astronaut who enters a wormhole inside the Andromeda Galaxy in the year 3000, she would possibly discover herself rising from the alternative result in our personal galaxy in the year 2000.

Closely associated with time travel is the capacity to journey hastily from one position in space to another. Einstein confirmed that it might take a limitless quantity of rocket power to boost up a spaceship to past the rate of light. So, the most effective manner to get from one facet of the galaxy to the alternative in a reasonable time might appear to be if we could warp space-time so much that we created a little tube or wormhole. This ought to join two facets of the galaxy and act as a quick way to get from one to the alternative. One can even manage to travel back in time with a single wormhole if its two ends were moving relative to each other. One can show that one needs to warp space-time in the opposite way to that in which normal matter warps it. Ordinary matter curves space-time back on itself, like the surface of the Earth. Even more, to create a wormhole one desires be counted that warps space-time with-inside the contrary manner, just like the floor of a saddle.

In the book 'Brief Answers to Big Questions', renowned physicist Stephen Hawking stated that "a possible way to reconcile time travel with the fact that we don't seem to have had any visitors from the future would be to say that such time travel can occur only in the future. In this view one would say space-time in our past was fixed because we have observed it and seen that it is not warped enough to allow travel into the past.

On the other hand the future is open. So, we might be able to warp space-time only in the future, we wouldn't be able to travel back to the present time or earlier. This picture would explain why we haven't been overrun by tourists from the future. But it would still leave plenty of paradoxes."

Over the years, physicists and philosophers have contemplated numerous resolutions associated with more than one timelines.



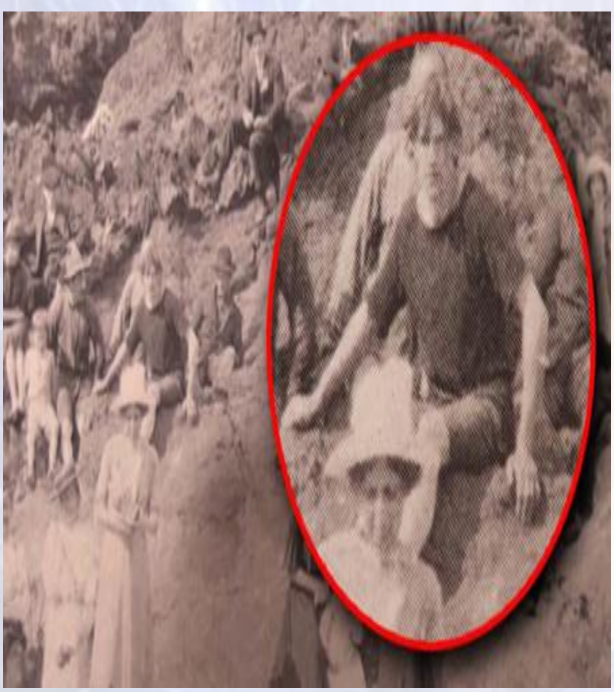
One amongst them is, Grandfather Paradox, that's a potential logical hassle that could rise up if someone to a beyond time. The name comes from the concept that if someone travels to a time earlier than their grandfather had children, and kills him, it might make their personal beginning impossible. So, if time travel is possible, it somehow must avoid such a contradiction. Another logical inconsistency of time travel is Polchinski's Paradox.

It says that if a ball is fired right into a wormhole at a perspective such that, if it keeps going alongside that path, it will exit the wormhole in the past at just the right angle to collide with its in advanced self, thereby knocking it off path and stopping it from coming into the wormhole with-inside the first place.

