

QUANTA

8th Edition 2022-23



Annual Departmental Magazine Physics Department Bijni College, Bijni

SESSION: 2023-2024

Editor
Abhijit Barman



Students Of Physics Department With Faculty Members



Major Students of B Sc 1st Semester



Honours Students of B Sc 5th Semester



Honours Students of B Sc 3rd Semester

Department of Physics Bijni College, Bijni

QUANTA

AN ANNUAL DEPARTMENTAL MAGAZINE

8th Edition, 2023-2024

Department of Physics, Bijni College, Bijni



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গোৱায়নি মাৰুখ' :: বিজনি সোণোৱালিমা

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Message



It is indeed a great pleasure for me to know that Bijni College Physics Department is going to bring out the 8th issue of annual departmental magazine "QUANTA" for the session 2023-24 shortly.

Wishing all concerned in achieving a grand success, I sincerely feel that the publication would enable the upcoming writers to express their talent pertaining to literary skill.

With best wishes.

(Dr. Birhash Giri Basumatary)
Principal,
Bijni College, Bijni
Principal
Bijni College

From Editorial Table.....

The theory of relativity, usually encompasses two interrelated theories by **Albert Einstein**, special relativity & general relativity. Special theory applies to all physical phenomena in absence of gravity. General relativity explains gravitational law and its relation to force of nature. It applies to the cosmological and astrophysical realm, including astronomy. The theory transformed theoretical physics and astronomy during the 20th century, superseding a 200-year-old theory of mechanics created primarily by Isaac Newton. In the field of physics, relativity improved the science of elementary particles and their fundamental interactions, along with ushering in the nuclear age. With relativity, cosmology and astrophysics predicted extraordinary astronomical phenomena such as neutron stars, black holes and gravitational waves.

Our department has a custom of publishing annual departmental magazine every year. So, it is hereby my great honour and pleasure to present the annual departmental magazine QUANTA for the year 2023-24.

I would like to extend my sincere and special thanks to our professors for helping me with their valuable advices in publishing this magazine. I also thank my Colleagues, the editorial board members and cover designers in making this publication a grand success. This magazine is an effort to nurture the inner talents of students and help them gain confidence.

I beg your pardon for any mistake in this publication.

-Editor

Abhijit Barman

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Interesting Physics Topics

Syed Jawahar Hussain, Assistant Professor, Department of Physics

Topic 1

॥ জাপানি প্রোজেক্ট-পার্টিকুলিয়ে দিও পাৰে আওগাৰ মৰণকাৰ তথ্য ॥

[illegible][illegible]

ବାହାରିବାର ପୂର୍ବରୁ ପରିସ୍ଥିତିର ସାମ୍ୟଭାବର ଉପେକ୍ଷା କରି ଧରା ମହାଜାଗାତିକ
 ସମ୍ପାଦନା ସାଧ୍ୟମଣ୍ଡଳର ଧରା ମାଡ଼ିଫ୍ରିଜେନକ ଧ୍ୟାନୀ ସମ୍ପଦ ଫଳତ କାର୍ଯ୍ୟର ଏକ ମନୋନୀତକ C-14 ବ ମାଡ଼ି
 ଧରା। ଏହି C-14 ଡେଜିନ୍ସ, ଅଧ୍ୟାୟ ୫ ଓ ୬ ଡିଡ଼ିବୋନିୟମ ଆଦି ନୌକର ନଠେ ଅନ୍ୟା ଡେଜିନ୍ସ ବାନ୍ଧି
 ଗିରିକର୍ମ କରି ସେଲେ ମୋଲେ ମାରିବିଡିତ ଧରା। ଆକୃତି C-14 ଅଧିକାଂଶକାଳ ମାଡ଼ି ଧରା
 ସହରରେ ଅଧିକ। ଅନ୍ତରାଷ୍ଟ୍ରୀୟ କାର୍ବୋଲେ ମାଲେ ୧୦୦ ଗ୍ରାମ C-14 ବ ଡେଜିନ୍ସ ବିଭିନ୍ନ ସାମାଜିକ
 ଆଦି ଆଦି ୧୦ ଗ୍ରାମ ଧରାଲେ ମାଡ଼ି ଧରା ସହରରେ ଅଧିକ ମନସର ଉପେକ୍ଷା ଧରା।

ଏତିଆ ଏହି C-14 ସାମ୍ୟବଳୀର ଯକା ଆକ୍ସିଜେନ(୦୨) ନମ୍ବ ଲାଗି କାର୍ବନ ଡାଇ
 ବକ୍ସାଇଡ୍(୧୦୨) ମିଶ୍ରୀତ ଯଥା। ହୁଫାଲେ ଗଛ ଗଛିନି ବା ହୁଡିଡିନେ ମାଲୋକ ମଧେଷ୍ୟେ ମକ୍ଷାତିତେ
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 ଜୌଷ ଉତ୍ତେ ଧାନ୍ୟ ହିପାବେ ହୁଡ୍ ହୁଡିନ ଶ୍ରବନ କରେ। ଫଳତ ଧାନ୍ୟ ଯେତେ ହୁଡିନେ ନେବେ କାର୍ବନ
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You cannot blame gravity for falling in love
-Albert Einstein

ଫିକ୍ସ ମାନ୍ଦ୍ରଜନର ସା ଜାଣିବେ ସ୍ବପ୍ନା ରୋଷର ଲେଖକଙ୍କ ସାମ୍ୟ ଯୋଗ୍ୟ ଥାନିକାସ୍ତ୍ରୋ ସକ୍ଷ ରେ
 ଆସିବ । ସମଗ୍ର ସ୍ବପ୍ନା ଶିକ୍ଷିତ ଜୀବର ଲେଖକ ଥିବା C-14 ଓ ଆସିବାର ଲେଖକ କାନ୍ତି ଆସିବ ।

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Topic 2

କ୍ଷୁଦ୍ଧ ଗୋଟିଏ ସାମାଜିକ

[illegible]

The Ghost Particles: What are the Neutinos?

-Abhijit Barman, Student, B. Sc. 5th Semester, Department of Physics

It came from deep space, moving at the speed of light, and crashed into Antarctica. Deep below the ice, it met its end. It wasn't an asteroid or alien spacecraft, but a particle that rarely interacts with matter, known as a neutrino.

Though theorized in the 1930s and first detected in the 1950s, neutrinos maintain a mysterious aura, and are often dubbed "ghost particles" -- they're not haunting or dangerous, but they just zip through the Earth without us even noticing them. Oh, "and it's a cool name," according to astrophysicist Clancy James at Curtin University in Western Australia.

In recent years, ghost particles have been making headlines for all sorts of reasons and not just because they have a cool name. That Antarctic collision was traced to a black hole that shredded a star, for instance, and other neutrinos seem to come via the sun. In early 2022, physicists were able to directly pin down the approximate mass of a neutrino -- a discovery that could help uncover new physics or break the rules of the Standard Model.

What is a neutrino?

In a nutshell, a neutrino is a fundamental, subatomic particle. Under the Standard Model of particle physics it's classified as a "lepton." Other leptons include electrons, the negatively charged particles that make up atoms, with protons and neutrons. But look, if we get into all that, we're going to go real deep on particle physics and it'll explode our brains.

The neutrino is unique because it has a vanishingly small mass and no electrical charge and it's found across the universe. "They are made in the sun, in nuclear reactors, and when high-energy cosmic rays smash into Earth's atmosphere," says Eric Thrane, an astrophysicist at Monash University in Australia. They're also made by some of the most extreme and powerful objects we know of, like supermassive black holes and exploding stars, and they were also produced at the beginning of the universe: the Big Bang.

Like light, they travel in basically a straight line from where they're created in space. Other charged particles are at the mercy of magnetic fields, but neutrinos just barrel through the cosmos without impediment; a ghostly bullet fired from a monstrous cosmic gun.

But why should we care about neutrinos?

Studying them for decades has thrown up a bit of a surprise for scientists. Under the standard model, neutrinos shouldn't have any mass. But they do. "The fact they do points us to new physics to enhance our understanding of the universe," notes James.

The puzzle of the neutrino mass first came to light in the 1960s. Scientists had suggested the sun should be producing what's known as electron neutrinos, a particular type of the subatomic particle. But it wasn't. This "solar neutrino problem" led to a breakthrough discovery: that neutrinos can change *flavor*.

Like an almost-empty bag of Mentos, the ghost particle comes in just three distinct flavors -- electron, muon and tau -- and they can change flavor as they move through space (flavor is the actual terminology, I'm not making that up for this analogy). For instance, an

electron neutrino might be produced by the sun and then be later detected as a muon neutrino.

And such a change implies the neutrino does have mass. Physics tells us they couldn't change flavor if they were massless. Now research efforts are focused on elucidating what the mass is.

In a study published in the prestigious journal *Nature* in February 2022, researchers revealed the mass of a neutrino to be incredibly tiny (but definitely there). Physicists were able to show directly, using a neutrino detector in Germany, that the maximum mass for a neutrino is around eight-tenths of an electron volt (eV). That's an unfathomably tiny mass, more than a million times "lighter" than an electron.

How do we detect neutrinos?

As James notes, "the darn things mostly pass straight through whatever detector you build!"

But there are a number of ways to trap a ghost.

One of the key ingredients you need is space. Physical space, deep underground. For great results, scientists have built their neutrino detectors under meters of ice in Antarctica and, soon, at the bottom of the ocean. This helps keep the data clean from any interference from things like cosmic rays, which would bombard the sensitive detectors at the surface. The detector in Antarctica, known as IceCube, is buried about 8,000 feet straight down.

