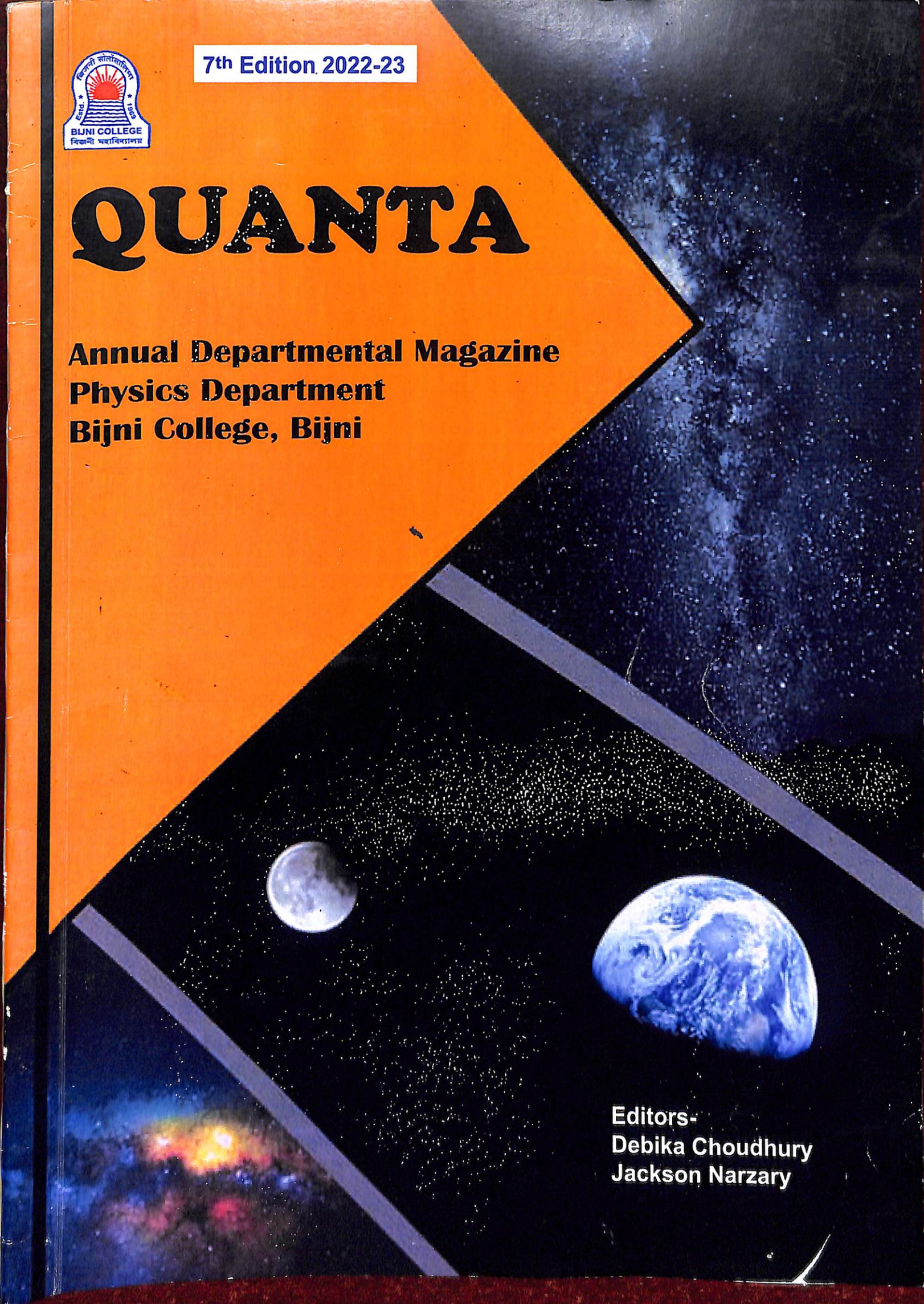
7th Edition 2022-23

BIJNI COLLEGE
বিজনী মহাবিদ্যালয়

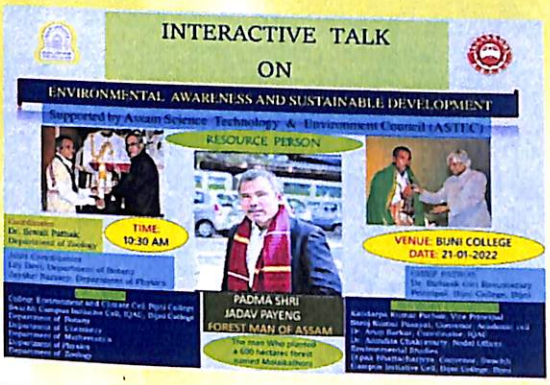
QUANTA

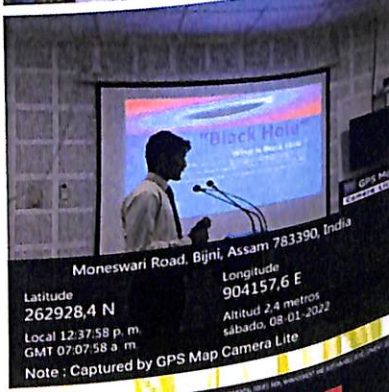
Annual Departmental Magazine
Physics Department
Bijni College, Bijni



Editors-
Debika Choudhury
Jackson Narzary

DEPARTMENTAL ACTIVITIES: 2021-2022





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FROM EDITORIAL DESK

Astronomy is a natural science that studies celestial objects and phenomena. Astronomy tries to explain the origin and evolution of universe by applying physics, mathematics and chemistry. Astronomy is considered to be the oldest science, with the first observation of heavens conducted by our early human ancestors. It is a broad subject which could be classified into many sub-branches. Some of the sub-branches of astronomy are: Astrophysics(deals with the study of physical and chemical structure of the heavenly bodies), Astrogeology(deals with the study of geology of solid bodies in the solar system), Astrometry(locating a celestial object and its measurement within the plane of the sky),Astrobiology(deals with the study of extraterrestrial life).There are many inventions which have come from Astronomy. We unknowingly uses many inventions of astronomy in our daily life. Some of them are: Digital camera on Smartphones,Wi-Fi systems, GPS Satellites, x-ray machines and MRI (Magnetic Resonance Imaging) scanner, etc . By studying the cosmos we can understand where we came from and where we are going. In Astronomy, The universe is Our laboratory.

Our department has a custom of publishing annual magazine every year. So, It is hereby our great honour and pleasure to present the annual departmental magazine QUANTA for the year 2022-23. We would like to extend our sincere and special thanks to JayshriNarzary(HOD, assistant prof) and Sanjita Ray(assistant prof) for helping us with their valuable advices in publishing this magazine. The magazine is an effort to nurture the inner talents of students and help them gain confidence.

We beg your pardon for any mistake in this publication.

