“The Project Work On To Study About The Recent Tends In Physics”

A PROJECT WORK SUBMITTED FOR THE PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE GRADE-XII SCIENCE IN PHYSICS

By

Mr. Janak Singh Dhami

Registration No.:- 787710100207

Grade-XII
(2078)

National Academy of Science and Technology (***NAST***)

Dhangadhi, Kailali, Nepal

Date: 2078/12/….

ACKNOWLEDGEMENTS

I would like to express my special thanks of gratitude to our Lecturer of Physics ***Mr. Bimal Adhikari*,** who gave me the golden opportunity to do this wonderful project on the topic **"TO STUDY ABOUT THE RECENT TENDS IN PHYSICS"**, which also helped me in doing a lot of research in recent tends in physics and i came to know about so the recently physics. I am really thankful to them. Secondly, i would also like to thank my friends, who helped me a lot in finalizing this project within the limited time frame.

Student's Name

Mr. Janak Singh Dhami

Grade-XII 'A'

Registration No.:- 787710100207

CERTIFICATE OF APPROVAL

The project work on **"TO STUDY ABOUT THE RECENT TENDS IN PHYSICS"** by *Mr. Janak Singh Dhami* under the supervision Lecturer of Physics ***Mr. Bimal Adhikari***, National Academy of Science and Technology College, Nepal, is hereby submitted for the partial fulfillment of requirement of Physics in Grade-XII. This project work in my knowledge has not been submitted in any other schools or institutions.

Department of Physics

National Academy of Science and Technology College, Kailali, Nepal

(NAST)

Head of the Department	**Principal**
Mr. Krishna Singh Bhandari	*Mr. Upendra Bom*
……………………	…………………….

RECOMMENDATION

This is to certify that the project work entitled "**TO STUDY ABOUT THE RECENT TENDS IN PHYSICS**" has been carried out by ***Mr. Janak Singh Dhami*** as a partial fulfilment of grade XII in Physics under my supervision. To the best of knowledge, this work has not been submitted to any other purpose in this institute. I, therefore recommend the project work report for appraisal.

Designation of the Supervisor

Lecturer of Physics: - ***Mr. Bimal Adhikari***

Signature:-…………………

Department of Physics

National Academy of Science and Technology College, Nepal

(NAST)

Date: 2078/12/….

DECLARATION

I am hereby declare that the project work entitled "**TO STUDY ABOUT THE RECENT TENDS IN PHYSICS**" under the supervision Lecturer of Physics ***Mr. Bimal Adhikari***, National Academy of Science and Technology college, Nepal, presented here as genuine work done originally by me and has not been published or submitted elsewhere. Any literature, data or works done by others and cited in this project work has been given due acknowledgement and listed in the reference section.

Student's Name

Mr. Janak Singh Dhami

Grade-XII 'A'

Registration No.:- 787710100207

Date: 2078/12 /….

“The Project Work On To Study About The Recent Tends In Physics”

INTRODUCTION

The topic “recent tends in physics” provide us all the information about the new discoveries, inventions, theories, etc. in physics. There are many such new things in physics but we will focus over gravitational waves and Higgs boson which will be very interesting and exciting for us. In this project work we will also include seismology and nanotechnology.

SEISMOLOGY

The scientific study of earthquakes is called seismology. A person specialized in the field of seismology a called seismologist. A device used to record the shaking (vibration) of ground during the earthquake a called seismograph or seismometer. A record produced by a seismograph on a display screen or paper printout is called a seismogram. Data of seismogram are used to locate and characterize earthquakes, and to study the earth's internal structure.

SEISMIC WAVES

The waves radiating by the earth due to earthquake are called seismic waves. Seismic waves are measured to determine the location of the earthquake, and to estimate the amount of energy released by he earthquake (its magnitude).

Types of seismic waves

There are two main types of seismic waves:

(1) Internal wave (body wave)
(2) Surface wave

INTERNAL WAVE

The seismic wave traveling through the interior of the earth is called internal wave or body wave. These waves are higher in frequency, move faster, and carry more energy. There are two types of internal wave;

a) P-waves (primary waves)

(b) S-waves (secondary waves).