"Trapping" a ghost particle might not actually be the best terminology for what these detectors are doing. IceCube, for instance, doesn't hold any neutrinos prisoner. The particles mostly blast straight through the detector. But on the way, some very (very!) rarely interact with the Antarctic ice and produce a shower of secondary particles emitting a type of blue light known as Cherenkov radiation. A range of light-sensing spherical modules, vertically arranged like beads on a string, pick up the light those particles emit. A similar detector exists in Japan: Super-Kamiokande. This uses a 55,000 ton tank of water instead of ice and is buried under Mount Ikeno.

Both are able to detect which direction the neutrino came from and its flavor. And so, physicists can see signs the ghost particle was there, but not the ghost particle itself. It's kind of like a poltergeist -- you can see the way it interacts with chairs (throwing them at you) and lights (menacingly switching them on and off), but you can't see the phantom itself. Spooky!

Things we need to know about neutrinos?

As Deborah Conway once sang, "It's only the beginning, but I've already gone and lost my mind."

We haven't gotten into some of the more mind-blowing theories about neutrinos, like neutrinoless double beta decay and the idea of the neutrino as a Majorana particle.

Several new neutrino experiments have been proposed, including the Giant Radio Array for Neutrino Detection, or GRAND, which would see up to 200,000 receivers placed. The total area of the array is designed to be about the same size as Great Britain. The first 10,000 antennas are expected to be placed on the Tibetan plateau, near the city of Dunhuang, in the next few years.

Though we've been able to detect and trace only a few neutrinos so far, the next decade should see neutrino astronomy really take off. The bottom line is that understanding

neutrinos, their flavors and masses, will provide a window into the fundamental nature of our universe. And it's always cool to chase ghosts.

String Theory: Unraveling the Fabric of the Universe

Jackson Narzary, student, B.Sc 5th semester, Department of physics

Introduction

String theory, often hailed as the "theory of everything," is a fascinating and highly speculative framework in modern physics that seeks to unite all the fundamental forces of the universe. This theory attempts to provide a unified description of the fundamental building blocks of the cosmos and the interactions that govern them. While it has not yet been experimentally proven and remains a subject of ongoing research, it offers a tantalizing glimpse into the nature of reality.

The Basics of String Theory

At the heart of string theory is the idea that the fundamental constituents of the universe are not point particles, as described by the Standard Model of particle physics, but rather tiny, vibrating strings. These strings, on the order of 10^{-33} centimeters in length, oscillate at various frequencies to produce different particles and forces.

One of the key insights of string theory is that it proposes the existence of multiple dimensions beyond the familiar three spatial dimensions and one time dimension. In fact, string theory suggests that there are at least 10 dimensions in total, with additional dimensions curled up or compactified, making them virtually imperceptible on macroscopic scales.

Different Vibrational Modes

The vibrational modes of strings correspond to the different particles and forces in the universe. The variety of particles we observe in nature, such as quarks, electrons, and photons, arise from different vibrational patterns of these strings. Thus, in string theory, the unification of forces and particles emerges naturally.

One of the remarkable features of string theory is its ability to incorporate gravity into the framework. General relativity, Einstein's theory of gravity, describes the force that governs the large-scale structure of the universe. String theory, in its quest for unification, demonstrates that gravitons, hypothetical particles associated with gravity, are also string vibrational modes.

String Theory and Quantum Mechanics

String theory is inherently quantum mechanical in nature, and it seeks to reconcile the behavior of subatomic particles with the theory of relativity. Quantum mechanics, which governs the behavior of particles at the quantum scale, introduces uncertainty, wave-particle duality, and the famous Heisenberg Uncertainty Principle. String theory provides a consistent framework that can potentially merge the laws of quantum mechanics with those of general relativity, resolving some of the conflicts that have persisted between these two pillars of modern physics.

Superstring Theory

There are different versions of string theory, with the most prominent being superstring theory. Superstring theory introduces the concept of supersymmetry, a hypothetical symmetry between particles with different spin values. This symmetry predicts the existence of superpartners for known particles, such as the selectron (superpartner of the

electron) and the photino (superpartner of the photon). Supersymmetry, if confirmed, could offer a solution to some of the puzzles in particle physics, including the nature of dark matter.

The Multiverse and String Theory

String theory leads to the intriguing possibility of a multiverse, a vast ensemble of universes coexisting alongside our own. These universes may have different physical laws, constants, and dimensions, giving rise to a diverse array of potential realities. The concept of a multiverse challenges our traditional understanding of the uniqueness of our universe and poses significant philosophical and scientific questions.

Challenges and Controversies

While string theory is an elegant and enticing framework, it faces significant challenges. One of the primary criticisms is the lack of experimental evidence to support it. Due to the incredibly tiny scale at which strings are believed to operate, direct experimentation is currently beyond our technological capabilities. This lack of empirical validation has led some to question the scientific merit of string theory.

Furthermore, string theory presents numerous variations and models, making it difficult to pinpoint a definitive version. Critics argue that the vast number of possible string theory configurations may make it more of a mathematical playground than a predictive scientific theory.

Conclusion

String theory is a captivating and ambitious approach to understanding the fundamental nature of the universe. It offers a glimpse into a world where vibrating strings hold the key to unifying the forces of nature and reconciling quantum mechanics with general relativity. However, it remains a highly speculative and unproven theory, with many questions and controversies surrounding it.

Despite its challenges, string theory continues to be a vibrant area of research in theoretical physics. The pursuit of a theory of everything, which would unite all the fundamental forces and particles, remains a tantalizing goal. Whether string theory ultimately fulfills this role or leads to a deeper understanding of the cosmos, it serves as a testament to the boundless human curiosity and our unrelenting quest to unravel the mysteries of the universe.

"String theory weaves the fabric of the cosmos with the delicate threads of possibility, connecting the smallest of particles to the grandest of mysteries."



Superluminal Speed

Gwmshart Basumatary, student, B.Sc 3rd semester, Department of Physics

Superluminal means about things that move faster than light. The Lorentz transformations have no meaning in the event that the relative speed of two inertial frames exceed the speed of light. This is generally taken to be a prohibition on the moving of mass, energy and information faster than c . However, it is possible for certain processes to proceed at speeds greater than c and for the speeds of moving objects to appear to be greater than c without contradicting relativity theory. A common example of the first of these is the motion of the point where the blades of a giant pair of scissors intersect as the scissors are quickly closed, sometimes called the scissors paradox. A long straight rod makes an angle θ with the x axis (the second blade) and moves in the y direction at constant speed $V_y = \Delta y / \Delta t$. During time Δt the intersection of the blades, point P , moves to the right distance Δx .

$\frac{\Delta y}{\Delta x} = \tan \theta$. The speed with which p moves to the right is

$$V_p = \frac{\Delta x}{\Delta t} = \frac{\Delta x}{\Delta y / \Delta V_y} = \frac{V_y \Delta x}{\Delta x \tan \theta}$$

Or
$$V_p = \frac{V_y}{\tan \theta}$$

Since $\tan \theta \rightarrow 0$ as $\theta \rightarrow 0$, it will always be possible to find a value of θ close enough to zero so that $V_p > c$ for any (non zero) value of V_y . As a real scissors are closed, the angle gets progressively smaller, so in principle all that one need for $V_y > c$ are long blades so that $\theta \rightarrow 0$.



A Physics is just an atom's way of looking at itself

-Niels Bohr

Bohr Model of the Hydrogen Atom

Rhitom Ray, student, B.Sc 1st semester, Department of Physics

Introduction

Bohr model of the hydrogen atom was the first atomic model to successfully explain the radiation spectra of atomic hydrogen. Niels Bohr introduced the atomic Hydrogen model in the year 1913. Bohr's Model of the hydrogen atom attempts to plug in certain gaps as suggested by Rutherford's model. It holds a special place in history as it gave rise to quantum mechanics by introducing the quantum theory.

Objectives

Quantum mechanics emerged in the mid-1920s. Neil Bohr, one of the founders of quantum mechanics, was interested in the much-debated topic of the time – the structure of the atom. Numerous atomic models, including the theory postulated by J.J Thompson and the discovery of the nucleus by Ernest Rutherford, had emerged. But Bohr supported the planetary model, which asserted that electrons revolved around a positively charged nucleus just like the planets around the sun.

Methodology

In 1924 de Broglie postulated wave-particle duality for the electron and other massive particles, thereby providing the opportunity to remove some of the arbitrariness from Bohr's model. For example, an electron possessing wave properties is subject to constructive and destructive interference. As will be shown this leads naturally to quantization of electron momentum and kinetic energy, and consequently a manifold of allowed energy states for the electron relative to the nucleus. The de Broglie-Bohr model of the hydrogen atom presented here treats the electron as a particle on a ring with wave-like properties.

$$\lambda = h/mv$$

Discussion

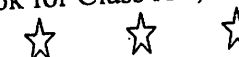
Bohr Model of the hydrogen atom first proposed the planetary model, but later an assumption concerning the electrons was made. The assumption was the quantization of the structure of atoms. Bohr's proposed that electrons orbited the nucleus in specific orbits or shells with a fixed radius. Only those shells with a radius provided by the equation below were allowed, and it was impossible for electrons to exist between these shells.

Conclusion

The quantum mechanical interpretation of these "Bohr orbits" is that they are stationary states. In spite of the fact that we use the expression kinetic energy, which implies electron motion, there is no motion. The electron occupies the orbit as a particle-wave, it is not orbiting the nucleus. If it was orbiting in a classical sense it would radiate energy and quickly collapse into the nucleus. Clearly the stability of matter requires the quantum mechanical version of kinetic energy.

Reference

1. en.wikipedia.org/wiki/Bohr_model
2. Physics, NCERT Text Book for Class XII, Part II.



Aditya L1

Sujay Sarkar, student, B.Sc 1st semester, department of physics

Introduction:

Aditya-L1 a coronagraphy spacecraft to study the solar atmosphere, designed and developed by the Indian Space Research Organisation (ISRO) and various other Indian research institutes. It will be orbiting at about 1.5 million km from Earth in a halo orbit around the L1 Lagrange point between the Earth and the Sun where it will study the solar atmosphere, solar magnetic storms, and their impact on the environment around the Earth.