Editors:

Debika Choudhury
Jackson Narzary

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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 7th issue of annual departmental magazine "**QUANTA**" 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, Bijni

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QUANTA

7th Edition, 2022-2023

ENERGY USES : GLOBAL ISSUE

Syed Jawahar Hussain, Assistant Professor, Department of Physics, Bijni College

Energy consumption is said to be the index of development of a country. Development in different sectors depends upon energy . Agriculture, Industry, Mining, Transportation, lighting etc need energy. Developed countries like U.S.A and Canada constitute about 5%of the world population but consume one fourth of the global energy resources. An average person there consumes 300 GJ (Giga joules) per year. By contrast, an average man in poor countries like Bhutan, Nepal etc consumes less than 1GJ in a year . This clearly shows that our life style and standard of living are closely related to energy needs. The solution of this problem is to have more equitable distribution if energy resources . The rich countries will have to lower down their consumption levels while the minimum needs of the poor have to be fulfilled by providing them resources. A fairer sharing of the resources will narrow down the gap between the rich and the poor and will lead to sustainable development for all.

Biogas uses : Case Study: It is estimated that one ton of organic wastes can yield 120 cubic meter of bio- methane. This can in turn create 200kw of electricity. China is currently the largest biogas producer harvesting 6 billion Nm3 of bio-methane per year. The potential of biogas continues to grow. More than one trillion Nm3 of bio-methane could be harvested considering the amount of agricultural by- products and domestic waste created. This in turn can cover a quarter of worlds current natural gas consumption and 6% of global demand of energy.

So, we should invest more and more in harvesting biogas in our country too as we have abundance of agricultural by- products as well as domestic wastes in our country. This could lead to a pollution free sustainable development.

Solar energy uses : A country like India which falls in tropical region of the earth has enough sun shine throughout the year to be used to produce solar energy for sustainable use. In summer we have sun shine for 10 to 12 hours , 8 to 10 hours in winter , which is enough to harvest huge amount of energy throughout the country. Advance technology should be employed to cut down the cost of production of solar panels and its installation.

Countries like USA are using more & more solar energy in houses as well as office buildings, public halls etc thus by cutting down the pollution levels & electricity costs contributing towards sustainable energy uses.

Case Study : In Bavaria , Germany one family of five installed a solar energy system with batteries. The whole system included a SMA pv inverter , a SMA battery inverter and a SMA sunny home manager for system monitoring and energy management thus by cutting electricity cost by 875 Euro per year.

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RADIATION

Bikram Chetry, B.Sc. 1st semester, Physics Honours

What is Radiation?

Radiation can be described as energy or particles from a source that travels through space or other mediums. Light, heat, microwaves and wireless communications are all forms of radiation. This includes the following:

- *Particle Radiation*: such as alpha radiation (α), beta. radiation (β), and neutron radiation.
- *Gravitational Radiation*: such as radiation that takes the form of gravitational waves, or ripples in the curvature of space-time.
- *Acoustic Radiation*: such as ultrasound, sound, and seismic waves.
- *Electromagnetic radiation*: such as radio waves, visible light, x-rays, and gamma radiation (ϒ).

Types of Radiation:

Radiation is often categorized into two types depending on the energy of the radiated particles.

- *Ionizing Radiation* - Ionizing radiation carries more than 10 eV, which is enough to ionize atoms and molecules and break chemical bonds. The ionizing radiation consists of alpha particles, beta particles, and gamma rays.
- *Non-ionizing Radiation* - Ionization is not caused by these radiations. They usually emit heat, which can sometimes be so intense as to result in burn Visible light and infrared radiation are examples of non-ionizing radiation that may be seen by humans.

What is Nuclear Radiation?

Nuclear radiation is an energy that is released by elementary particles of the atomic nucleus that are caused by the process of nuclear decay. According to the International Atomic Energy Agency, nuclear radiation can cause consequences to nature, human life and facility significantly. However, nuclear radiation could be both beneficial and harmful depending upon its utilization.

Types of Nuclear Radiation:

There are three types of nuclear radiation emitted from radioactive atoms:

- Alpha Radiation
- Beta Radiation
- Gamma Radiation

Alpha Radiation:

Alpha radiation is a heavy and very short-range particle. It is actually an ejected helium nucleus. Alpha radiation is another name for the alpha particles emitted in the type of radioactive decay called alpha decay. Alpha particles are helium-4 (He) nuclei.

Beta Radiation:

They are classified into two categories: Beta-minus (β^-) and Beta-plus (β^+).The Beta-minus radiation consists of an energetic electron. It is more penetrating than alpha radiation but less than gamma. While, the Beta plus radiation is the emission of positrons, which are the antimatter form of electrons.

Gamma Radiation:

The Gamma rays or Gamma radiation consists of photo with a wavelength less than 3×10^{-11} meters. The emission is a nuclear process that occurs to rid an unstable nucleus of excess energy after most nuclear reactions.

Radiation Pressure:

It is the pressure exerted by the electromagnetic radiation on the surface. It is defined as the mechanical pressure applied upon any surface due to the exchange of momentum between the object and the electromagnetic field. Radiation pressure on any surface depends on the nature of the surface and intensity of light used.

Radiation Pressure is given by the formula,

$P_R = (1+\alpha)\, I / c$

where α is the coefficient of reflection of the surface.

For a completely reflecting surface, $\alpha = 1$.

For a completely reflecting surface, $\alpha = 0$.

The radiation pressure is independent of the wavelength of incident light and depends on the nature of the surface on which light falls.

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SOLAR ENERGY

Roshan Subedi, B.Sc. 1st semester, Physics Honours

The Sun is one of the major renewable energy sources. The radiating light and heat from the sun are harnessed and converted into other forms of energy. In this article, let us learn about solar energy in detail.

What Is Solar Energy?

Solar energy is defined as the transformation of energy that is present in the sun and is one of the renewable energies. Once the sunlight passes through the earth's atmosphere, most of it is in the form of visible light and infrared radiation. Plants use it to convert into sugar and starches; this conversion process is known as photosynthesis. Solar cell panels are used to convert this energy into electricity.

Solar Energy Advantages and Disadvantages

Advantages of solar energy are:

- *Clean*: It is considered to be the cleanest form of energy as there is no carbon dioxide emission like in the case of fossil fuels which is one of the causes of global warming.
- *Renewable*: There is ample energy available on earth as long as the sun exists.
- *Reliable*: The energy can be stored in the batteries, so there is no unreliability.
- reduction in utility costs.
- Free energy because it can be trapped easily.

Disadvantages of solar energy:

- The production is low during winters and on cloudy days.
- Installation and the initial cost of the materials are expensive.
- Space consumption is more.

Solar Energy Project:

Solar energy - the experiment on the efficiency of the solar heating working model is one of the easiest science experiments that you can prepare for your school fair science project. This working model is quick, simple and very informative.

The result may vary if the project is performed outdoors due to the wind and weather conditions, so it is recommended to conduct the experiment indoors.

In this solar heater project, reflectors concentrate the solar energy in one small place to collect and store heat energy. In this experiment, you will see the efficiency of solar energy.

Uses Of Solar Energy:

- *Water heating*: Solar energy is used to replace electric heaters and gas as efficiency is more with 15-30%.
- *Heating of swimming pools*: Solar blankets are used to keep the pool warm. The other way is by using a solar water heater to keep the water warm.
- *Cooking purposes*: Solar cookers are used for cooking food. Solar energy is used to heat, cook and pasteurize food. A solar cooker consists of an elevated heat sink such that when food is placed in it, it gets cooked well.