(a) P-waves (primary waves):

The seismic waves hitting the ground first and foremost during the earthquake are called P-waves. They are the fastest of all seismic waves. When an earthquake occurs, this wave is the first to arrive the earth surface so they are called primary waves or simply P-waves. As the interior of the Earth is almost incompressible, P-waves transmit their energy quite easily through the medium and thus travel quickly. The P-waves move through solid rock and fluids. The rocky materials compress and expand the waves pass. Obviously, the P-wave is similar to a wave travelling through a spring in which the spring compresses and expands along the direction of traveling of wave. That is why, it is also called compressional wave. Sometimes animals can hear the P-waves of an earthquake, Dogs, for instance, commonly being barking just before an earthquake hits. Usually, people can only feel the bump and rattle of these waves

b) S-waves (secondary waves):

Secondary waves (S-waves) are shear waves that are transverse in nature. Following an earthquake event, S-waves arrive at seismograph stations after the faster-moving P-waves and displace the ground perpendicular to the direction of propagation. Depending on the propagational direction, the wave can take on different surface characteristics; for example, in the case of horizontally polarized S waves, the ground moves alternately to one side and then the other. S-waves can travel only through solids, as fluids (liquids and gases) do not support shear stresses. S-waves are slower than P-waves, and speeds are typically around 60% of that of P-waves in any given material. Shear waves can't travel through any liquid medium, so the absence of S-waves in earth's outer core suggests a liquid state.

SURFACE WAVES

Seismic surface waves travel along the Earth's surface. They can be classified as a form of mechanical surface waves. They are called surface waves, as they diminish as they get further from the surface. They travel more slowly than seismic body waves (P and S). In large earthquakes, surface waves can have an amplitude of several centimeters.

Rayleigh waves

Rayleigh waves, also called ground roll, are surface waves that travel as ripples with motions that are similar to those of waves on the surface of water (note, however, that the associated particle motion at shallow depths is retrograde, and that the restoring force in Rayleigh and in other seismic waves is elastic, not gravitational as for water waves). The existence of these waves was predicted by John William Strutt, Lord Rayleigh, in 1885. They are slower than body waves, roughly 90% of the velocity of S waves for typical homogeneous elastic media. In a layered medium (like the crust and upper mantle) the velocity of the Rayleigh waves depends on their frequency and wavelength. See also Lamb waves.

Love waves

Love waves are horizontally polarized shear waves (SH waves), existing only in the presence of a semi-infinite medium overlain by an upper layer of finite thickness. They are named after A.E.H. Love, a British mathematician who created a mathematical model of the waves in 1911. They usually travel slightly faster than Rayleigh waves, about 90% of the S wave velocity, and have the largest amplitude.

Stoneley waves

A Stoneley wave is a type of boundary wave (or interface wave) that propagates along a solid-fluid boundary or, under specific conditions, also along a solid-solid boundary. Amplitudes of Stoneley waves have their maximum values at the boundary between the two contacting media and decay exponentially towards the depth of each of them. These waves can be generated along the walls of a fluid-filled borehole, being an important source of coherent noise in vertical seismic profiles (VSP) and making up the low frequency component of the source in sonic logging. The equation for Stoneley waves was first given by Dr. Robert Stoneley (1894–1976), Emeritus Professor of Seismology, Cambridge.