Objectives

The main objectives of Aditya L1 are:

- To study chromospheric and coronal heating, the physics of partially ionised plasma, of coronal mass ejections (CMEs) and their origins, of the coronal magnetic field and heat transfer mechanisms, and flare exchanges
- To observe the physical particle environment around its position
- To determine the sequence of processes in multiple layers below the corona that lead to solar eruptions
- To study space weather, and the origin, composition and dynamics of solar wind

Methodology

This article is collected form ISRO, Wikipedia and other different sources of internet

Discussion:

The Aditya-L1 mission will take around 109 Earth days after launch to reach the halo orbit around the L1 point, which is about 1,500,000 km (930,000 mi) from Earth. The spacecraft is planned to remain in the halo orbit for its mission duration while being maintained at a stationkeeping Δv of 0.2–4 m/s per year. The 1,500 kg (3,300 lb) satellite carries seven science payloads with various objectives, including instruments to measure coronal heating, solar wind acceleration, coronal magnetometry, origin and monitoring of near-UV solar radiation (which drives Earth's upper atmospheric dynamics and global climate), coupling of the solar photosphere to the chromosphere and corona, and in-situ characterisations of the space environment around Earth by measuring energetic particle fluxes and magnetic fields of the solar wind, and solar magnetic storms.

Aditya-L1 will provide observations of the sun's photosphere, chromosphere and corona. Its scientific payloads must be placed outside the interference from the Earth's magnetic field and hence could not have been useful in the low Earth orbit as proposed in the original Aditya mission concept.

Conclusion

In conclusion, Aditya-L1 represents a significant milestone in the field of space exploration and solar research. Developed by the Indian Space Research Organisation (ISRO) and several Indian research institutes, this coronagraph spacecraft is poised to unlock a deeper understanding of the solar atmosphere, solar magnetic storms, and their influence on our Earth's environment.



Thermodynamics

Radheshyam Das, student, B.Sc 3rd semester, department of physics

Thermodynamics, science of the relationship between heat, work, temperature, and energy. In broad terms, thermodynamics deals with the transfer of energy. from one place to another and from one form to another. The key concept is that heat is a form of energy corresponding to a definite amount of mechanical work. Heat was not formally recognized as a form of energy until about 1798, when count Rumford (sir Benjamin Thompson), a British military engineer, noticed that limitless amount of heat could be generated in the boring of cannon barrels and that amount of heat generated is proportional to the work done in turning a blunt boring tool. Rumford's observation of the proportionality between heat generated and work done lies at the foundation of thermodynamics. Another pioneer was the French military engineer sadi carnot, who introduced the concept of heat-engine cycle and the particle of reversibility in 1824. Carnot work concerned the limitation on the maximum amount of work that can be obtain from a stem engine operating with a high temperature heat transfer as it's driving force . later that century ,these ideas were developed by Rudolf clausius, a German mathematician and physicist , into the first and second laws of thermodynamics , respectively.

The most important laws of thermodynamics are :

1. Zeroth law of thermodynamics.
2. First law of thermodynamics.
3. Second law of thermodynamics
4. Third law of thermodynamics.

- The zeroth law of thermodynamics : when two system are each in thermal equilibrium with a third system ,the first two system are thermal equilibrium with each other. This property makes it meaningful to use thermometers as the "third system" and to define a temperature scale.
- The first law of thermodynamics or the law of conservation of energy: the change in a system's internal energy is equal to the difference between heat added to the system form it's surrounding and work done by the system on its surroundings. in other words , energy can not be created or destroyed but merely converted from one from to another.
- The second law of thermodynamics: Heat does not flow spontaneously from a colder region to a hotter region ,or ,equivalently , heat at a given temperature cannot be converted entirely into work. Consequently, the entropy of a closed system, or heat energy per unit temperature, increases over time toward some maximum value. Thus all closed system tend towards an equilibrium state in which entropy is at a maximum and no energy is available to do useful work.
- Third law of thermodynamics: The entropy of perfect crystal of an element in its most stable form tends to zero as the temperature approaches absolute zero. This allows an absolute scale for entropy to be established that, from a statistical point of view, determines the degree of randomness or disorder in a system.



Photoelectric Effect

Ajay Chouhan, student, B.Sc 1st semester, department of physics

Introduction :

The photoelectric effect, a groundbreaking phenomenon in the realm of physics, represents a pivotal chapter in the understanding of the dual nature of light and behavior of light as both waves and particles. In essence, the photoelectric effect demonstrates how photons, which are discrete packets of light energy, can liberate electrons from a material's surface when they strike it. This process revolutionized our comprehension of quantum mechanics and a pivotal role in the development of modern physics. In this introduction, we embark on a journey to explore the intricacies of the photoelectric effect and its profound implications for science and technology.

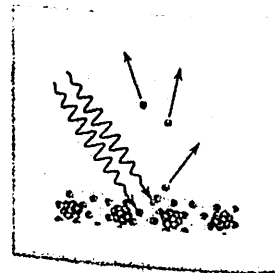
Objectives:

The objectives of this articles are-

1. To understand the fundamental principles of the photoelectric effect and its historical significance in the field of physics.
2. To explore the concept of photons as discrete packets of energy and how they interact with matter to release electrons.
3. To discuss s the implications of the photoelectric effect for the development of quantum mechanics and its role in validating the particle nature of light.

Discussion

The photoelectric effect's discussion delves into confirming the particle nature of light, understanding the significance of the threshold frequency, and its practical applications like photodetectors and solar cells, all of which have transformed technology and modern science.



Conclusion

In conclusion, the photoelectric effect, with its validation of the particle nature of light and the elucidation of the threshold frequency, has had far-reaching implications. It underpins modern quantum physics, contributes to technological advancements, and remains a cornerstone in our understanding of the interaction between light and matter.

Reference

1. https://en.wikipedia.org/wiki/Photoelectric_effect



Prism

Sagar Chouhan, student, B.Sc 1st semester, department of physics

Introduction

A prism is a geometric shape that has two parallel and congruent polygonal bases connected by rectangular or parallelogram faces. When light enters a prism, it refracts, causing it to disperse into its constituent colors. Prisms are fundamental in optics, science, and art for their ability to separate and manipulate light.

Objectives

The objectives of studying prisms include understanding the principles of refraction and dispersion of light, exploring their geometric properties, and their applications in optics. Students aim to grasp how prisms bend and separate light, enabling the creation of spectrums and optical instruments. Additionally, it's important to appreciate their role in architecture and art, where prisms can be used to manipulate and enhance natural light in creative and functional ways.

Methodology

All Secondary Data And some parts of this article is collected form different sources of internet and Books

Discussion

The study of prisms revealed their pivotal role in the dispersion and manipulation of light. By observing the refraction patterns and color dispersion, we gained insights into how prisms are integral in creating spectrums and optical instruments. Furthermore, their application in art and architecture, where they harness and enhance natural light, highlights their versatility. Understanding prisms' properties not only deepens our grasp of optics but also demonstrates their significance in various fields, from science to design.

Conclusion

In conclusion, the study of prisms has unveiled their profound impact on the world of optics, art, and architecture. Their ability to refract and disperse light, creating colorful spectrums, is fundamental to understanding the behavior of light. Moreover, prisms find practical applications in optical instruments, artistic expressions, and architectural designs. By exploring their geometric properties and optical principles, we have gained valuable knowledge that transcends scientific boundaries. Prisms serve as a bridge between the realms of science and creativity, proving their importance in shaping our understanding of light and their pivotal role in enhancing our visual experiences.

Reference

1. <https://en.wikipedia.org/wiki/Prism>



Semiconductor*Bishal Rakshit, student, B.Sc 1st semester, department of physics***Introduction**

Semiconductors are crucial electronic materials with properties between conductors and insulators. They enable the manipulation of electrical current, making them the foundation of modern electronics. Semiconductors are the building blocks of microchips and transistors, powering everything from computers to smartphones and countless other electronic devices.

**Objectives**

1. To understand Semiconductor Fundamentals: Gain a comprehensive knowledge of semiconductor physics, including band theory, carrier mobility, and doping, to grasp the behavior of semiconductors.

4. To discuss applications and Trends: Explore the diverse applications of semiconductors in electronics, communication, and emerging technologies, while staying up-to-date with the latest advancements in the field.

Methodology

This article and secondary data was collected from different sources of internet and some books

Discussion

The discussion on semiconductors encompasses a broad range of topics. It can include debates on the future of semiconductor technology, such as Moore's Law and the development of new materials like graphene. Additionally, discussions may focus on the environmental impact of semiconductor manufacturing and the need for more sustainable practices. The role of semiconductors in emerging technologies like quantum computing and artificial intelligence is also a topic of great interest and debate within the field.

Conclusion

In conclusion, semiconductors are the bedrock of modern technology, playing an integral role in our daily lives. Understanding their fundamental principles, device applications, fabrication processes, and emerging trends is essential for the continued growth and innovation in the electronics industry. As we look to the future, semiconductors will continue to evolve, shaping the course of technology and society. Their significance remains unwavering, making them a fascinating and enduring field of study and innovation.

Reference

Google
Books
wikipedia

**Physics in Everyday Life***Suma saha, student, B.Sc 1st semester, department of physics***Introduction:-**

We live in an era in which science and technology has become a part of our everyday life. Even in the pre-scientific era, human's everyday life was governed by several principles of physics. They were just not aware of the concept. Simplest functions like walking, cutting, and cooking can only be explained through concepts of physics. Physics is a significant aspect of modern culture and human history.

Objectives :-

1. To study the physics behind our surrounding.
2. To apply physical theory in daily life.

Methodology:-

This article has been prepared by using the secondary data collected from internet sources.

