Relativity Theory Essay, Research Paper

The theory of relativity was introduced by Albert Einstein around the early

nineteen hundereds. It is a theory which enables the human mind to understand

the possible actions of the universe. The theory is divided into two parts, the

special, and the general. In each part, there is a certain limit to which it

explains and helps to comprehend. In the special, Einstein explains ways of

understanding the atom and other small objects, while the general is designed

for the study of large objects, such as planets. The theory of relativity having

being created, succeeded the two hundred year old mechanics of Isaac Newton,

thus showing Einstein as more of a futuristic thinker and adapter. Einstein

introduced the concept of Relativity, which means that there is no absolute

motion in the universe. Einstein showed that humans are not in a flat, absolute

time of everyday experience, but in a curved space-time. Take for example the

Earth as a whole. The earth has a circumference of around twenty five thousand

miles, and it can be covered within a twenty-four hour time frame. Having this

completion of distance covered within the set amount of time, shows that the

Earth rotates a little over one-thousand miles per hour. it can be assumed that

something in the solar system is not moving, and we can measure how fast the

earth is moving by relative to the object. However, no matter what object is

chosen, it is moving as well, thus showing that nothing is fixed and that

everything is moving, and it is unknown how fast or in what direction. The

Theory of Relativity is a theory compressing mechanics, gravitation, and

space-time. Having known this, it is seen so that all things are related, but

can not be thought of as individual. The Theory of Relativity is known for

having two parts to it. The first part is the special relativity; the other is

the general relativity. Special relativity is known for it?s publication in

1906; it is used for microscopic physics, such as atoms and small objects. The

other type of relativity, the general, is known for its publication in 1916,

well after the birth of it?s counterpart. The general half of the theory is

intended for astrophysics and cosmology, such as solar systems, planets, and

large objects. A British Astronomer named Sir Arthur Eddington, was one of the

first to fully understand the Theory of Relativity. A little humor about his

intelligence can be seen to when he was asked about there being three people who

understood the Theory of Relativity, his response was ?who is the third??

The discovery of Quasars, the 3 kelvin microwave background radiation, pulsars,

and possibly blackholes were studied with to see the accuracy of the Theory of

Relativity with gravity. This led the development of the space program,

telescopes, computers, etc?to make better calculations of the accuracy of the

theory. The Theory of Relativity has two main parts, the special and the

general. The internal part of the special theory is in reference to any region,

such as a free falling laboratory, in which objects move in straight lines and

have uniform velocities. In the lab, nothing would appear to be moving if

everything in the lab was falling, the movement of the lab is relevant to the

person that is in the lab. The principle of relativity theorizes that

experiments in an internal frame, is independent from uniform velocity of the

frame. An example of this is the speed of light. The speed of light within the

internal frame is the same for all, regardless of the speed of the observer. Two

events that are simultaneos in one frame, may not be simultaneos when viewed

from a frame moving relative to the first one. Movement looks different

depending on where the observer is located, how fast it is moving, and in what

direction. An interesting fact about the special relativity, is that the

mechanical foundations of special relativity were researched in 1908 by a german

mathmetician named, Hermann Minkowski. Minkowski ler einstein to postulate the

vanishing of gravity in free fall. In any free fall, laws of physics should take

on special relitavistic forms, this is what led to the EEP(Eisteins Equivalence

Principle.) A consequence of EEP is that the space time must be curved. It is

techinical, consider two frames falling freely, but on opposite sides of the

Earth. According to Minkowski, spare time is valid locally in each frame, but

since the frames are accelerating towards each other, the two Minkowski

space-times can not be extended untill they meet. Therefor, with gravity, space

time is not flat locally, but spaced globally. Any theory of gravity that

fulfills EEP, is called a metric theory. Along with the special side of the

theory, is the genral side of it. The principle to show space-time curved by

presence of matter. To determine curvature, requires a specific metric theory of

gravity, such as general relativity. Einsteins aim was to find the simplist

equations, he found a set of 10. To test the general theory Einstein performed

three tests. Gravitational red shift, light deflection, and perihelion shift of

mercury. To test light deflection, Einstein used the curve space-time of the sun

light; it shoul be deflected 1.75 seconds of arc if it glazes the solar surface.