Normal Modes

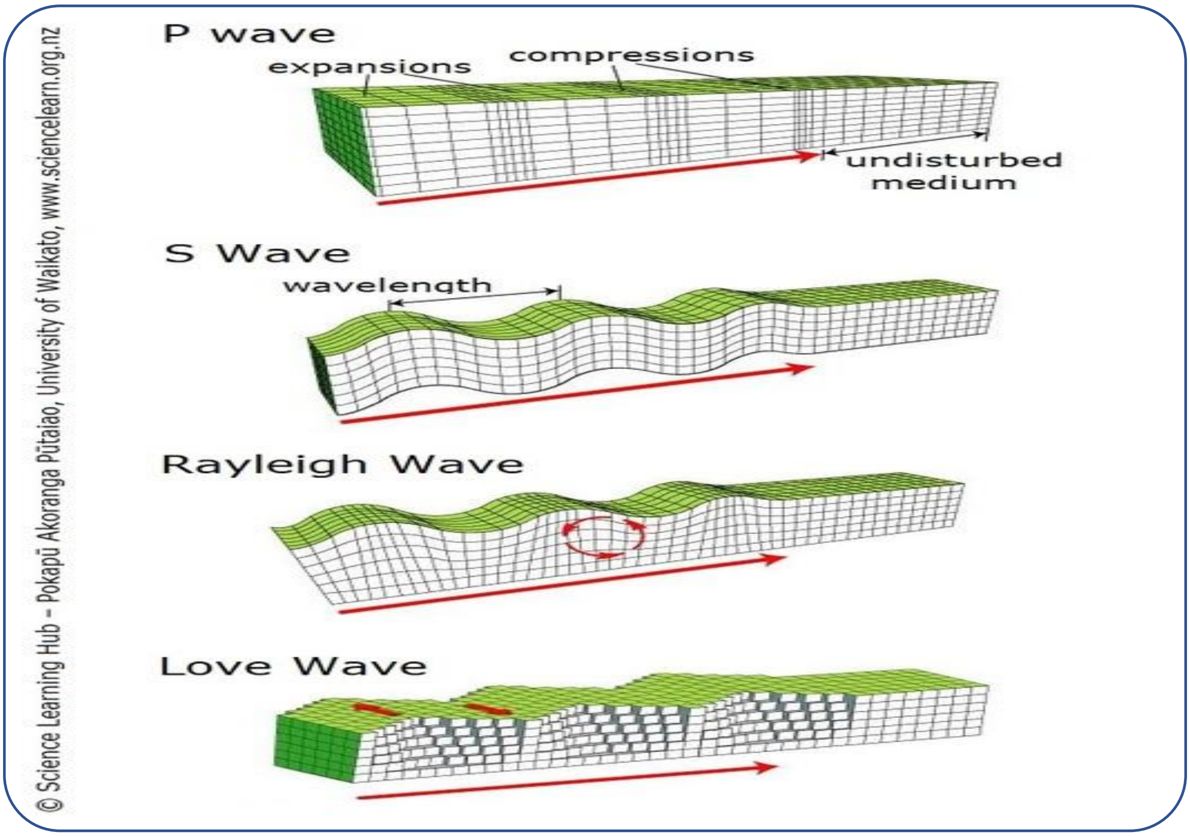
Free oscillations of the Earth are standing waves, the result of interference between two surface waves traveling in opposite directions. Interference of Rayleigh waves results in spheroidal oscillation S while interference of Love waves gives toroidal oscillation T. The modes of oscillations are specified by three numbers, e.g., ${}_{n}S_{l}^{m}$, where l is the angular order number (or spherical harmonic degree, see Spherical harmonics for more details).

The number m is the azimuthal order number. It may take on $2l+1$ values from $-l$ to $+l$. The number n is the radial order number. It means the wave with n zero crossings in radius. For spherically symmetric Earth the period for given n and l does not depend on m.

Some examples of spheroidal oscillations are the "breathing" mode ${}_0S_0$, which involves an expansion and contraction of the whole Earth, and has a period of about 20 minutes; and the "rugby" mode ${}_0S_2$, which involves expansions along two alternating directions, and has a period of about 54 minutes. The mode ${}_0S_1$ does not exist because it would require a change in the center of gravity, which would require an external force.

Of the fundamental toroidal modes, ${}_0T_1$ represents changes in Earth's rotation rate; although this occurs, it is much too slow to be useful in seismology. The mode ${}_0T_2$ describes a twisting of the northern and southern hemispheres relative to each other; it has a period of about 44 minutes.

The first observations of free oscillations of the Earth were done during the great 1960 earthquake in Chile. Presently periods of thousands of modes are known. These data are used for determining some large scale structures of the Earth interior.