Discussion:-

Some examples of Physics in daily life:

1. Alarm Clock Ringing:

To going to sleep at night. The alarm clock's buzz helps our wake up in the morning according to our schedule. Sound is something that you cannot see but can hear or feel. Physics studies the origins, transmission, and properties of sound. The concept of quantum mechanics is applicable here.

2. Electricity:

Electricity is one of physics' most important direct applications in people's lives and a major energy source. It is a continuous stream of electric charges moving inside a conductor, known as electric current. The importance of electricity can be understood from the conditions people endure when electricity is disconnected from their houses. All the electrical appliances stop working, the lights go out, and life becomes difficult.

3. Smartphone:

Smartphone have became like oxygen in modern social life. Now hardly anyone will be untouched by the effects of smartphones. Whether it is to send an important message, chat constantly, talk on video calls, send money or do any other important work, smartphones are everywhere. But do you know how smart phone works? It works on the principles of electricity and the electromagnetic spectrum, the wavy patterns of electricity and magnetism.

Conclusion:-

Here, we have seen a limited example of physics, but over life is governed by this branch of science. Physics governs a lot of natural phenomenon and also define a number of man made things. Hence, we can say that our world is ruled by physics.

Reference:-

www.allenoverseas.com



Quantum Mechanics

Swrji Muchahary, student, B.Sc 1st semester, department of physics

Introduction:

Quantum mechanics, a fundamental branch of physics, delves into the behavior of matter and energy at the smallest scales. It challenges classical physics by introducing the concept of quantization, where particles exhibit wave-particle duality and uncertainties. This revolutionary theory has profound implications for understanding the subatomic world and underpins many modern technologies.

Objectives

The objectives of studying quantum mechanics are to:

1. Comprehend the fundamental principles governing the behavior of particles at the quantum level.
2. Explore wave-particle duality, quantization, and the uncertainty principle.

Methodology

This article was collected from different sources of internet and some books

Discussion

Quantum mechanics is pivotal in understanding the enigmatic behavior of particles. It challenges classical intuition with its probabilistic nature and wave-particle duality. Quantum phenomena like superposition and entanglement have revolutionized technology, offering groundbreaking applications in quantum computing and cryptography. Its study continues to reshape our perception of the fundamental nature of the universe.

Conclusion

In conclusion, quantum mechanics stands as a profound paradigm shift in physics. It unveils the mysteries of the subatomic world, emphasizing the probabilistic and interconnected nature of particles. Its applications, from quantum computing to secure communication, demonstrate its real-world significance. This remarkable field will continue to shape the future of science and technology.

Reference

1. Google
2. Wikipedia
3. byju's



Zeroth Law of Thermodynamics

Bikram Chetry, student, B.Sc 3rd semester, department of physics

The zeroth law of thermodynamics states that if two systems are in thermal equilibrium with a third system, then they are thermal equilibrium with each other. This law provides a foundation for temperature measurement and the concept of thermal equilibrium.

Statement of the Zeroth Law of Thermodynamics:

The Zeroth law of thermodynamics state that if two systems are in thermal equilibrium with a third system, then they are thermal equilibrium with each other. In simple terms, this means that if two objects are at the same temperature as a third object, they are also at the same temperature as each other. This law forms the basis for temperature measurement and the establishment of a temperature scale.

Explanation of the Significance of the Zeroth Law:

The zeroth law of thermodynamics is of great significance in the field of thermodynamics. It allows us to define and measure temperature, which is a fundamental property of any system, by establishing the concept of thermal equilibrium. This law enables us to understand and predict how heat will flow between objects and systems. It provides a fundamental principle for the study of energy transfer and transformation.

Examples and Application of Zeroth Law:

The zeroth law of thermodynamics finds numerous applications in our everyday lives and in scientific research. For instance, it is used in weather forecasting to understand and predict temperature patterns. In industries, it helps design effective cooling systems and temperature control mechanisms. Moreover, this law is essential for the calibration of medical thermometers, ensuring accurate temperature measurement for patient care.

Conclusion and Summary of the Zeroth Law:

The zeroth law of thermodynamics is a fundamental principle that governs the behaviour of temperature in various systems. It establishes the concept of thermal equilibrium, which allows for temperature measurement and the understanding of heat transfer. The law has widespread application in physics, engineering, and chemistry, enabling advancements in energy efficiency, weather forecasting, and medical technology.



Electric Physics

Rahul Amin Sheikh, student, B.Sc 1st semester, department of physics

Introduction

Electric current is the flow of electric charge through a conductor, such as a wire. It's a fundamental concept in physics and the basis for all electrical systems. Current is measured in amperes (A) and is responsible for powering our everyday devices, from light bulbs to complex electronic circuits.

Objectives

The objectives of studying electric current are twofold. First, to understand the fundamental principles governing the flow of electric charge in conductors, allowing us to design and optimize electrical circuits. Second, to apply this knowledge in practical applications, enabling the operation of electrical devices and systems, from household appliances to advanced technologies. This understanding is crucial for both theoretical and practical aspects of electrical engineering and science.

Methodology

The methodology for studying electric current involves experimental investigation and theoretical analysis. It includes setting up circuits with power sources, conductors, and measuring instruments. Current is measured using ammeters, and voltage with voltmeters. Observations are recorded, and data is analyzed to validate mathematical models, such as Ohm's Law, which describe current-voltage relationships in electrical circuits.

Discussion

The discussion of electric current revolves around its practical implications. It's crucial for powering our modern world, enabling technology, but also requires careful management to prevent overheating, power losses, and electrical hazards. Understanding current's role in circuits is vital for electrical safety and efficiency.

Conclusion

In conclusion, electric current is the lifeblood of our electrical systems, powering everything from our homes to the most advanced technologies. Its study provides the foundation for electrical engineering and science, allowing us to harness its potential while ensuring safety and efficiency in our increasingly electrified world.

Reference

- Books
- Google
- Wikipedia



Mystery of Black Holes

Niranjan Brahma, student, B.Sc 1st semester, department of physics

Introduction

A black hole is a region in space where the gravitational pull is so intense that nothing, not even light, can escape from it. This happens when a massive star collapses under its own gravity, creating a singularity at its core and an event horizon beyond which nothing can return.

Black holes are one of the most intriguing and mysterious phenomena in the universe. Their existence challenges our understanding of space, time, and the fundamental laws of physics. They are like cosmic vacuum cleaners, swallowing everything that comes too close, and their properties are governed by some of the most extreme conditions in the universe. Studying black holes has led to groundbreaking discoveries and continues to be a fascinating area of research in astrophysics.

The formation of black holes from massive stars.

Black holes can form from massive stars through a process known as stellar collapse. Here's a brief overview of the formation of black holes from massive stars:

1. Stellar Evolution: Massive stars, those with many times the mass of our Sun, go through a series of stages in their evolution. These stars burn hydrogen into helium through nuclear fusion, and this process continues with heavier elements until iron is formed in the star's core.

2. Core Collapse: Iron cannot sustain nuclear fusion, so when the core accumulates a sufficient amount of iron, it rapidly collapses under the force of gravity. This sudden collapse triggers a supernova explosion, which expels the outer layers of the star into space.

3. Formation of a Singularity: What remains at the core after the explosion is a highly dense, compact object. If the core's mass is more than about 3 times the mass of the Sun (the Tolman-Oppenheimer-Volkoff limit), it continues to collapse further and forms a singularity – an infinitely dense point at the center of a black hole.

4. Event Horizon: The singularity is surrounded by an event horizon, which is the boundary beyond which nothing can escape, not even light. This is what defines a black hole.

Time dilation near a black hole is a consequence of the strong gravitational effects, which are described by Einstein's theory of General Relativity. Here's an explanation of how time slows down near a black hole due to these gravitational effects:

1. Warping of Spacetime: According to General Relativity, massive objects, like a black hole, warp the fabric of spacetime around them. Imagine spacetime as a flexible rubber sheet, and the black hole creates a deep depression in this sheet.

2. Gravitational Time Dilation: When an object, such as a spaceship or a clock, approaches the vicinity of a black hole, it experiences a more intense gravitational field as it enters the curved spacetime near the black hole. This results in a phenomenon called gravitational time dilation, where time flows more slowly for the object in this strong gravitational field compared to an observer farther away from the black hole.

3. Impact on Nearby Objects: As an object gets closer to the black hole, the difference in the flow of time becomes more pronounced. For example, if there were two synchronized clocks, one near the black hole and one farther away, the clock near the black hole would appear to tick more slowly when observed from the distant location.

Studying black holes presents numerous challenges, and there are several unresolved mysteries in this field:

Challenges in Studying Black Holes:

1. Invisibility: Black holes are inherently dark and invisible, as they do not emit or reflect light. Detecting them requires indirect methods like observing their gravitational effects on nearby matter.

2. Extreme Gravitational Forces: Getting close to a black hole is hazardous due to the intense gravitational forces. This limits our ability to explore them up close and places constraints on observational instruments.

3. Limited Resolution: Even with advanced telescopes and detectors, the spatial details or events near the event horizon.

4. Data Collection: Observing black holes often relies on capturing data from across the electromagnetic spectrum, including radio waves, X-rays, and gamma rays. Coordinating such observations can be complex.

Unresolved Mysteries Related to Black Holes:

1. Information Paradox: Black holes seem to violate the principle of information conservation. When matter falls into a black hole, it appears to be lost forever. Understanding what happens to this information is a major unresolved mystery.

2. Quantum Gravity: Combining General Relativity (describing gravity) with quantum mechanics (the physics of subatomic particles) is a fundamental challenge. This is crucial for understanding what happens at the singularity inside a black hole.

3. Formation of Supermassive Black Holes: The origin of supermassive black holes at the centers of galaxies is still not fully understood. How did they form, and what processes led to their enormous sizes?

4. Black Hole Mergers: The dynamics of black hole mergers, as observed through gravitational wave detections, pose questions about their formation, interaction, and the properties of the final merged black hole.