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DARK MATTER AND DARK ENERGY: BEYOND VISIBLE UNIVERSE

Abhijit Barman, B.Sc. 3rd semester, Physics Honours

The visible universe-including Earth, the sun, stars and galaxies- is made up of protons, neutron & electrons bundled together into atoms. Perhaps one of the most surprising discoveries of the 20th century was that this ordinary or baryonic matter makes only 5% of total universe. The rest appears to be made of a mysterious, invisible substance and a force that repels gravity.

In the early '90s, one thing was fairly certain about the expansion of the universe .It might have enough energy density to stop its expansion and re-collapse or might have so little energy density that it would never stop expanding, but gravity was certain to slow the expansion as time went on. Though the slowing had not been observed, but, theoretically it had to slow .However in 1998, the Hubble Space Telescope observations of very distant supernovae showed that, a long time ago the universe was expanding more slowly than it is today .So the expansion of the universe has not been slowing due to gravity as expected .No one expected this, no one knew how to explain it.

Eventually theorists came up with many sort of explanations .Theorists still don't know which is the correct explanation but they have given the solution a name .It is called dark energy .

What is dark energy?

More is unknown than is known .We know how much dark energy there is because we know how it affects the universe's expansion .Other than that, it is a complete mystery but it's important to know about them .It turns out that roughly 68% of the universe is dark energy .Dark matter makes up about 27% .Remaining less than 5% of universe is visible to us, a very small fraction.

One explanation for dark energy is that it is a property of space. Einstein was the first person to realize that empty space is not "nothing". Space has amazing properties, many of which are just beginning to be understood. The first property that Einstein discovered is that it is possible for more space to come into existence .Then one version of Einstein's gravity theory , the version that contains a cosmological constant ,makes a 2nd prediction : "empty space" can possess its own energy .Because this energy is a property of space itself ,it would not be diluted as space expands .As more space comes into existence ,more of this energy-of-space would appear .As a result ,this form of energy would cause the universe to expand faster and faster .Unfortunately ,no one understands why the cosmological constant should even be there ,much less why it would have exactly the right value to cause the observed acceleration of the universe .

Another explanation for how space acquires energy comes from the quantum theory .In this theory "empty space" is actually full of temporary particles that continually form and then disappear .But when physicist tried to calculate how much energy this would give empty space the answer came out wrong, wrong by a lot .The number came out 10^{120} times big, hard to get an answer that bad. So the mystery continues.

The thing that is needed to decide between dark energy possibilities - a property of space, a new dynamic fluid, or a new theory of gravity - is more data, better data.

What is dark matter?

We are much more certain what dark matter is not than we are what it is .First it is dark, meaning that it is not in the form of stars and planets that we see .Observations show that there is far too little visible matter in the universe to make up the 27% required by the observations .Second ,it is not in the form of dark clouds of normal matter ,matter made up of particles called baryons .We know this because we would be able to detect baryonic clouds by their absorption of radiation passing through them .Third ,dark matter is not anti-matter ,because we do not see the unique gamma rays that are produced when anti matter annihilates with matter. Finally, we can rule out large galaxy –sized black holes on the basis of how many gravitational lenses we see .High concentration of matter bend light passing near them from objects further away ,but we do not see enough lensing events to suggest that such objects to make up the required 25% dark matter contribution .

Recent discoveries:

- **April 23, 2022 :** *Hubble spies a tenuous diffuse galaxy*
- **June 17, 2021 :** *Mystery of galaxy's missing dark matters deepens*
- **November 26, 2020:** *New Hubble data explains missing dark matter in 1052-DF4*
- **September 21, 2020:** *Dark matter surplus (NGC 5585)*
- **September 10, 2020:** *Hubble data suggests there is an ingredient missing from current dark matter theories*
- **January 8, 2020:** *Hubble detects smallest known dark matter clumps*

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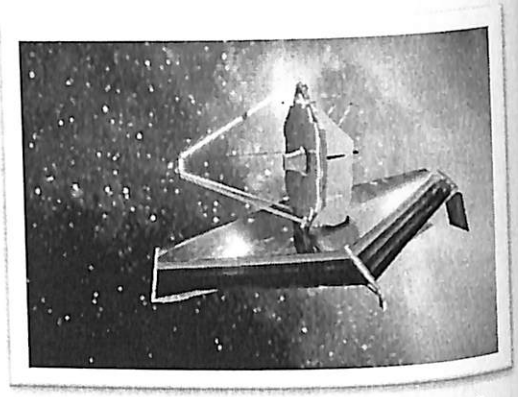
JAMES WEBB SPACE TELESCOPE

Jackson Narzary, B.Sc. 3rd semester, Physics Honours



James Webb space telescope is the largest optical telescope ever sent by the humans to the space. It conducts infrared astronomy. It is the scientific successor of the Hubble Space telescope. It is kept at Sun-Earth L2 Lagrange point on the space. The primary objectives of James Webb Space telescope is to figure out the formation of first stars and galaxies in the early universe: the chemical, morphological and dynamical buildups of galaxies and the formation of stars and planetary systems. Also, to inspect the existence of dark energy, dark matter, active galactic nuclei, Exoplanet and solar systems objects. Altogether, James Webb space telescope is launched to understand the universe in a more precise way.

We Humans are very curious to know more about the working systems of surroundings. We are eager to unveil the underlying mystery behind the creation of Universe and its heavenly bodies. Our ancestors were no different. They were enticed by the sparkling stars on the night sky. They were desperate to know more about the stars with practical evidences rather than just believing the manly produced theories (mostly superstitions). Many theories were made about the creation and about what lies at the center of the universe to quench the thirst to know more about the universe. However, those theories were never sufficient to describe the universe as a whole. The thirst to look the Heavenly bodies more closely wasn't quenched until Galileo invented an instrument to peer into the deep space. Galileo in the year 1609 discovered a telescope to see the heavenly bodies. When Galileo pointed his telescope towards the planet Jupiter, he found that Jupiter was accompanied by several small satellites or moons that orbits around it. This implied that everything did not have to orbit directly around the Earth and Earth is not the center of the universe (as Earth was presumed to be the center of the universe previously). Eversince then humans have developed the telescope in a better and better way and peer into the space. Rather than just peering into the space from the ground level, humans have also sent many telescopes to the space. Some of them are: Spacelab Infrared Telescope, Infrared Space Observatory and Hubble space telescope. The data provided by every telescope sent to the space is new to us. Human enthusiasm towards the space and heavenly bodies doesn't ends here.

To understand the space and its heavenly bodies more precisely NASA (National Aeronautics and Space Administration) on 25 December 2021 launched a telescope to the space named James Webb Space Telescope on Ariane 5 Rocket from Kourou, French Guiana. JWST(James Webb Space Telescope) has four key goals: To search for light from the first stars and galaxies that formed in the universe after the Big Bang, To study galaxy formation, To understand star formation and planet formation, To study planetary systems and the origins of life. Its high resolution and sensitivity allow it to view objects too old, distant or faint to previously launched other telescopes such as the Hubble Space Telescope. NASA(National Aeronautics and Space Administration) led JWST(James Webb Space Telescope) design and partnered with two space agency: The European Space Agency(ESA) and Canadian Space Agency(CSA).The telescope is named after James E. Webb who was the

administrator of NASA from 1961 to 1968 during the Mercury, Gemini and Apollo programs.