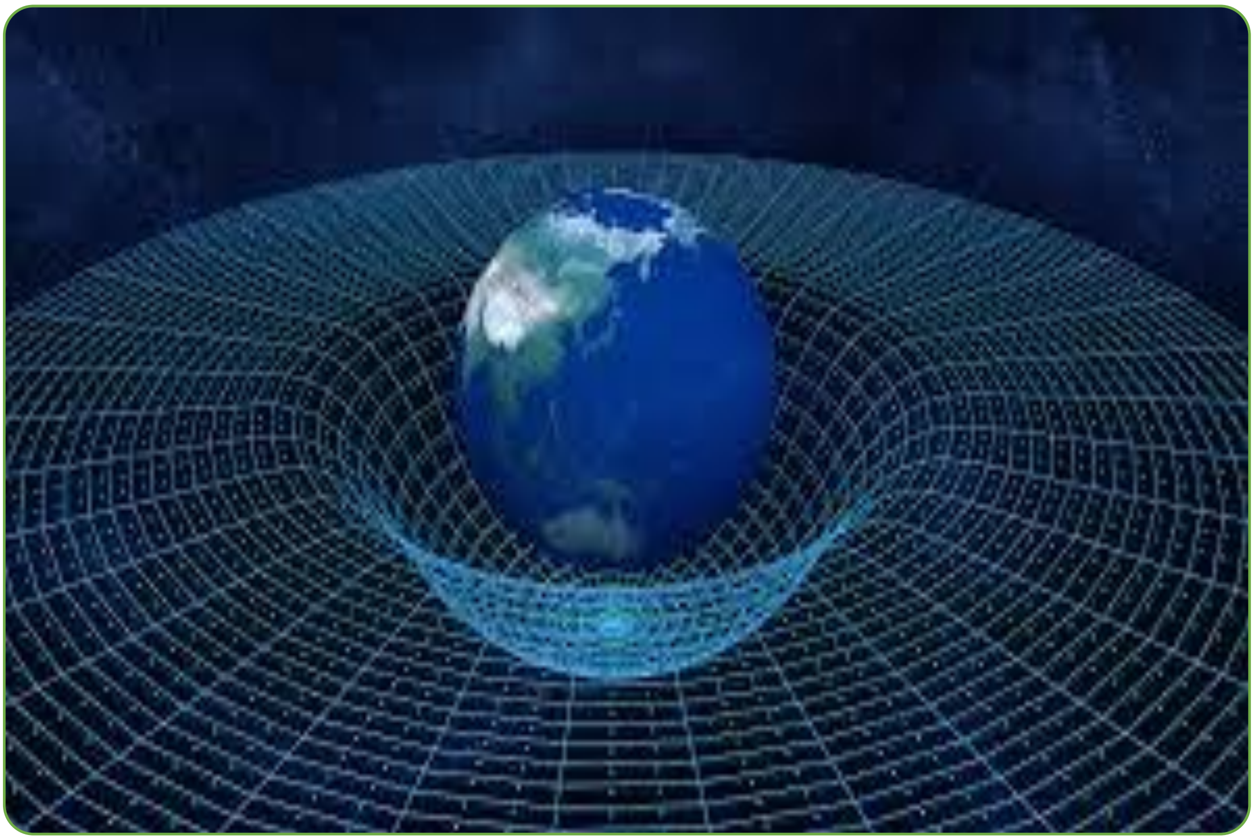


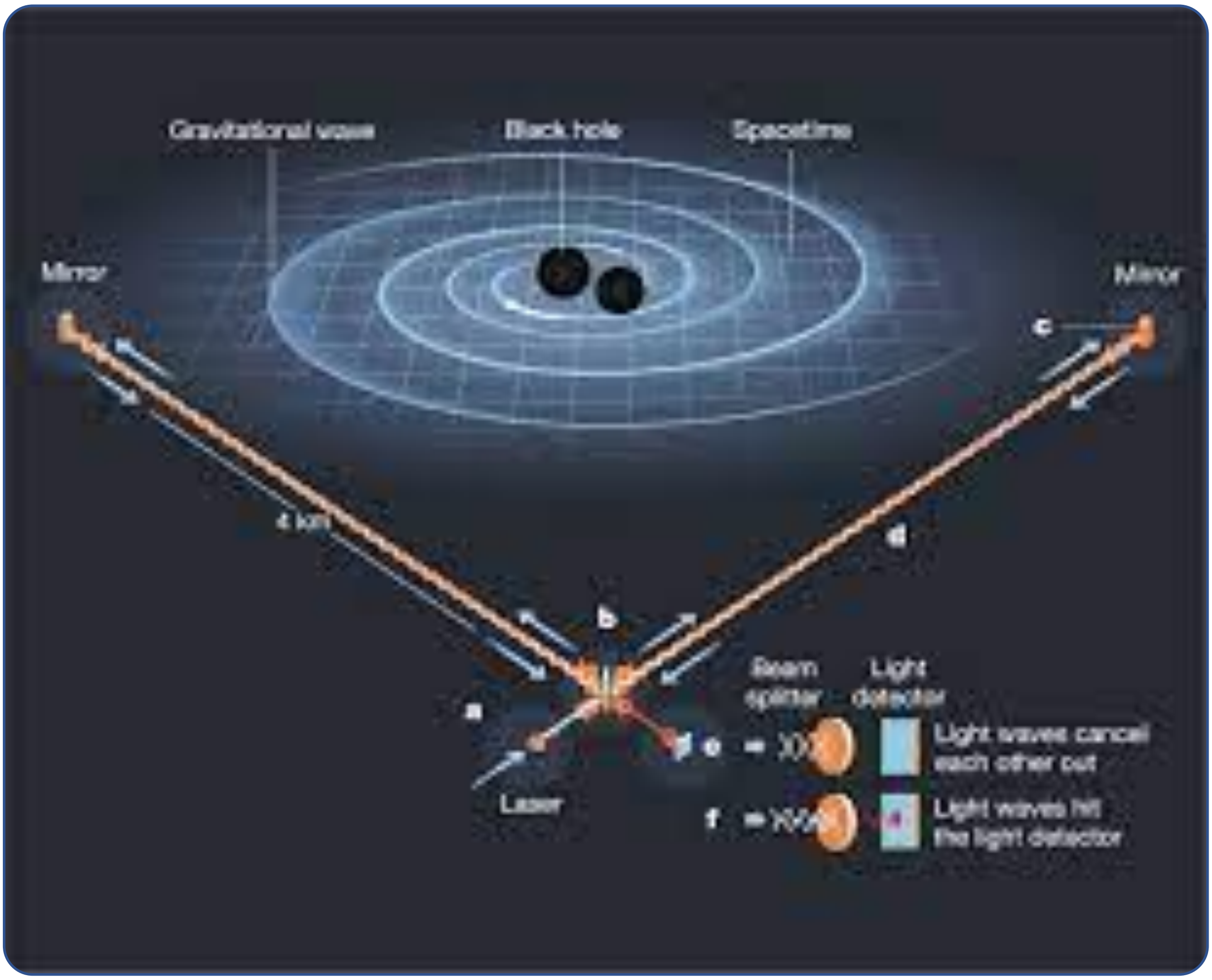
GRAVITATIONAL WAVES

Gravitational waves are disturbances or ripples in the curvature of spacetime, generated by accelerated masses, that propagate as waves outward from their source at the speed of light. They were proposed by Henri Poincaré in 1905 and subsequently predicted in 1916 by Albert Einstein on the basis of his general theory of relativity. Later he refused to accept gravitational waves. Gravitational waves transport energy as gravitational radiation, a form of radiant energy similar to electromagnetic radiation. Newton's law of universal gravitation, part of classical mechanics, does not provide for their existence, since that law is predicated on the assumption that physical interactions propagate instantaneously (at infinite speed) – showing one of the ways the methods of classical physics are unable to explain phenomena associated with relativity.

The first indirect evidence for the existence of gravitational waves came from the observed orbital decay of the Hulse–Taylor binary pulsar, which matched the decay predicted by general relativity as energy is lost to gravitational radiation. In 1993, Russell A. Hulse and Joseph Hooton Taylor Jr. received the Nobel Prize in Physics for this discovery. The first direct observation of gravitational waves was not made until 2015, when a signal generated by the merger of two black holes was received by the LIGO gravitational wave detectors in Livingston, Louisiana, and in Hanford, Washington. The 2017 Nobel Prize in Physics was subsequently awarded to Rainer Weiss, Kip Thorne and Barry Barish for their role in the direct detection of gravitational waves.

In gravitational-wave astronomy, observations of gravitational waves are used to infer data about the sources of gravitational waves. Sources that can be studied this way include binary star systems composed of white dwarfs, neutron stars, and black holes; events such as supernovae; and the formation of the early universe shortly after the Big Bang.