5. Hawking Radiation: Theoretical physicist Stephen Hawking proposed that black holes can emit radiation due to quantum effects near the event horizon. While this Hawking radiation is well-established theoretically, detecting it directly is challenging.

6. Nature of the Singularity: The singularity at the center of a black hole is a point where our physical laws break down. Understanding the nature of the singularity and what occurs there is a central mystery.

These challenges and mysteries make black holes one of the most enigmatic and exciting areas of research in astrophysics and theoretical physics. Ongoing advancements in technology and theoretical understanding continue to shed light on these cosmic enigmas.

Conclusion:

Black holes are crucial in our understanding of the universe because they challenge our fundamental laws of physics, such as the interplay between gravity and quantum mechanics. They provide insights into the behavior of matter and energy in extreme conditions and offer opportunities for testing the frontiers of our scientific knowledge. As we continue to unravel the mysteries surrounding black holes, they play a central role in shaping our understanding of the cosmos and the forces that govern it.



All physics is either impossible or trivial. It is impossible until you understand it, and then it becomes trivial

-Ernest Rutherford

Nuclear Physics

Binojit Brahma, student, B.Sc 1st semester, department of physics

Introduction:

Nuclear physics is the study of atomic nuclei and their constituents. It delves into the structure, behavior, and interactions of atomic nuclei. The field has significant implications for various scientific disciplines, including energy production, medicine, and understanding the fundamental forces of nature.

Objective:

The objective of this report is to explore the key principles of nuclear physics, highlighting its relevance in contemporary scientific research and technological applications. By examining nuclear reactions, structure, and properties, this report aims to provide a comprehensive overview of the field.

Discussion:

Nuclear physics encompasses a range of topics, such as nuclear fission, fusion, and decay processes. Additionally, it investigates the forces that hold nuclei together and the energy production, medical imaging, and cancer treatment.

Reaction:

Nuclear reactions involve the manipulation of atomic nuclei, leading to the release of large amounts of energy. These reactions can be harnessed to generate electricity, produce medical isotopes, and create new elements through particle accelerators.

Used:

The knowledge gained from nuclear physics has contributed to the development of nuclear power plants, radiation therapy for cancer treatment, and advanced imaging techniques in medical diagnostics. Additionally, it has aided in understanding the fundamental building blocks of matter and the origins of the universe.

Conclusion:

In conclusion, nuclear physics plays a crucial role in modern society, offering invaluable insights into the fundamental nature of matter and energy. Its applications have revolutionized various fields, ranging from energy production to medicine. Continued research in nuclear physics holds the potential for further advancements and discoveries that can benefit humanity and deepen our understanding of the universe.



Time Travelling is Possible

Mondeep Brahma, student, B.Sc 1st semester, department of physics

Time travel is a popular topic in science fiction, but is it possible in reality? In this essay, we will explore the concept of time travel, its objectives, discuss the various theories and possibilities, and conclude with the current scientific understanding of this intriguing idea.

Introduction:

Time travel has captured the human imagination for generations. The idea of journeying to the past or future has been a staple of science fiction literature, movies, and television. But is time travel more than just a fanciful concept from the realm of fiction? In this essay, we will delve into the concept of time travel, examine its objectives, explore the scientific theories behind it, and attempt to answer the question of its feasibility.

Objectives:

1. **Exploring the Past:** One of the primary objectives of time travel is the ability to travel back in time to observe historical events firsthand, providing insights into the past that are otherwise inaccessible.

2. **Predicting the Future:** Time travel could offer the ability to journey into the future, allowing us to gain knowledge of events and developments that lie ahead.

3. **Altering History:** Some envision time travel as a means to alter the course of history, raising intriguing ethical and philosophical questions about the consequences of such actions.

Discussion:

1. **Theoretical Frameworks:** Discuss various theoretical frameworks that allow for time travel, including concepts like wormholes, the theory of relativity, and closed timelike curves. Explain how these theories propose the possibility of time travel.

2. **Time Paradoxes:** Explore the paradoxes and challenges associated with time travel, such as the grandfather paradox and the butterfly effect. These paradoxes raise questions about the consistency of time travel scenarios.

3. **Scientific Progress:** Provide insights into the scientific progress made in the field of time travel research and experiments, including studies on time dilation and the effects of extreme speeds on time.

4. **Technological Challenges:** Discuss the technological challenges and energy requirements that would need to be overcome to create a practical time machine.

Conclusion:

In conclusion, the concept of time travel remains a captivating and complex topic. While it has been a mainstay of science fiction, its realization in reality is currently beyond our reach. The objectives of time travel, from exploring the past to altering history, are intriguing but also fraught with paradoxes and ethical dilemmas. As our understanding of physics and the universe continues to advance, the possibility of time travel may become clearer. Until then, time travel remains a tantalizing idea, challenging our imagination and serving as a reminder of the boundless mysteries that science continues to explore.

Doppler Effect

Sagar Chouhan, student, B.Sc 1st semester, department of physics

Introduction-

The Doppler effect, named after the Austrian physicist Christian Doppler, is a phenomenon that describes the change in frequency or wavelength of a wave in relation to an observer moving relative to the source of the wave. This effect is commonly observed with sound and light waves, and it has important applications in various fields, including astronomy, meteorology, and medical diagnostics. The Doppler effect can be categorized into two main types: the redshift and blueshift, which represent an increase or decrease in frequency, respectively, as the source and observer move closer together or farther apart. This effect plays a crucial role in our understanding of the motion and properties of celestial objects, as well as in the development of technologies like radar and Doppler ultrasound.

Objective-

The objective of studying the Doppler effect is to understand how the frequency and wavelength of waves, such as sound or light, change relative to an observer's motion. This phenomenon has various applications in fields like astronomy, physics, and medical diagnostics. By studying the Doppler effect, we can analyze the motion and properties of objects, measure velocities, and even detect redshift in astronomical objects to gain insights into the expansion of the universe.

Discussion-

It describes the change in frequency (or wavelength) of a wave as observed by an observer in relative motion to the source of the wave. There are two main types of Doppler effects: the redshift and blueshift. Redshift: When a wave source and observer move away from each other, the observed wavelength of the wave becomes longer, and the frequency decreases. This is known as redshift and is commonly associated with objects moving away from us, such as galaxies in an expanding universe. Redshift is a key piece of evidence for the Big Bang theory. Blueshift: When a wave source and observer move toward each other, the observed wavelength becomes shorter, and the frequency increases. This is referred to as blueshift and is observed in objects moving closer, like an ambulance siren approaching you. Doppler effects have several practical applications and implications:

Conclusion-

In conclusion, the Doppler effect is a fundamental and versatile phenomenon in wave physics with significant implications across various fields. It provides a mechanism to understand how the frequency and wavelength of waves change when an observer is in relative motion to the source of the waves. Key points to note about the Doppler effect: It encompasses redshift (for motion away from the observer) and blueshift (for motion toward the observer), which are crucial in various applications. In astronomy, the Doppler effect is used to measure the velocity and distance of celestial objects, contributing to our understanding of the universe's expansion. In medical diagnostics, it aids in measuring blood flow and identifying health issues.

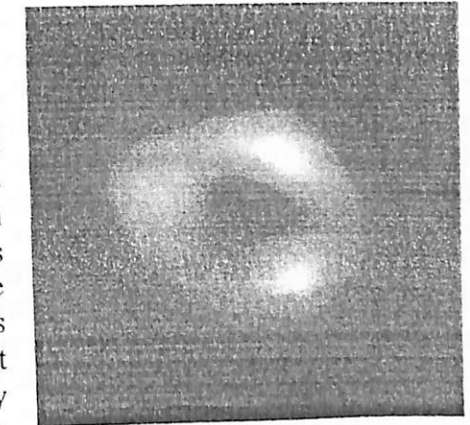


Sagittarius A*

Sujay Sarkar, student, B.Sc 1st semester, department of physics

Introduction

Sagittarius A* is the supermassive black hole at the Galactic Center of the Milky Way. It is located near the border of the constellations Sagittarius and Scorpius, about 5.6° south of the ecliptic, visually close to the Butterfly Cluster (M6) and Lambda Scorpii. The object is a bright and very compact astronomical radio source. The name Sagittarius A* follows from historical reasons. In 1954, John D. Kraus, Hsien-Ching Ko, and Sean Matt listed the radio sources they identified with the Ohio State University radio telescope at 250 MHz. They arranged these sources by constellation and then assigned capital letters in order of brightness within each constellation, with A denoting the brightest radio source within the constellation. The asterisk * is a later addition and was added because its discovery was considered "exciting", in parallel with the nomenclature for excited state atoms which are denoted with an asterisk (for example, the excited state of helium would be He*). The asterisk was assigned in 1982 by Robert L. Brown, who understood that the strongest radio emission from the center of the galaxy appeared to be due to a compact nonthermal radio object.



The observations of several stars orbiting Sagittarius A*, particularly star S2, have been used to determine the mass and upper limits on the radius of the object. Based on mass and increasingly precise radius limits, astronomers concluded that Sagittarius A* must be the Milky Way's central supermassive black hole. The current value of its mass is 4.297 ± 0.012 million solar masses.

Objectives

Sagittarius A* (pronounced Sagittarius A-star) is a supermassive black hole located at the center of the Milky Way galaxy. Astronomers have several key objectives when studying this fascinating celestial object:

Understanding Black Hole Physics

Sagittarius A* provides a unique opportunity to study the behavior of supermassive black holes. Researchers aim to better understand the physical properties of black holes, including their mass, spin, and accretion processes.

Testing General Relativity:

Observations of Sagittarius A* can help test the predictions of Albert Einstein's theory of General Relativity in the extreme gravitational field near a black hole. This includes studying the warping of spacetime, the behavior of light, and the dynamics of matter around the black hole.