The JWST(James Webb Space Telescope) has a mass that is about half of the mass of its predecessor Hubble Space Telescope. JWST(James Webb Space Telescope) has 6.5 meter(21ft) diameter gold coated beryllium primary mirror made up of 18 separate hexagonal mirrors. The mirror has a polished area of 26.3 m^2(283 sq ft) of which 0.9 m^2(9.7 sq ft) is obscured by the secondary support struts, giving a total collecting area of 25.4m^2(273 sq ft). The gold coated on the mirror is to provide infrared reflectivity and this is covered by a thin layer of glass for durability. JWST(James Webb Space Telescope) is designed mainly to deal with near infrared astronomy. But it can also see orange and red visible light rays as well as mid-infrared region. It can detect objects upto 100 times fainter than Hubble can, and objects much earlier in the history of the universe , back to Redshift z=20(about 180 million years cosmic time after the Big Bang).The earliest stars are thought to have formed between z=30 to z=20(100-180 million years cosmic time), and the first galaxies may have formed around Redshift z=15 (about 270 million years cosmic time).Hubble is unable to see further back than very early reionization at about z=11.1 (galaxy GN-z11,400 million years cosmic time).Because of its ability to look back that far in time JWST is being called the Time Machine of 21th century. There are number of reasons why the design of JWST is emphasized near to infrared. Some of them are:

- High Redshift (very early and distant) objects have their visible emission shifted into the infrared and therefore their light can be observed today only via infrared astronomy.
- Infrared light passes more easily through dust clouds than visible light.
- Colder objects such as debris disc and planets emit most strongly in the infrared.
- These infrared bands are difficult to study from the ground or by existing space telescopes such as Hubble.

JWST (James Webb Space Telescope) operates in a Halo orbits, circling around a point in space known as the sun-Earth L2 Lagrange point which is approximately 1500000 km beyond Earth's orbit around the sun. Its actual position varies between about 250000 km to 832000 km from L2 as it orbits, keeping it out of both Earth's and Moon's shadow. Objects near this Sun-Earth L2 point can orbit the sun in synchrony with the Earth , allowing the Telescope to remain at a roughly constant distance with continuous orientation of its unique sunshield and equipment bus(primary support element of JWST(James Webb Space Telescope), hosting multitude of computing ,communication, propulsion and structural components),towards the sun ,Earth and Moon. Combined with its wide shadow avoiding orbit, the telescope can simultaneously block incoming heat and light from all three of these bodies and avoid even the smallest change of temperature from Earth and Moon shadow that would affect the structure, yet still maintain uninterrupted solar power and Earth communications on its sun facing side. This arrangement keeps the temperature of the spacecraft constant and below 50 K(-223 C) necessary for faint infrared observation.

JWST (James Webb Space Telescope) will function for the upcoming 10 years. It is expected that within this 10 years our understanding of the space along with its way of functioning would be better than now. NASA released the first five infrared images taken by James Webb Space telescope on July 11, 2022. The level of details images carried has surpassed the expectation. The images carries news about the early universe, the birth and death of stars,

the collision of galaxies and the atmosphere of exoplanet. In future, the data and information provided by JWST(James Webb Space Telescope) would enable us to ensure many unproven ideas and theories of astronomy.

"When you look at the stars and the galaxy, you feel that you are not just from any particular piece of land, but from the Solar System.

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ALPHA DECAY

Gwmshart Basumatary, B.Sc. 1st semester, Physics Honours

INTRODUCTION

Alpha decay is a nuclear decay process where an unstable nucleus changes to another element by shooting out a particle composed of two protons and two neutrons. This ejected particle is known as an alpha particle. Ernest Rutherford distinguished alpha decay from other forms of radiation by studying the deflection of the radiation through a magnetic field. The deflection of alpha decay would be a positive charge as the particles have a +2e charge. In this article, you will study alpha decay in detail.

In alpha decay, the nucleus emits an alpha particle or a helium nucleus. Alpha decay occurs in massive nuclei that have a large proton to neutron ratio. Alpha radiation minimizes the protons to neutrons ratio in the parent nucleus, thereby bringing it to a more stable configuration. As an example, let us consider the decay of ^{210}Po by the emission of an alpha particle.

Polonium nucleus has 84 protons and 126 neutrons, therefore the proton to neutron ratio is Z/N = 84/126, or 0.667. On the other hand, ^{210}Pb nucleus has 82 protons and 124 neutrons, thereby resulting in a ratio of 82/124, or 0.661. This small change in the Z/N ratio is enough to put the nucleus into a more stable state (into the region of stable nuclei in the Chart of the Nuclides.)

Gamow Theory of Alpha Decay

The Geiger–Nuttall law or Geiger–Nuttall rule relates to the decay constant of a radioactive isotope with the energy of the alpha particles emitted. This relation also states that half-lives are exponentially dependent on decay energy, so that very large changes in half-life make comparatively small differences in decay energy, and thus alpha particle energy.

As per this rule, short-lived isotopes emit more energetic alpha particles than long-lived ones. This law was stated by Hans Geiger and John Mitchell Nuttall in the year 1911, hence the name was dedicated to these physicists.

Alpha Decay Equation

In α-decay, the mass number of the product nucleus (daughter nucleus) is four less than that of the decaying nucleus (parent nucleus), while the atomic number decreases by two

Use of Alpha Decay:

Americium-241, an alpha emitter, is used in smoke detectors. The alpha particles ionize air in an open ion chamber and a small current flows through the ionized air. Smoke particles from the fire that enter the chamber reduce the current, triggering the smoke detector's alarm.

Radium-223 is also an alpha emitter. It is used in the treatment of skeletal metastases (cancers in the bones).

Alpha decay can provide a safe power source for radioisotope thermoelectric generators used for space probes[6] and were used for artificial heart pacemakers.[7] Alpha decay is much more easily shielded against than other forms of radioactive decay.

Static eliminators typically use polonium-210, an alpha emitter, to ionize the air, allowing the 'static cling' to dissipate more rapidly.

CONCLUSION

Rutherford's α-particle scattering experiment gives the experimental evidence for deriving the conclusion that most of the space inside the atom is empty. The atomic number increase caused by two beta decays is the same as the decrease caused by one ALPHA DECAY.

REFFERENCE

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Physics Quiz

Radhe Shyam Das, BSc 1st semester, Physics Honours

1. How many Indian astronauts have been selected for India's first human space mission?
   (A) Two (B) Three (C) Four (D) Five
   Ans. (C) Four
2. Which country has unveiled it's first artificial intelligence (AI) Police officer Ella?
   (A) Japan (B) Singapore (C) New Zealand (D) Saudi Arabia
   Ans. (C) New Zealand
3. When is Earth Day Observed?
   (A) 20 March (B) 22 April (C) 5 June (D) 24 September
   Ans.(B) 22 April
4. Who is called the father of Earth day?
   (A) Gaylord Nelson (B) Vandana Shiva (C) Wangari Maathai (D) Mark Boyle
   Ans. Gaylord Nelson
5. Which of the following part of the sun is visible to human?
   (A) Photosphere (B) Corona (C) Chromospheres (D) Core
   Ans. (A) Photo sphere
6. Which is the deepest point from the sea level on the Earth?
   (A) North channel (B) Pacific Ocean (C) Mariana Trench (D) Red sea
   Ans. (C) Mariana Trench
7. Which planet in the solar system has the highest density?
   (A)Earth (B) Uranus (C) Neptune (D) Jupiter
   Ans. (A)Earth.
8. Which global Tele-communication company's arm has recently launched a new privacy focused search engine called "one search"?
   (A) AT&T (B) Verizon (C) Vodafone (D) China mobile
   Ans. (B) Verizon
9. What is the name of the humanoid robot, which was recently unveiled by the Indian space research organisation (ISRO)?
   (A) Gagan Mitra (B) Vyom Mitra (C) Vayu Mitra (D) Human Mitra
   Ans. (B) Vyom Mitra