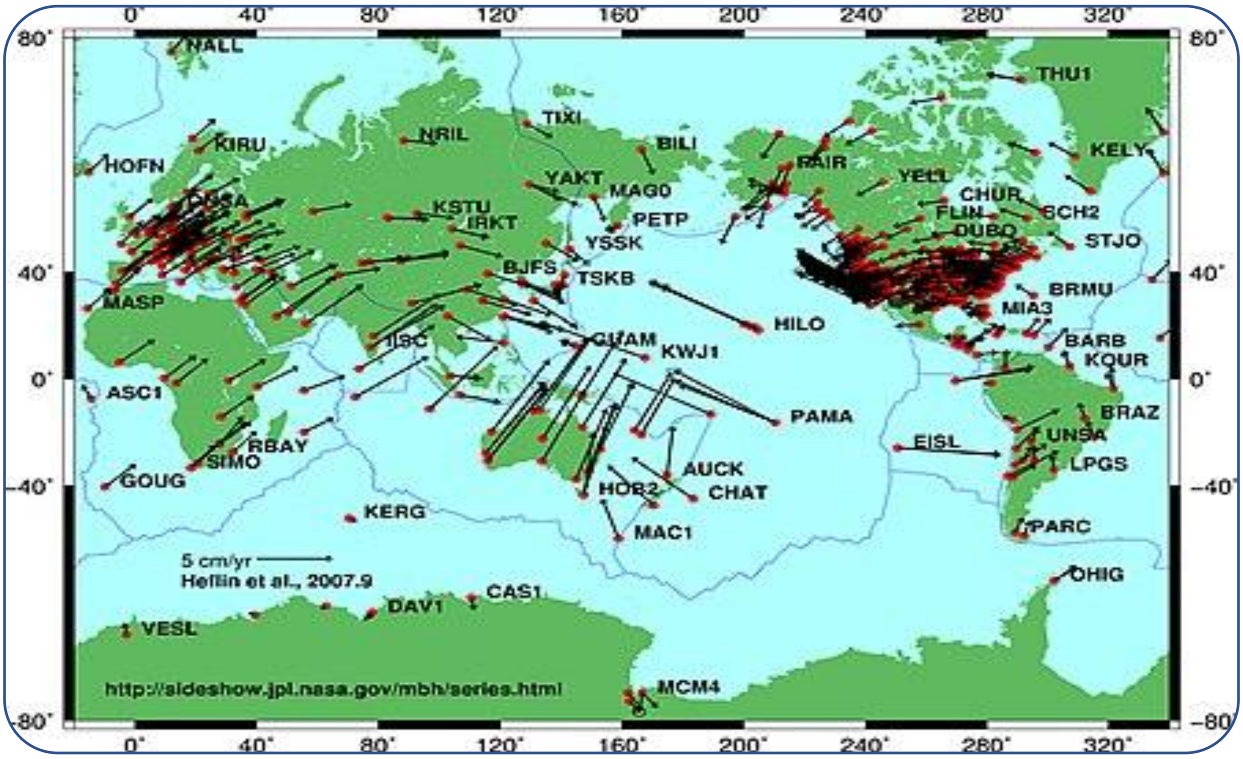
Gravitational wave
Black hole
Spacetime
Mirror
Mirror
c
4 km
d
b
a
Beam splitter
Light detector
e
Light waves cancel each other out
Laser
f
Light waves hit the light detector

EARTHQUAKE

An earthquake (also known as a quake, tremor or temblor) is the shaking of the surface of the Earth resulting from a sudden release of energy in the Earth's lithosphere that creates seismic waves. Earthquakes can range in size from those that are so weak that they cannot be felt to those violent enough to propel objects and people into the air, and wreak destruction across entire cities. The seismicity, or seismic activity, of an area is the frequency, type, and size of earthquakes experienced over a particular time period. The word tremor is also used for non-earthquake seismic rumbling.

At the Earth's surface, earthquakes manifest themselves by shaking and displacing or disrupting the ground. When the epicenter of a large earthquake is located offshore, the seabed may be displaced sufficiently to cause a tsunami. Earthquakes can also trigger landslides and, occasionally, volcanic activity.

In its most general sense, the word earthquake is used to describe any seismic event whether natural or caused by humans—that generates seismic waves. Earthquakes are caused mostly by rupture of geological faults but also by other events such as volcanic activity, landslides, mine blasts, and nuclear tests. An earthquake's point of initial rupture is called its hypocenter or focus. The epicenter is the point at ground level directly above the hypocenter.