Probing Stellar Orbits:

By tracking the motion of stars near Sagittarius A*, astronomers can precisely measure the black hole's mass and determine its gravitational influence on nearby objects. This can also help confirm the existence of the black hole.

Discussion

On May 12, 2022, the first image of Sagittarius A* was released by the Event Horizon Telescope Collaboration. The image, which is based on radio interferometer data taken in 2017, confirms that the object contains a black hole. This is the second image of a black hole. This image took five years of calculations to process. The data were collected by eight radio observatories at six geographical sites. Radio images are produced from data by aperture synthesis, usually from night long observations of stable sources. The radio emission from Sgr A* varies on the order of minutes, complicating the analysis.

Their result gives an overall angular size for the source of $51.8 \pm 2.3 \mu\text{as}$. At a distance of 26,000 light-years (8,000 parsecs), this yields a diameter of 51.8 million kilometres (32.2 million miles). For comparison, Earth is 150 million kilometres (1.0 astronomical unit; 93 million miles) from the Sun, and Mercury is 46 million km (0.31 AU; 29 million mi) from the Sun at perihelion. The proper motion of Sgr A* is approximately $-2.70 \text{ mas per year}$ for the right ascension and $-5.6 \text{ mas per year}$ for the declination. The telescope's measurement of these black holes tested Einstein's theory of relativity more rigorously than has previously been done, and the results match perfectly.

In 2019, measurements made with the High-resolution Airborne Wideband Camera-Plus (HAWC+) mounted in the SOFIA aircraft revealed that magnetic fields cause the surrounding ring of gas and dust, temperatures of which range from -280 to $17,500^\circ\text{F}$ (99.8 to $9,977.6 \text{ K}$; -173.3 to $9,704.4^\circ\text{C}$), to flow into an orbit around Sagittarius A*, keeping black hole emissions low.

Conclusion

In conclusion, the study of Sagittarius A* offers a captivating window into the fascinating world of supermassive black holes and their influence on the cosmos. Astronomers have set forth a multitude of objectives, ranging from advancing our understanding of black hole physics and testing the fundamental principles of General Relativity to exploring the dynamics of the galactic center and the broader implications for galactic evolution. The observations and research conducted on Sagittarius A* not only deepen our understanding of the universe but also drive technological innovations in the field of astronomy. As our knowledge of this enigmatic cosmic entity continues to grow, it underscores the critical role that supermassive black holes play in shaping the universe and contributes to the ongoing quest to decipher the mysteries of the cosmos.

Reference

- Google
- Wikipedia



Eisenstein theory of relativity

Ajay Chouhan, student, B.Sc 1st semester, department of physics

Introduction

Relativity, a groundbreaking theory by Albert Einstein, consists of two major components: special and general relativity. Special relativity, published in 1905, redefined our understanding of space and time, introducing the concept of spacetime and demonstrating that the laws of physics are the same for all observers in uniform motion. General relativity, presented in 1915, extends these ideas to incorporate gravity, explaining it as the curvature of spacetime caused by massive objects. Together, these theories revolutionized our comprehension of the universe.

Objectives

The objective of the theory of relativity, formulated by Albert Einstein, is to provide a comprehensive framework for understanding the fundamental principles of space, time, and gravitation. There are two main branches of relativity:

1. **Special Relativity:** This theory, proposed in 1905, aims to describe the behavior of objects moving at constant velocities, particularly when they approach the speed of light. It introduces concepts like time dilation and length contraction, demonstrating that the laws of physics are the same for all observers in inertial frames of reference.
2. **General Relativity:** Developed by Einstein in 1915, general relativity expands upon special relativity by incorporating the effects of gravity. Its objective is to provide a unified theory of gravity, explaining how mass and energy warp the fabric of spacetime, resulting in the gravitational attraction between objects. General relativity has been remarkably successful in explaining phenomena such as the bending of light by gravity and the motion of celestial bodies.

Overall, the objective of relativity is to provide a consistent and mathematically elegant framework for understanding the fundamental principles that govern the behavior of the universe on both macroscopic and microscopic scales.

Discussion

Relativity, as formulated by Albert Einstein, comprises two theories: Special and General. Special Relativity, introduced in 1905, revolutionized our understanding of space and time, postulating that the laws of physics are the same for all observers in constant motion. It gave rise to the famous equation $E=mc^2$, linking energy and mass. General Relativity, published in 1915, delves into gravity's nature, describing it as the curvature of spacetime caused by mass and energy. This theory has been confirmed through various experiments and observations, such as the bending of light by gravity. Both theories have fundamentally shaped modern physics and cosmology.

Conclusion

Relativity, a groundbreaking theory by Albert Einstein, consists of two major components: special and general relativity. Special relativity revolutionized our understanding of space and time, introducing the idea that the laws of physics are the same for all observers, regardless of their motion. It gave rise to the famous equation $E=mc^2$, for all observers, revealing the equivalence of energy and mass. General relativity extended these concepts to gravity, suggesting that massive objects warp spacetime, causing the curvature that we perceive as gravity. This theory has been confirmed through numerous experiments and observations and has fundamentally transformed our understanding of the universe, with applications in cosmology, GPS systems, and more.

Reference

Wikipedia

Hubble space telescope

Enjen Muchahary, student, B.Sc 1st semester, department of physics

Introduction

Edwin Hubble space telescope is named in honor of the trailblazing astronomer Edwin Hubble, the Hubble Space Telescope is a large, space-based observatory that has changed our understanding of the cosmos since its launch and deployment by the space shuttle Discovery in 1990.

Telescopes have a particular range of light that they can detect. Hubble's domain extends from the ultraviolet through the visible (which our eyes see) and into the near-infrared. This range has allowed Hubble to deliver stunning images of stars, galaxies, and other astronomical objects that have inspired people around the world.

Hubble has made more than 1.5 million observations over the course of its lifetime. Over 20,000 peer-reviewed science papers have been published on its discoveries, and every current astronomy textbook includes contributions from the observatory. The telescope has tracked interstellar objects as they soared through our solar system, watched a comet collide with Jupiter, and discovered moons around Pluto. It has found dusty disks and stellar nurseries throughout the Milky Way that may one day become fully fledged planetary systems and studied the atmospheres of planets that orbit other stars. Hubble has peered back into our universe's distant past, to locations more than 13.4 billion light-years from Earth, capturing galaxies merging, probing the supermassive black holes that lurk in their depths, and helping us better understand the history of the expanding universe.

In its over 30 years of operation, Hubble has made observations that have captured humanity's imaginations and deepened our knowledge of the cosmos. It will continue to do so for years to come.

Facts

The facts and figures of the Hubble Space Telescope paint a picture of the telescope in orbit and provide a glimpse of the engineering prowess behind the observatory.

Length	43.5 feet (13.2 m)
Weight (at launch)	about 24,000 pounds (10,800 kg)
Weight (post-SM4)	about 27,000 pounds (12,200 kg)
Diameter (at widest point)	14 feet (4.3 m)

Spaceflight Statistics

Low-Earth Orbit	altitude of 326 miles (283 nautical miles, or 525 km), inclined 28.5 degrees to the equator
Time to Complete One Orbit	about 95 minutes
Speed	about 17,000 mph (27,000 kph)

Hubble was designed to be repaired and upgraded in orbit by spacewalking astronauts. Space shuttle crews made five trips to Hubble, keeping the telescope in top condition and at the cutting edge of scientific technology.

In it's still and glass Hubble space telescope has unfurled a cosmic poem that will echo through the corridor of time, inspiring generations yet to come to reach for the sparkling stars.



A Person Who Never Made A Mistake Never Tried Anything New

- Albert Einstein

Harmony of The Cosmos

Jackson Narzary, student, B.Sc 5th semester, department of physics

*In the dance of atoms, a cosmic ballet,
Physics unveils the secrets of our day.
A tapestry of wonder, woven with grace,
It touches every corner of time and space.*

*Life's heartbeat, in quantum's mystic trance,
Particles waltz in a delicate dance.
In atoms' embrace, the essence of being,
From quarks to galaxies, we are all seeing.*

*Love, the force that binds hearts and souls,
In physics, too, its connection unfolds.
Entangled particles, no matter the distance,
Share a bond that defies all resistance.*

*The mind, a universe in its own right,
Explores the mysteries, day and night.
In the labyrinth of neurons, it roams,
Seeking answers in quantum realms unknown.*

*The universe, a canvas of infinite art,
In the pages of physics, we play our part.
From the smallest quarks to galaxies vast,
We're stardust, connected, in the cosmos we're cast.*

*So let us ponder, with awe and delight,
The beauty of physics, in day and night.
For it unveils the secrets of life's grand scheme,
Love, mind, and universe, like a beautiful dream.*



Article on Photoelectricity

Dimasa Goyary, student, B.Sc 1st semester, department of physics

Introduction:

Photoelectricity is a phenomenon that describe the emission of electron from a material when it absorbs electromagnetic radiation such as light .This concept has profound implication in various scientific and technological domains , including Solar systems,photodete -tor and quantam mechanics

Objectives :

- To comprehend the fundamental principles of the photoelectric effect and its implications in modern technology.
- To explore the practical applications of photoelectricity in solar panels, photodetectors, and other electronic devices.
- To analyze the theoretical models and experimental setups used to study the photoelectric effect and its various parameters

Methodology :

Secondary sources are used for the preparation of this article.

Discussion :

The photoelectric effect is the phenomenon where electrons are emitted from a material when it absorbs energy from light. This effect led to the understanding of light as composed of discrete particles called photons, and it laid the foundation for the development of modern technology such as solar panels, photodiodes, and various types of light sensors used in digital cameras and other devices.

Conclusion:

Photoelectricity serves as a fundamental concept in the field of physics and engineering enabling the development of innovative technologies thar harness light energy for partical application.