SOLAR ENERGY

Amardeep Basumatary, BSc 5th semester, Physics Honours

ABSTRACT

Solar energy is inexhaustible, freely available and clean source of energy generation. The solar PV system generates variable output, its operation depends upon the solar irradiance. Solar power is the Earth's most important source of energy. It is responsible for the biomass on the Earth and the fossil fuels within it, as well for driving the weather systems responsible for rain and wind. The Sun can be used to generate electricity in two ways, either by using its heat as a heat source, or by utilizing its light in a solar cell. Solar power is an intermittent source of energy and cannot alone provide a continuous source of electrical power. The development of both solar cells and solar thermal power generation can be traced back to the 19th century. At the end of 2014 there were close to 180 GW of solar generating capacity around the world. Solar energy is the transformation of heat, the energy that comes from the sun. It has been used for thousands of years in many different ways by people all over the world. The oldest uses of solar energy are for heating, cooking, and drying. Today, it is also used to make electricity where other power supplies are not there, such as in places far away from where people live, and in outer space. It is becoming cheaper to make electricity from solar energy. Because the Sun always gives heat and light, solar energy can be considered a renewable energy and an alternative to non-renewable resources like coal and oil.

KEYWORDS: Solar energy, renewable energy sources, nuclear fusion, Photo voltaic panels.

INTRODUCTION:

The large usage of the fossil fuels, like the oil, the gas and the coal, results in greenhouse effect and pollutes the atmosphere. Meanwhile, there is a huge conflict between the fossil fuels supply and the global energy demand leading to a hike oil price in the market. The energy shortage and the atmosphere pollution have been the major limitations for the human development. In order to meet the rising global energy demand from environmental friendly sources, various renewable energy are given attention . From , all the renewable energy sources , solar energy is the most rapidly increasing renewable energy source because it is inexhaustible, freely available and clean source of energy generation.The power obtained from solar energy are connected to the grid for better utilization of solar power.

THE SOLAR RESOURCE:

Solar energy is generated by nuclear fusion reactions within the Sun. The energy that radiates from the Sun is a mixture of ultraviolet, visible, and infrared radiation. The intensity of this radiation when it reaches the Earth is 1361 power plants can only utilize direct radiation from the Sun, but solar cells, like plants, can absorb both direct and scattered, diffuse radiation. The distribution of solar energy across the globe is not even, and some regions have much higher insolation levels than others. These might become major sources of solar generated electricity in the future.

ENERGY USES:

Solar energy is used today in a number of ways:

- As heat for making hot water, heating buildings and cooking
- To generate electricity with solar cells or heat engines

- To take the salt away from sea water.
- To use sun rays for drying clothes and towels.
- It is used by plants for the process of photosynthesis.
- To use in cooking (Solar cookers).

ENERGY FROM THE SUN:

After passing through the Earth's atmosphere, most of the Sun's energy is in the form of visible light and infrared light radiation. Plants convert the energy in sunlight into chemical energy (sugars and starches) through the process of photosynthesis. Humans regularly use this store of energy in various ways, as when they burn wood off fossil fuels, or when simply eating plants, fish and animals.

Solar radiation reaches the Earth's upper atmosphere with the power of 1366 watts per square meter (W/m2). Since the Earth is round, the surface nearer its poles is angled away from the Sun and receives much less solar energy than the surface nearer the equator.

At present, solar cell panels convert, at best, about 15% of the sunlight hitting them into electricity. The dark disks in the third diagram on the right are imaginary examples of the amount of land that, if covered with 8% efficient solar panels, would produce slightly more energy in the form of electricity than the world needed in 2003.

TYPES OF TECHNOLOGIES:

Many technologies have been developed to make use of solar radiation. Some of these technologies make direct use of the solar energy (e.g. to provide light, heat, etc.), while others produce electricity.

- Solar power plants

Solar power plants convert sunlight into electricity, either directly using photovoltaics(PV), or indirectly using concentrated solar power (CSP). Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. Photovoltaics converts light into electric current using the photoelectric effect.

- Solar panel

Solar panels get energy from the sun for people to use. There are two types of solar panels, those that collect heat (thermal), and those that produce electricity (photovoltaic). Heat from solar panels is often used for space heating and for hot water.

Solar panels collect renewable energy. In the 20th century some used the heat of the sun to make steam for a steam engine to turn a generator. Nowadays producing electricity from the sun's light is cheaper. This is a solid state way of producing electricity, meaning that it has no moving parts.

Home solar panels are often mounted on rooftops. Commercial or industrial installations are often on trackers mounted on the ground. The trackers point the panel towards the sun as the sun moves across the sky. Photovoltaic panels are also commonly used in outer space, where they are one of the few power sources available.

- Photovoltaic

Photovoltaics (PVs) are arrays of cells containing a solar photovoltaic material that converts solar radiation or energy from the sun into direct current electricity. Due to the growing demand for renewable energy sources, the manufacturing of solar cells and photovoltaic arrays has advanced considerably in recent years, and costs have dropped.

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PHYSICS IS EASY

Debika Choudhury, Bsc 5th semester, Physics Honours

Every Formula has dimension,
Just Do Some Calculation,
Work With Full Devotion,
You Will Get The Solution.

Each Liquid Has The Surface Tension,
Everything Has A Motion,
Newton Said, "It Has Duration",
So, Force Equals To Mass. Acceleration.

Frictional Force Is Between Road And Tire,
Generator Contains Copper Wire,
Light Consists Of Dual Pair,
So, E Equals To M.C Square.

Every One Is Doing Activity,
With Acertain Velocity,
Force Acting On It Is Gravity,
Due To Which We Are Producing Electricity.
Physics Is Very Easy,
Study It Just Like A Crazy.

COSMIC RAYS: PARTICLES FROM OUTER SPACE

Rupjyoti Das, B. Sc 3rd Semester, Physics Honours

We may think that the greatest, most perplexing mysteries of the universe exist way out there, at the edge of a black hole, or inside an exploding star. But , great mysteries of the universe surround us all the time .They even permeate us, sailing straight through our bodies. One such mystery is cosmic rays, made of tiny bits of atoms. These rays are not harmful to us or any other life on the surface of the earth.

"Studies of cosmic rays opened the door to a world of particles beyond the confines of the atom: The first particle of anti matter, the positron was discovered in 1932, the muon in 1937, followed by the pion, the kaon and several more. Until the advent of high energy particle accelerators in the early 1950s, this natural radiation provided the only way to investigate the growing particle zoo".

The energies of the primary cosmic rays range from around 1 GeV-the energy of a relatively small particle accelerator-to as much as 10^8 TeV, far higher than the beam energy of the large hadron collider. The rate at which this particles arrive at the top of the atmosphere falls off with increasing energy, from about 10,000 per square meter at 1GeV to less than 1 per square kilometer per century for the highest energy particles. The very high energy cosmic rays generate huge showers of upto 10 billion secondary particles or more, which can be picked up by particle detectors when they are spread over areas as large as 20 square kilometer on the surface of the earth.