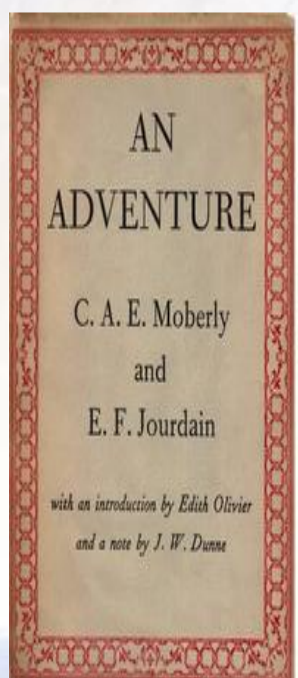
Another logical inconsistency of time travel is Bootstrap Paradox which takes place while an object or piece of information sent back in time becomes trapped inside an limitless cause- effect loop wherein the object now no longer has a discernible factor of origin, and is stated to be "uncaused" or "self-created". It is likewise called an Ontological Paradox.

Another logical inconsistency of time journey is Twin Paradox, that's an idea test in special relativity related to same twins, certainly considered one among whom makes an adventure into space in an excessive-velocity rocket and returns home discovering that the dual who remained on Earth has aged more.

Most importantly, according to theoretical physicist Carlo Rovelli, time is an illusion: our naive perception of its flow doesn't correspond to physical reality. Indeed, as Rovelli argues in The Order of Time, much more is illusory, including Isaac Newton's picture of a universally ticking clock. Even Albert Einstein's relativistic space-time — an elastic manifold that contorts so that local times differ depending on one's relative speed or proximity to a mass— is just an effective simplification.



Time traveler Hipster



Is Time Travel possible?

Then let's see a few testimonies of people who've claimed to journey in time. One is, According to a TED-Ed video by Colin Stuart, Russian cosmonaut Sergei Krikalev clearly traveled 0.02 seconds into his own future because of time dilation during the time he spent at the International Space Station. For the curiosity, Krikalev has spent a sum of 803 days, nine hours, and thirty nine minutes in space over the course of his career, which might be true, scientifically. Second is, The Moberly–Jourdain Incident. In 1901, Englishwomen, Anne Moberly and Eleanor Jourdain, took a holiday to France. whilst they have been there, they claimed, they noticed a few peculiar occurrences. They stated they noticed humans carrying anachronistic clothing, heard mysterious voices, and noticed homes and different systems that were no longer present and, indeed, hadn't existed because the past due 1700s. Finally, they stated, they stuck sight of Marie Antoinette herself, drawing in a sketchbook. They claimed to have fallen right into a "time slip" and been in short transported back more than a hundred years earlier being jolted back to the to the present by a tour guide. Third is, 'The Hipster Time Traveler', with-inside the early 2010s, a photograph depicting the 1941 reopening of the South Fork Bridge in Gold Bridge, British Columbia in Canada went viral for reputedly depicting a person that looked simply a bit too modern to were photographed in 1941. He looks, in fact, like a time visiting hipster: Graphic t-shirt, textured sweater, sunglasses, the works. And, there are numerous other testimonies associated with time visiting, all of which are under investigation till this date whether those were real stories or else.

"The best evidence we have that time travel [into the past] is not possible, and never will be, is that we have not been invaded by hordes of tourists from the future."
~ Quoted.Late Stephen Hawking. 'Black Holes and Baby Universes'.

Is Time Travel really possible?

Shortly, yes, and you're doing it right now — hurtling into the future at the impressive rate of one second per second. If an era in the future permits us to send a human into the future by travelling close to the speed of light, might there be any way for the traveler to use time dilation to go back to the beyond and record her findings? "Interstellar journey achieving near the rate of mild is probably possible," says Dr. Jaymie Matthews, professor of astrophysics at the University of British Columbia. If we can't use time dilation to go back to the beyond, then this doesn't mean that the past is always inaccessible. Einstein proposed that time travel into the past could be achieved through an Einstein-Rosen bridge, a type of wormhole. While it would be fascinating to travel back in time to see the dinosaurs or to meet Albert Einstein and show him the reality of time travel, perhaps it is best if the past remains untouched. Travelling to the past invites the possibility of making an alteration that could destroy the future.

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