Reference :

- Google
- Science Book



Physics Facts

Socratis Barman, Student, B.Sc 3rd Semester, Department of Physics

Future Source of Energy

Atomic energy, Solar energy and Energy from wind and Bio fuels are just a few the promising alternation for a Cleaner and Greener future other relatively new source of such as fuel cell Geothermal energy and ocean energy are also being explored.

Hydra Electricity

Hydric power, electricity produced from generators driven by turbines that convert the potential energy or just-flowing water into mechanical energy.

Fibre Optics And Communication

Fibre optics communication is a method of transmitting information from one place to carry information.

Doppler Effect In Sound And Light

When wave energy like sound or radio waves travels from two objects, the wave lengths can seem to be changed if one or both of them are moving this is called Doppler Effect.

Einstein Theory of Relativity

General relativity also known as the general theory of relativity is the Geometric theory of gravitation published by Albert Einstein in 1915 and the current description of gravitation is modern physics.

Planetary Motion and Gravity

Newton's law of motion and gravity explained Earths annual journey around the sun Earth would move straight forward through the universe but the sun exerts a constant pull on our planet, this force bends earth path towards the sun pulling the planet into an elliptical.

Photoelectric Effect

The photo electric effect is the emission of electrons or other free carriers when electromagnetic radiation, like light, hits a material. electrons emitted in this manner can be called photoelectrons.

The Big Bang Theory

The big bang theory is a cosmological model of the observable universe from the earliest known as periods through its subsequent large-scale evolution.

Satellite:

A satellite is a moon, or machine that orbits a planet or star. For example, Earth is a satellite because it orbits the sun..... Usually, the word "SATTELITE" refers to a machine that is launched into space and moves around earth or another body in space. Earth and the moon are example of natural satellite.



Transformer

Gwmsat Basumatary, Student, B.Sc 1st Semester, Department of Physics

Introduction:

Transformer is a device used to convert low alternating voltage at higher. Current into high alternating voltage at lower Current and vice-versa.

Objectives:

- (1) To discuss step up froms former.
- (2) To Study Stepdown froms former.

Methodology:

This article is collected from a book.

Discussion:

Step up transformer : A. Step up transformer is designed to increase the voltage from primary to secondary.

Step down transformer: A Step down trans former is designed to reduce the voltage from primary to secondary.

Conclusion:

The transformer is useful thing indaily life. It is used in a variety of applications including power generation, transmission and distribution, lighting, audio systems and electronic equipment. For example: Transformer are used in power plants to increase the voltage of the electricity generated by the plant before it is set to the grid. There fore and a transformer is important and useful device

Reference: "Physics Text book for class Xii"



Be Less Curious About People and More Curious About Ideas.

-Marie Curie

Rain detector alarm

Rwika Boro, student, B.Sc 1st semester, department of physics

Introduction

Water management and proper water usage has to be maintained in the recent years. So maintain proper usage of water we need to Save the water in every aspect. In agriculture field rain is a basic need but intense rain can affect the crops root growth. Irrigation is enough cover the water need of crop but if intense rainfall occurs it may damage the crops. Growth of the crops. When Rain detector detects rain it trigger the alarm. Rain detector alarm efficient way to stop irrigation whenever rain occurs.

Objectives:

1. To detect when it is raining
2. To shutoff power such as to the sprinkler system
3. To conserve the natural rain water that can be harnessed for different purpose.

Methodology:

The article on the topic of Rain detector alarm is written from the Google.

Discussion

When Rain detector detects rain it trigger the alarm. Rain detector alarm efficient way to stop irrigation whenever rain occurs. It is also used in home automation by users to reclaim their belongings cover windows. In some situations, we can collect some rain water.

Conclusion:

Concluding that rain sensor detect and trigger the alarm so that an action taken at a moment. It is activated even at thinnest water drop. Since it is used to stop irrigation, home automation.

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Physics and Indian women

-Sanjita Ray, Assistant Professor, Assistant Professor, Department of Physics, Bijni College

Today woman occupy an important role in every field, home as well as in society, politics etc. In the early Vedic period(2500-1500BC approximately) the position of women was very good in our Indian society but it gradually deteriorated after that. After Vedic period the society became patriarchal and then women were considered as inferior to the man. From the society became patriarchal and then women were considered as inferior to the man. From the Vedic age till today the position, status of woman has been fluctuating with time. But still there were some women who stood against all these social evils and ultimately the success came. In Vedas few women scholars are mentioned –Gargi, Maitreyi, Viswambhara and Apala. Women scientists in India have been started to get recognition after independence but most scientific institute were male dominated. Here I have discussed about some women who had a big success in the field of Physics.

Anna Mani(23rd. August 1918-16th. August 2001): She was the only women scientist to work with C.V.Raman, the great scientist who won Nobel Prize in 1930 for Scattering of Light. on atmospheric physics and instrumentation. She worked on theories like solar radiation, ozone and wind energy. In 1940 she was awarded.

Bibha Chowdhuri: She was the first woman high energy Physicist of India. She is one of the early contributors of science. Anandbai Jashi, Kadambini Ganguli, Bibha Chowdhuri, remembered as path breaking Women Scientists of India. She was an eminent Indian Physicist to work on Particle physics and Cosmic rays. The International Astronomical Union honoured her by renaming the yellow- white dwarf star HD 86081 as Bibha. She was the first women researcher selected by Homi J. Bhabha to join the newly established Tata Institute of Fundamental Research (TIFR) Bombay, in 1949

Ritu Karidhal: she is the Rocket Women of India. She was the Mission Director of the Chandrayan -2 mission. It is the India's Lunar Mission. Ritu Karidhal received the ISRO Young Scientist Award from A.P.J Abdul Kalam. She was a senior scientist at ISRO and played an important role in Mars Orbital Mission. She was also featured in the Forbes India Self – Made Women 2020 list.

Rohini Godbole: She is a Indian Physicist to work on hadronic structure of high energy photons. She is professor at the Centre of High Energy Physics of the Indian Institute of Science in Bengaluru. She has worked extensively on different aspects of Particle phenomenology.

Purnima Sinha: She was the first Bengali woman to receive doctorate in Physics in 1956. She worked with famous scientist S.N. Bose.

Lilabati Bhattacharjee: She is the physicist who along with the great scientist Satyendra Nath Bose. She specialized in the fields of structural crystallography, optical transform, computer programming, instrumentation methods. She is an elected fellow of all the three academies of Science of India.

B Vijayalakshmi: She was from conservative family but still fought and got success. She had 11 papers in International Journals to her credit.

Shobhana Narasimhan: She is from Theoretical Sciences Unit (TSU) of JNU for Advanced Scientific Research. She is the recipient of Stree Shakti Samman Science Award. She has been elected as the international Honorary Member of American Academy of Arts and Sciences.

AmrutaGadge: This India born physicist has created the fifth state of matter during the coronavirus lockdown. Lab News reported that Dr. Gadge, who works in the Quantum Systems and Devices Laboratory at the University of Sussex created a Bose-Einstein Condensate (BEC) which is considered to be the fifth state of matter. Researchers believe this is for the first time someone has created BEC remotely in a Lab. Researchers also say that this achievement could provide a blueprint for operating quantum tech in space or underwater.

Conclusion: Nari Narayani. They have potentiality, patience to do any thing. Nothing can resist the will power of them. India's Chandrayan-3 mission achieved a precise touch down on the Southern pole of the moon, elevating India to the esteemed position of the fourth nation globally. Female scientists (NARI SHAKTI) behind this Mission are- Dr. Ritu Karidhal, Nandini Harinath, Anuradha T.K. Minal Rohit, Moumita Dutta, Tessy Thomas, V.R. Lalithambika, Muthaya Vanitha. If we have efforts, we can achieve success.

Reference:

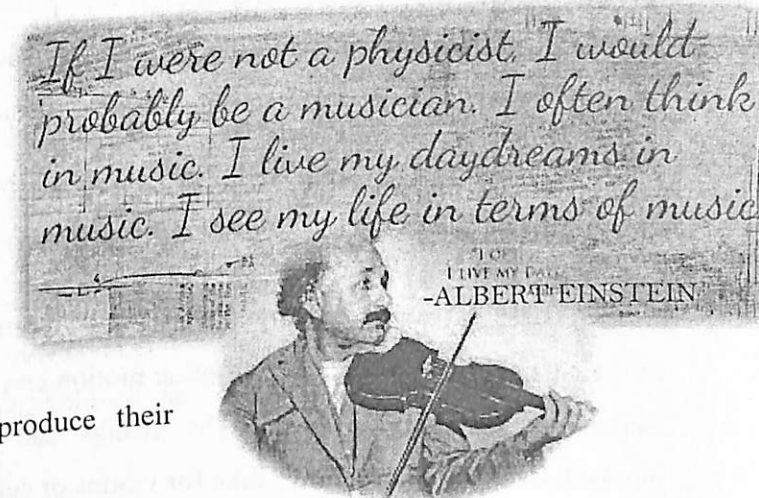
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3. <https://testbook.com/question>

PHYSICS BEHIND MUSIC AND MUSICAL INSTRUMENTS

-Jayshri Narzary, Assistant Professor, Department of Physics, Bijni College, Bijni

INTRODUCTION

One aspect of our daily sensory experience is sound and music. Humans are equipped with ears to perceive sound, just as they have eyes to detect light and color. We rarely stop to consider the properties and actions of sound and the processes involved in sound generation, propagation, and detection. The physics of waves forms the foundation for our knowledge of sound, music, and hearing. Waves are produced when the bodies vibrate and these waves are transferred from one place to another through a medium. Standing waves, which result from the constructive interference of waves moving in both directions along a string or a tube, are what allow musical instruments to produce their sounds.



OBJECTIVES

The objectives of this article are

1. To discuss the physics of waves for understanding sound, music and hearing.
2. To discuss the beauty of physics associated with music and musical instruments.

METHODOLOGY

Secondary data collected from different secondary sources has been taken in preparation of this article.