COSMIC ACCELERATORS

The lowest energy cosmic rays arrive from the sun in a stream of charged particles known as the solar wind, but pinning down the origin of the higher energy particles is made difficult as they twist and turn in the magnetic fields of interstellar space.

Clues have come through studying high energy gamma rays from outer space. These are far fewer than the charge cosmic rays, but being electrically neutral they are not influence by magnetic fields. They generate showers of secondary particles that can be detected on earth and that point back towards the point of origin of the gamma rays. Sources of the highest energy gamma rays in our own galaxy, the milky way, include the remnants of supernovae, such as the crab nebula; the shock waves from these stellar explosions have long beam proposed as possible natural accelerators. Others sources of ultra high energy gamma rays lie in other galaxies, where exotic objects such as super massive black holes may drive the acceleration. There is also evidence that the highest energy charged cosmic rays also have similar origins in other galaxies.

CERN'S CLOUD EXPERIMENT

The cosmic leaving outdoor droplets (CLOUD) experiment uses a special cloud chamber to study the possible link between galactic cosmic rays and cloud formation. Based on proton synchrotron at CERN, this is the first time a high energy physics accelerator has been used to study atmospheric and climate science.

In 2014 CERN's CLOUD experiment made a huge discovery when it showed that biogenic vapours emitted by trees and oxidized in the atmosphere have a significant impact on the formation of clouds, thus helping to cool the planet.

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THE LARGE HADRON COLLIDER

Prejen Iswary, B. Sc. 3rd Semester, Physics Honours

The Large Hadron Collider (LHC) is the world's largest and most powerful particle accelerator. It consists of a 27 km ring superconducting magnets with a number of accelerating structures to boost the energy of the particles along the way

Inside the accelerator, two high-energy particle beams travel at close to the speed of light before they are made to collide. The beams travel in opposite directions in separate beam pipes – two tubes kept at ultra high vacuum . they are guided around the accelerator ring by a strong magnetic field maintained by superconducting electro magnets. The electromagnets are built from coils of special electric cable that operates in a superconducting state, efficiently conducting electricity without resistance or lose of energy. This requires chilling the magnet to -271.3 degree Celcius , a temperature colder than outer space. For this reason, much of the accelerator is connected to a distribution system of liquid helium, which cools the magnets, as well as to other supply services.

Thousands of magnets of different varieties and sizes are used to direct the beams around the accelerator. This includes 1 232 dipole magnets, 15 metres in length, which bend the beams , and 392 quadrupole magnets , each 5 to 7 metres long, which focus the beams. Just prior to collisions , another type of magnet is used to "squeeze" the particles closer together to increase the chances of collisions. The particle are so tiny that the task of making them collide is akin to firing two needles 10 km apart with such precision that they meet halfway.

All the controls for the accelerator, its service and technical infrastructure are housed under one roof at the CERN control centre. From here, the beams inside the large hadron collider are made to collide at four locations around the accelerator ring, corresponding to the positions of four particle detectors- ATLAS, CMS, ALICE and LHCb.

Abbreviations :

CERN : Conseil Europeen la Recherche Nucleaire (European organization for nuclear research)

ATLAS: A Toroidal LHC Apparatus

ALICE: A Large Ion Collider Experiment

CMS: Compact Muon Solenoid

LHCb: Large Hadron Collider beauty

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THE BEAUTY OF PROGRAMMING LANGUAGE: PYTHON

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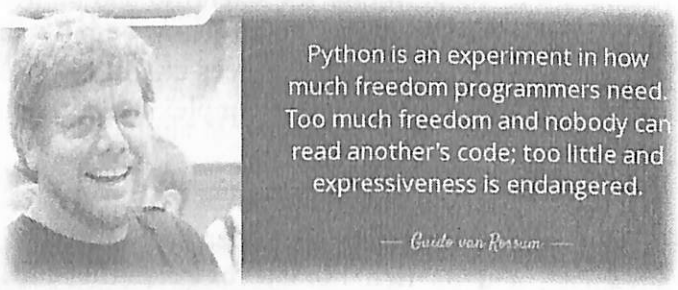
Abstract

This article discusses the various direction and fields of applications of python. The python programming language being a powerful, simple and user friendly language, it is employed in the scientific and numerical analysis, software development, business, audio or video based, web, image processing, big data analysis, machine learning, Internet of Things (IOT), computer vision, Artificial Intelligent, Graphical User Interface (GUI) design, robotics etc.

Keywords: python, programming language, application of python

Introduction



To share ideas, knowledge, opinions etc. we use the language as the communication tool. Computer is an electronic device i.e. a machine that understands only binary digits- zero and one. It does not understand the human language. So to communicate with the computer we need the language called computer programming language. The programming language is nothing but a set of instructions or commands developed by the programmer (man who writes computer programme) for the computer. Programming language may be low level and high level. Low level programming language is machined oriented (0s and 1s) i.e. it is only understand by the computer. High level programming language is user friendly and developed by human (programmer) and with the help of translator called interpreter, this language is made understandable to machine. There are different high level computer languages such as C, C++, Java, FORTRAN, Python etc. Python is popular, powerful, widely used high level programming language initially designed by Guido Van Rossum. He started this programming as his hobby project during the period of Christmas. Python was first released in 1991 under Python software Foundation. In this article, various emerging applications will be discussed.

Methodology

The secondary sources are used for collecting information.

Discussion

Python is a free software that can be downloaded and can be installed from https://www.python.org. The various fields where python programming language can be seen as programming language are discussed below-

Web Development:

The work associated with designing, creating and maintaining websites for hosting via internet or intranet is the web development. The huge library of python frameworks such as bottle.py, CherryPy, Pyramid, Django Web2py etc. are used for the web page designing. The world's most popular websites such as Spotify, Mozilla, Reddit and Yelp are develop using python.

Desktop Graphical User Interface (GUI) Development:

GUI provides the interface drawn on the screen which can interact with the users. The libraries that provides for GUI applications includes Tkinter, PyQt, Kivy.

Software Development

Python is being open source software, it is seen use as support language by software developers for build control, management, testing etc. The python libraries such as SCons is used for build control , Buildbot and Apache Gump for automated continuous compilation and Roundup or Tract is used for bug tracking and project management

Scientific and Numeric

Python offers huge library for scientific and numerical analysis. The python packets such as Pandas, Matplotlib, Scipy, Scikit-learn, Numpy can be used for analysis of complex data, drawing graphs, generating matrices etc. In Physics, these libraries are seen used in quantum mechanics, statistical analysis, complex network analysis etc.

Data Science

Python syntax are easy to understand compare to under programming language. This advantage and its rich library for scientific and numeric analysis, now a days, the data analysers are widely using python language for analysis of big and complex data.

There are many other areas where python is used widely. These areas are machine learning, Internet of Things, Computer Vision etc.

Conclusion

There are many advantages of using python.Python uses the elegant syntax hence programs becomes easy to understand, offers large library, the programs written in other languages can be implemented in python, coding can be done anywhere-windows, Mac OSX, UNIX, LINUX and this software is a free one.