HIGGS BOSON/ GOD PARTICLE

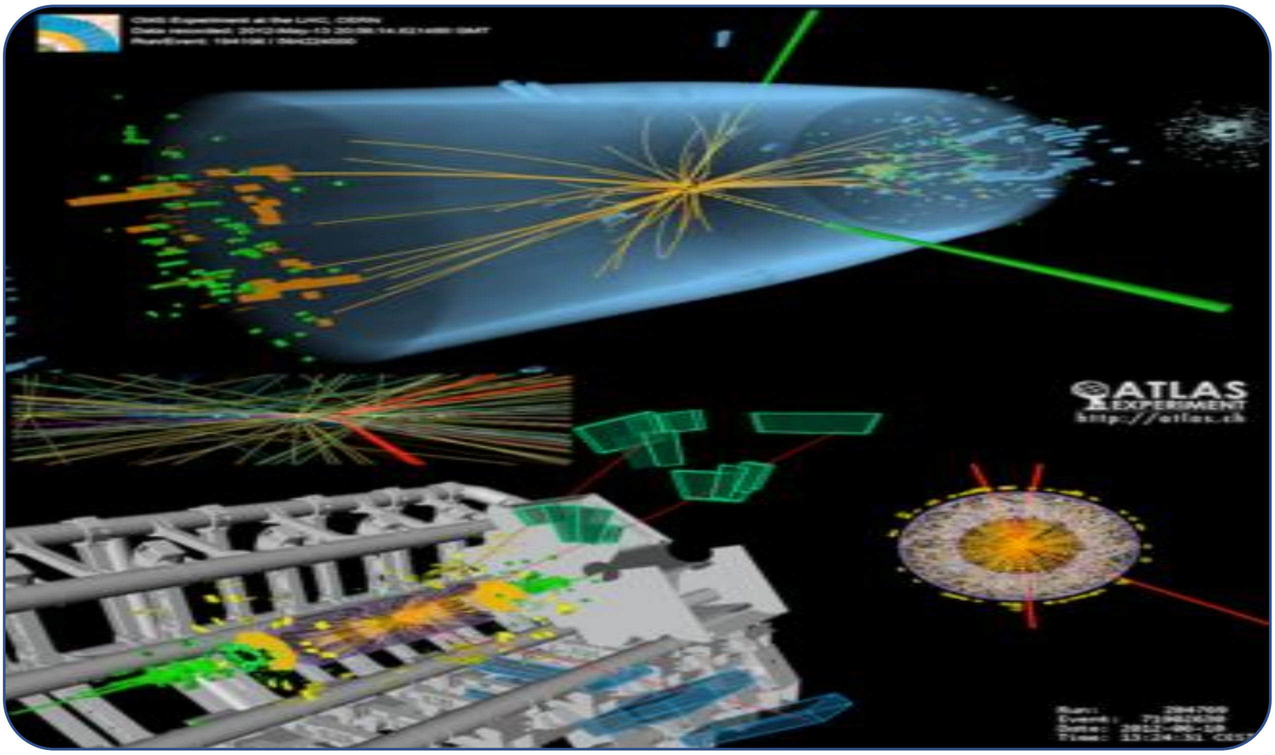
The Higgs boson, sometimes called the Higgs particle, is an elementary particle in the Standard Model of particle physics produced by the quantum excitation of the Higgs field, one of the fields in particle physics theory. In the Standard Model, the Higgs particle is a massive scalar boson with zero spin, even (positive) parity, no electric charge, and no colour charge, that couples to (interacts with) mass. It is also very unstable, decaying into other particles almost immediately.