DISCUSSION

Because a sound wave is a disturbance that propagates through a medium through the mechanism of particle interaction, a sound wave is characterized as a mechanical wave. The disturbance is first transported from one place to another by a medium; usually air or may be any substance like steel or water. Second, the wave originated from a vibrating object that was able to perturb the medium's first particle. The vibrating diaphragm of a radio speaker,

the vibrating tines of a tuning fork, the vibrating string and soundboard of a guitar or violin, or a person's voice chords could all be the source of the disturbance. Third, a sound wave travels from one place to another through interactions between particles. When a sound wave travels through air, when one air particle moves from its equilibrium position, it pushes or pulls on its nearest neighbors, causing them to move out of equilibrium. This particle interaction continues throughout the medium, with each particle interacting and causing interference with its nearest neighbours.

People refer to various precise sound frequencies when they discuss individual notes in music. Notes with higher frequencies are produced by lower frequencies, and vice versa. Higher frequencies create higher notes, and lower frequencies create lower notes. Let us understand the physics of some musical instruments.

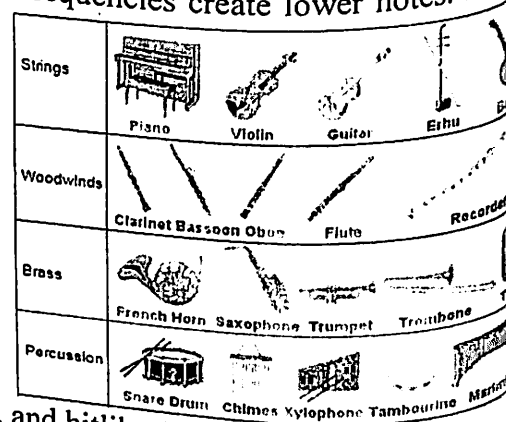
String Instruments

These instruments work through the vibration of their tensioned strings. The vibrating motion can be started by different methods. The strings can be plucked, like for guitars, bowed like for violins or cellos, and hit like for pianos.

A typical guitar has six strings having different natural vibrating frequencies, all of the same length, and all under about the same tension. If you look at the different strings, they're of different sizes, so the mass/length of all the strings is different. The one at the bottom has the smallest mass/length, so it has the highest frequency and the top heaviest string has the lowest frequency. Tuning a guitar simply means setting the fundamental frequency of each string to the correct value. This is done by adjusting the tension in each string. If the tension is increased, the fundamental frequency increases; if the tension is reduced the frequency will decrease. To obtain different notes (i.e., different frequencies) from a string, the string's length is changed by pressing the string down until it touches a fret. This shortens a string, and the frequency will be increased.

Woodwinds Instruments

Columns of air vibrate to produce sound, a mechanism used by woodwinds and related instruments. The inherent vibrating frequency of the column can be varied to produce different notes by varying the lengths of the instruments or by opening and closing holes in



the sides. A pipe organ consists of a variety of pipes, some open-ended and some closed at one end, all of varied lengths. Every pipe has a distinct fundamental frequency associated with it. On the other hand, there is only one pipe for an instrument like a flute. The effective length of the flute can be decreased by opening holes, which will raise the frequency.

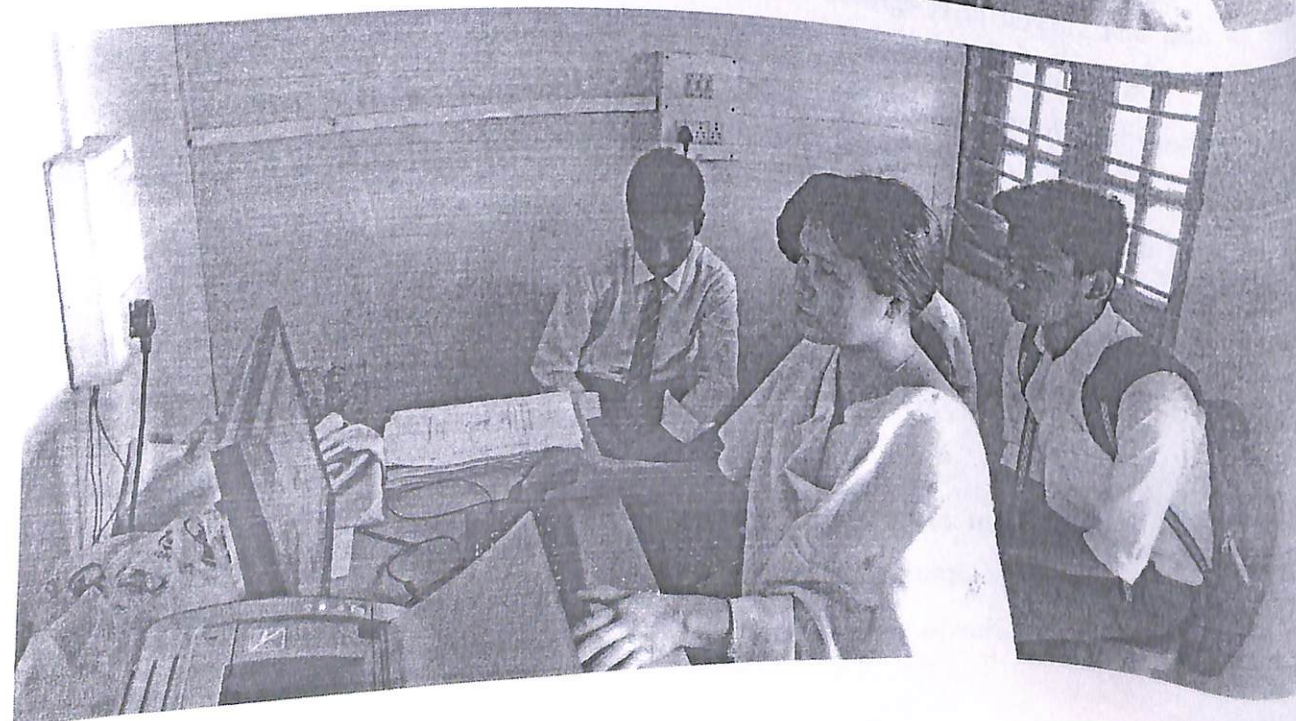
CONCLUSION

The physics behind musical instruments is really imaging. From the discussion, it is seen that the physics behind the musical instruments is they create standing waves instead of random vibrations.

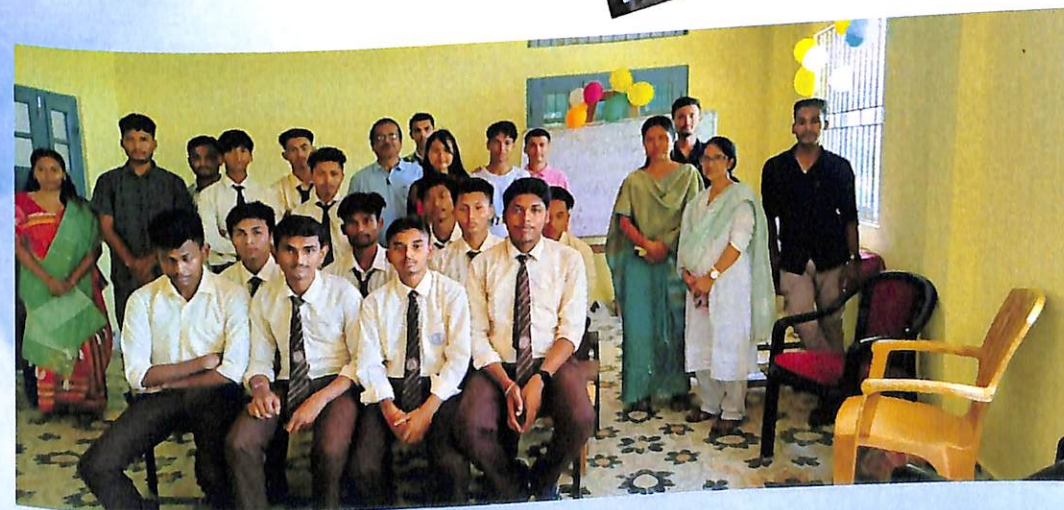
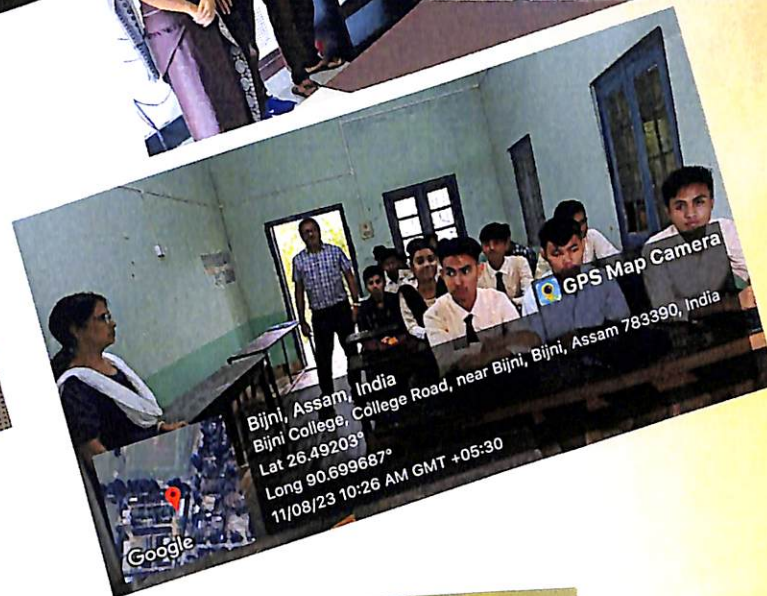
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PREPARATION WALL MAGAZINE "THE IMGE" AND DEPARTMENTAL ANNUAL MAGAZINE
"QUANTA"



Different Activities of Physics Department



Department of Physics Bijni College, Bijni

Participation of departmental students in various Competitions



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