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BLACK HOLE- A MASSIVE GRAVITY

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A black hole is a region of spacetime where gravity is so strong that nothing – no particles or even electromagnetic radiation such as light – can escape from it. The theory of general relativity predicts that a sufficiently compact mass can deform spacetime to form a black hole. The boundary of no escape is called the event horizon. Although it has a great effect on the fate and circumstances of an object crossing it, it has no locally detectable features according to general relativity.

Objects whose gravitational fields are too strong for light to escape were first considered in the 18th century by John Michell and Pierre-Simon Laplace. In 1916, Karl Schwarzschild found the first modern solution of general relativity that would characterize a black hole. The first black hole known was Cygnus X-1, identified by several researchers independently in 1971. Black holes of stellar mass form when massive stars collapse at the end of their life cycle. Supermassive black holes of millions of solar masses ($M_\odot$) may form by absorbing other stars and merging with other black holes. There is consensus that supermassive black holes exist in the centres of most galaxies. The first direct image of a black hole and its vicinity was published, following observations made by the Event Horizon Telescope (EHT) in 2017 of the supermassive black hole in Messier 87's galactic centre.

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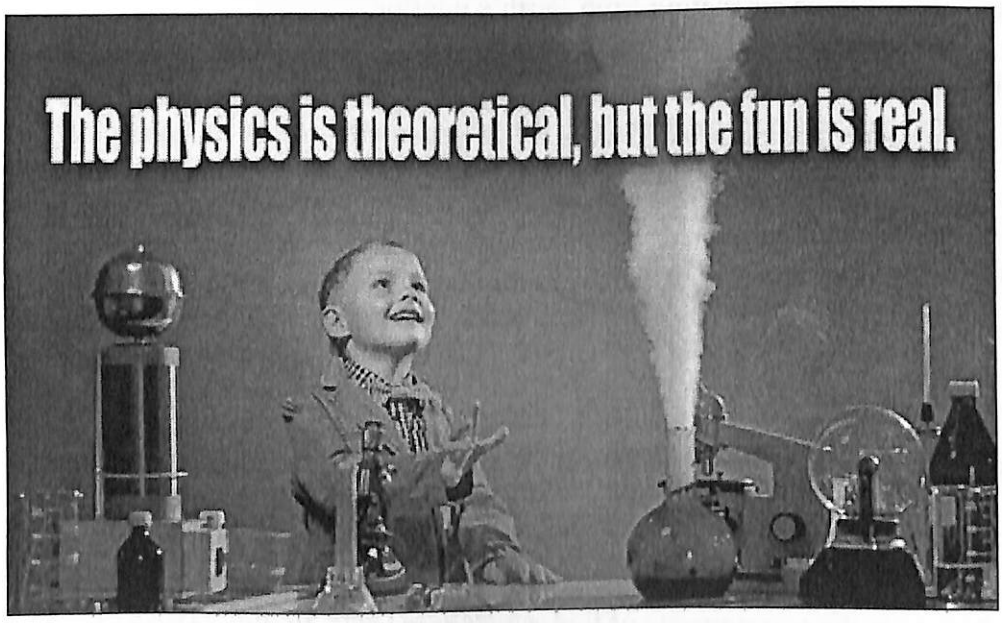

PLATE TECTONICS AND THE EARTHQUAKE

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

Our planet Earth is broadly divided into 3 parts- Crust, Mantle and Core depending on the properties of material present at different parts. Mantle plays an important role in the evaluation. Core is with two parts – inner core (solid state) and outer core (liquid state). The core is made up of heavy materials-mostly Nickel and Iron. The liquid iron core creates a magnetic field as the fluid flows around the solid core and interact with the Earth`s existing magnetic field and this process generates a dynamic energy condition that maintain the earth`s magnetic property.

Mental is the most voluminous portion of the earth interior.it occupies about 83% of the Earth`s volume. It extends from Moho`s discontinuity to depth 2900 km. Moho`s discontinuity separates the crust from the mantle. It`s density is higher than the crust The upper portion of mantle is asthenosphere. Mental is the chief source of Magma and it comes out at the time of volcano eruptions. There is temperature difference between the upper mantle and lower mantle. Lower mantle (about 2800^0C) is hotter than upper mantle (1800^0C).The plasticity of the upper mantle is the main cause of the movement of the plates. This part is highly malleable and forms the new landform with the movement of the plates. The convective movement inside the mantle is believed as the driving force behind the Plate Tectonics movement. Crust is the outermost part of the earth and it is solid state.

Crust and uppermost solid mantle is the Lithosphere. It is bounded by the atmosphere above and astheno sphere lower. Plate Tectonics are the parts of the Lithosphere which move due to the internal force emanating from Earth`s interior.

There are 7 major Tectonics plates and some minor plates. The major tectonic plates are –

1.Antarctic and surrounding oceanic plate.

2.North American plate.

3.South American plate.

4.Pacific plate.

5. India –Australia- New Zealand plate.

6.African with eastern Atlantic floor plate.

7. European and adjacent oceanic plate.

At plate boundaries the plates interacts with each other and Earthquakes, Volcanism, Mid oceanic Ridge are the consequence of this interaction.There are three types of plate boundaries - *Divergent plate boundaries*, *Convergent plate boundaries* and *Transform plate boundaries*.

Divergent plate boundaries: In this case the plates move away from each other forming a gap and this gap is filled up with Magma from the mantle causing volcanism and new crust is formed so, this type of boundaries is known as constructive boundaries. Frequent earthquake strike along the rift. Beneath the rift, Magma – molten rock rises.

Convergent plate boundaries: Here the plates move towards each other and causes collision and subduction of heavy plates under the lighter plate. These are destructive plate

boundaries. Oceanic crust is denser than the continental crust. Powerful earthquake shake a wide area. Tsunami is one example of this type of interaction.

Transform plate boundaries: Here the plates slide each other. The two plates are in contact along the vertical fracture. In this case no construction or destruction. Example: San Andreas Fault along eastern coast of Pacific Ocean.

The relative movement of the plates ranges fro 0 to 100mm annually.

Plate Tectonic Theory (movement of the Earth`s land masses) was first proposed by Alfred Wegner.

Earthquake is the shaking of the lithosphere and it is due to the energy release caused for the transient disturbance of the elastic or gravitational equilibrium of the rock at or under the surface of the earth. This energy moves as a wave in different direction and produce shakings.

Conclusion: Plate Tectonic Theory helps to understand the geography and formation of the major landform of our planet.

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GRAVITATION OF MOON

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The acceleration due to gravity on the surface of the Moon is approximately 1.625 m/s2, about 16.6% that on Earth's surface or 0.166 g. The gravitational field of the Moon has been measured by tracking the radio signals emitted by orbiting spacecraft. The principle used depends on the Doppler effect. Most low lunar orbits are unstable. Detailed data collected has shown that for low lunar orbit the only "stable" orbits are at inclinations near 27°, 50°, 76°, and 86°.[2] Because of the Moon's synchronous rotation it is not possible to track spacecraft from Earth much beyond the limbs of the Moon, so until the recent Gravity Recovery and Interior Laboratory (GRAIL) mission the far-side gravity field was not well mapped.