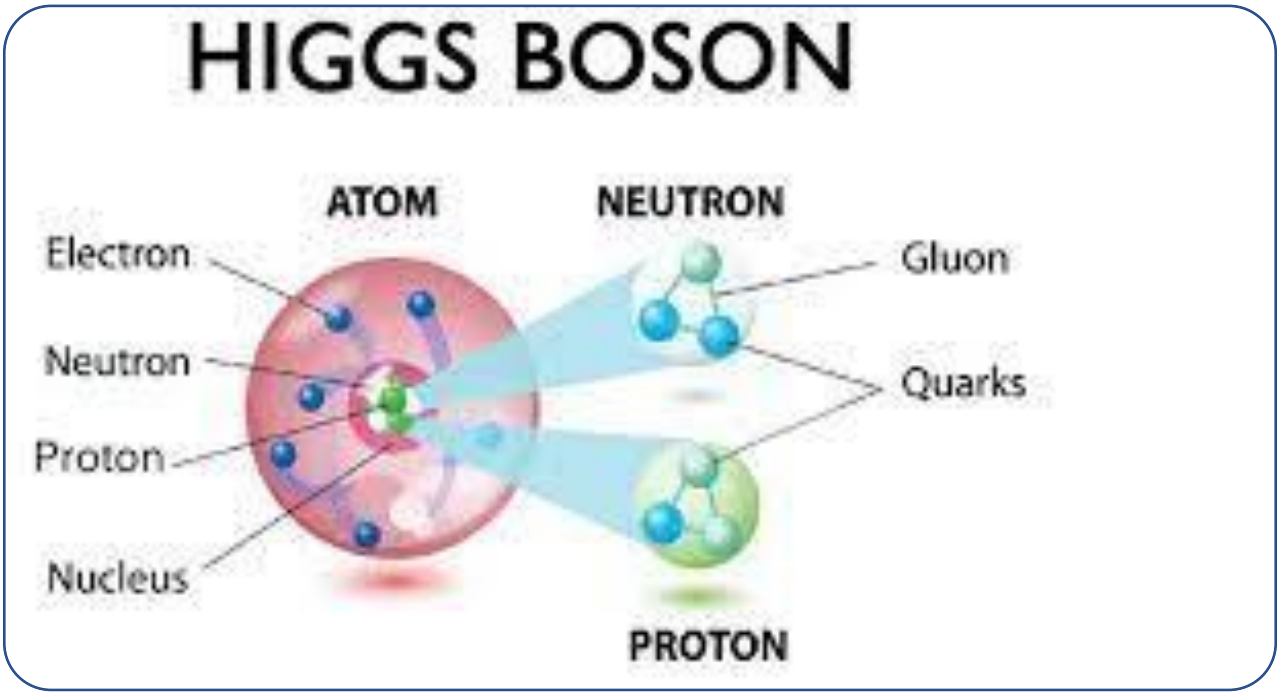
The Higgs field is a scalar field, with two neutral and two electrically charged components that form a complex doublet of the weak isospin SU(2) symmetry. Its "Mexican hat-shaped" potential has a nonzero value everywhere (including otherwise empty space), which breaks the weak isospin symmetry of the electroweak interaction, and via the Higgs mechanism gives some particles mass.

Both the field and the boson are named after physicist Peter Higgs, who in 1964 along with five other scientists in three teams, proposed the Higgs mechanism, a way that some particles can acquire mass. (All fundamental particles known at the time[c] should be massless at very high energies, but fully explaining how some particles gain mass at lower energies, had been extremely difficult.) If these ideas were correct, a particle known as a scalar boson should also exist, with certain properties. This particle was called the Higgs boson, and could be used to test whether the Higgs field was the correct explanation.

After a 40 year search, a subatomic particle with the expected properties was discovered in 2012 by the ATLAS and CMS experiments at the Large Hadron Collider (LHC) at CERN near Geneva, Switzerland. The new particle was subsequently confirmed to match the expected properties of a Higgs boson. Physicists from two of the three teams, Peter Higgs and François Englert, were awarded the Nobel Prize in Physics in 2013 for their theoretical predictions. Although Higgs's name has come to be associated with this theory, several researchers between about 1960 and 1972 independently developed different parts of it.

In the mainstream media, the Higgs boson has often been called the **"God particle"** from the 1993 book The God Particle by Nobel Laureate Leon Lederman, although the nickname is not endorsed by many physicists.





CONCLUSION

In this project work, I studied about recently discovered or observed physics things. There are many things, I just make report on some topics like as seismology, gravitational waves, earthquake & Higgs boson or God particles.

REFERENCES

- https://en.wikipedia.org/wiki/Seismic_wave
- https://www.google.com/
- Aryal, B., M.N., The Heart Of Physics, KEC publication