The concept of gravitational lenses is based on the already discussed and proven

relativistic prediction that when light from a celestial object passes near a

massive body such as a star, its path is deflected. The amount of deflection

depends on the massiveness of the intervening body. From this came the notion

that very massive celestial objects such as galaxies could act as the equivalent

of crude optical lenses for light coming from still more distant objects beyond

them. An actual gravitational lens was first identified in 1979. Another of the

early successes of general relativity was its ability to account for the puzzle

of Mercury’s orbit. After the perturbing effects of the other planets on

Mercury’s orbit were taken into account, an unexplained shift remained in the

direction of its perihelion (point of closest approach to the Sun) of 43 seconds

of arc per century; the shift had confounded astronomers of the late 19th

century. General relativity explained it as a natural effect of the motion of

Mercury in the curved space-time around the Sun. Recent radar measurements of

Mercury’s motion have confirmed this agreement to about half of 1 percent. One

of the remarkable properties of general relativity is that it satisfies EEP for

all types of bodies. If the Nordtvedt effect were to occur, then the Earth and

Moon would be attracted by the Sun with slightly different accelerations,

resulting in a small perturbation in the lunar orbit that could be detected by

lunar laser ranging, a technique of measuring the distance to the Moon using

laser pulses reflected from arrays of mirrors deposited there by Apollo

astronauts. One of the first astronomical applications of general relativity was

in the area of cosmology. The theory predicts that the universe could be

expanding from an initially condensed state, a process known as the big bang.

For a number of years the big bang theory was contested by an alternative known

as the steady state theory, based on the concept of the continuous creation of

matter throughout the universe. Later knowledge gained about the universe,

however, has strongly supported the big bang theory as against its competitors.

Such findings either were predicted by or did not conflict with relativity

theory, thus also further supporting the theory. Perhaps the most critical piece

of evidence was the discovery, in 1965, of what is called background radiation.

This "sea" of electromagnetic radiation fills the universe at a

temperature of about 2.7 K (2.7 degrees C above absolute zero). Background

radiation had been proposed by general relativity as the remaining trace of an

early, hot phase of the universe following the big bang. The observed cosmic

abundance of helium (20 to 30 percent by weight) is also a required result of

the big-bang conditions predicted by relativity theory. In addition, general

relativity has suggested various kinds of celestial phenomena that could exist,

including neutron stars, black holes, gravitational lenses, and gravitational

waves. According to relativistic theory, neutron stars would be small but

extremely dense stellar bodies. A neutron star with a mass equal to that of the

Sun, for example, would have a radius of only 10 km (6 mi). Stars of this nature

have been so compressed by gravitational forces that their density is comparable

to densities within the nuclei of atoms, and they are composed primarily of

neutrons. Such stars are thought to occur as a by-product of violent celestial

events such as supernovae and other gravitational implosions of stars. Since

neutron stars were first proposed in the 1930s, numerous celestial objects that

exhibit characteristics of this sort have been identified. In 1967 the first of

many objects now called pulsars was also detected. These stars, which emit rapid

regular pulses of radiation, are now taken to be rapidly spinning neutron stars,

with the pulse period represent the period of rotation. Black holes are among

the most exotic of the predictions of general relativity, although the concept

itself dates from long before the 20th century. These theorized objects are

celestial bodies with so strong a gravitational field that no particles or

radiation can escape from them, not even light–hence the name. Black holes most

likely would be produced by the implosions of extremely massive stars, and they

could continue to grow as other material entered their field of attraction. Some

theorists have speculated that supermassive black holes may exist at the centers

of some clusters of stars and of some galaxies, including our own. While the

existence of such black holes has not been proven beyond all doubt, evidence for

their presence at a number of known sites is very strong. in conclusion,

relativity is a way of looking at things, keeping in mind that everything is

moving, and that we really have no way of know just how fast. This theory, along

with complex equations developed many years ago, helped to explain certain long

misunderstood things about planets and their movements. But the same thinking

about very large objects, in motion, like stars, planets, solar sysems, simply

does not work accurately when you look at microscopic things, like atoms. Too,

since the development of the theory of relativity, we have made many

technological advances that have allowed us to make accurate measurements, and

to basically confirm the theory is correct.

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