A major feature of the Moon's gravitational field is the presence of mascons, which are large positive gravity anomalies associated with some of the giant impact basins. Mascons are in part due to the presence of dense mare basaltic lava flows that fill some of the impact basins. The huge expanse of mare basaltic volcanism associated with Oceanus Procellarum does not cause a positive gravity anomaly. The center of gravity of the Moon does not coincide exactly with its geometric center, but is displaced toward the Earth by about 2 kilometers

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CELL PHONE

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Selimoni Brahma , Student, B Sc. 5th Semester, Physics Honours

ABSTRACT:

Now a days, technology is getting really advanced and it is becoming an essential part of life. The most rapidly growing technologies in the world is cell phone. Cell phone is also called as a mobile phone. Today cell phones are the devices which provide all the facilities what a user need in his/her daily life, such as email, notebook, Bluetooth, high resolution camera applications, video call and many others computerized applications that a human being can just think of like everything has a positive and negative side.

KEYWORD: Mobile phone and cell phone work

INTRODUCTION:

A cell phone is a device used for various purposes. The mobile phone can be used to communicate over long distances without wire. Another name for cell phone is mobile phone in earlier times mobile phone were used only for communication but now days it is used for various purposes. It is a multipurpose device. We can communicate with people all around the world using various mobile applications. A phone with access to a cellular radio system so it can be used over a wide area, without a physical connection to a network, a mobile phone.

METHODOLOGY:

A cell phone is a two way wireless communication device and needs both the inbound signal (reception) and the outbound signal (transmission) to work. The magnitude of the received signal from the cell tower is called the signal strength, which is commonly indicated by the bars on phone. The connectivity between a cell and its cellular network depends on both signals and is affected by many factors, such as the distance between the phone and the nearest cell tower, the number of impediment between them and the wireless technology.

A cell phone is essentially a two way radio consisting of a radio transmitter and a radio receiver. Cell phones used radio waves to communicate. Radio waves transport digitized voice or data in the form of oscillating electric and magnetic fields, called the electromagnetic field (EMF) . The rate of oscillation is called frequency. Radio waves carry the information and travel in air at the speed of light. Cell phones transmit radio waves in all direction. The waves can be absorbed and reflected by surrounding objects before they reach the nearest cell tower.

ADVANTAGES:

- Cell phone keeps us connected. We can call anyone in the world easily. Moreover we can make video calls too with cell phone.
- We can access internet with our cell phone. We can gain a lot knowledge from website and YouTube channel.
- We can store a lot of information on a cell phone. Images, video and text files can be saved.
- It is also used in marketing purpose. We can store a lot of business document.

DISADVANTAGES:

- People are mostly interacting with others through phone call and social media.
- Cell phone cause isolation in people.
- The cell phone radiation can bring an adverse effects on human health.
- Cell phones are one of main reason for road accident.

CONCLUSION:

Cell phones have brought on a whole new age of technology and they do make life more convenient in terms of communication. However, the side effects of cell phones and the distractions that they are cause many dangerous and unhealthy situations to occur. Cell phones cause brain damage, car accidents and are distractions at school. On top of that, they are also huge threats to the environment. When comparing the health of ourselves and our world to convenience, our world is more important.

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THE BIG BANG THEORY

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The Big Bang event is a physical theory that describes how the universe expanded from an initial state of high density and temperature. Various cosmological models of the Big Bang explain the evolution of the observable universe from the earliest known periods through its subsequent large-scale form. These models offer a comprehensive explanation for a broad range of observed phenomena, including the abundance of light elements, the cosmic microwave background (CMB) radiation, and large-scale structure. The overall uniformity of the Universe, known as the flatness problem, is explained through cosmic inflation: a sudden and very rapid expansion of space during the earliest moments. However, physics currently lacks a widely accepted theory of quantum gravity that can successfully model the earliest conditions of the Big Bang. According to the big bang models, the universe at the beginning was very hot and very compact and since then it has been expanding and cooling down.

The history of the Big Bang theory began with the Big Bang's development from observations and theoretical considerations. Much of the theoretical work in cosmology now involves extensions and refinements to the basic Big Bang model. The theory itself was originally formalised by Belgian Catholic priest, theoretical physicist, mathematician, astronomer, and professor of physics Georges Lemaître. Hubble's Law of the expansion of the universe provided foundational support for the theory.

In the 1910s, Vesto Slipher and later, Carl Wilhelm Wirtz, determined that most spiral nebulae (now correctly called spiral galaxies) were receding from Earth. Slipher used spectroscopy to investigate the rotation periods of planets, the composition of planetary atmospheres, and was the first to observe the radial velocities of galaxies. Wirtz observed a systematic redshift of nebulae, which was difficult to interpret in terms of a cosmology in which the universe is filled more or less uniformly with stars and nebulae. In 1927, the

Belgian Catholic priest Georges Lemaitre proposed an expanding model for the universe to explain the observed redshifts of spiral nebulae, and calculated the Hubble law. He based his theory on the work of Einstein and De Sitter, and independently derived Friedmann's equations for an expanding universe. Also, the red shifts themselves were not constant, but varied in such manner as to lead to the conclusion that there was a definite relationship between amount of red-shift of nebulae, and their distance from observers.In 1929, Edwin Hubble provided a comprehensive observational foundation for Lemaitre's theory. Hubble's experimental observations discovered that, relative to the Earth and all other observed bodies, galaxies are receding in every direction at velocities (calculated from their observed red-shifts) directly proportional to their distance from the Earth and each other. In 1929, Edwin Hubble discovered that most of the universe was expanding and moving away from everything else. If everything is moving away from everything else, then it should be thought that everything was once closer together. The logical conclusion is that at some point, all matter started from a single point a few millimetres across before exploding outward. It was so hot that it consisted of only raw energy for hundreds of thousands of years before the matter could form. Whatever happened had to unleash an unfathomable force, since the universe is still expanding billions of years later. The theory he devised to explain what he found is called the Big Bang theory.

Expansion of space:

The expansion of the Universe was inferred from early twentieth century astronomical observations and is an essential ingredient of the Big Bang models. Mathematically, general relativity describes spacetime by a metric, which determines the distances that separate nearby points. The points, which can be relative to galaxies, stars, or other objects, are specified using a coordinate chart or "grid" that is laid down over all spacetime. The cosmological principle implies that the metric should be homogeneous and isotropic on large scales, which uniquely singles out the Friedmann–Lemaître–Robertson–Walker (FLRW) metric. This metric contains a scale factor, which describes how the size of the universe changes with the time. This enables a convenient choice of a coordinate system to be made, called comoving coordinates. In this coordinate system, the grid expands along with the universe, and objects that are moving only because of the expansion of the universe remain at fixed points on the grid. While their coordinate distance (comoving distance) remains constant, the physical distance between two such co-moving points expands proportionally with the scale factor of the universe.The Big Bang is not an explosion of matter moving outward to fill an empty universe. Instead, space itself expands with time everywhere and increases the physical distances between comoving points. In other words, the Big Bang is not an explosion in space, but rather an expansion of space. Because the FLRW metric assumes a uniform distribution of mass and energy, it applies to our universe only on large scales—local concentrations of matter such as our galaxy do not necessarily expand with the same speed as the whole Universe.

Reference: www.wikipedia.org

PRESENT BATCHES AND LABORATORY BEARER OF THE DEPARTMENT

B SC 1ST SEMSESTER

B SC 3RD SEMSESTER

B SC 5TH SEMSESTER

Rabiram Muchharv. Lab Bearer

Students of Physics Dept. with faculty members