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# Space Structure: Einstein's Theory of Relativity & Universe

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***Posthumous Research Paper of Mr. Baldev Singh Jhawer, M. A., B. Ed. of Jhawan, Hoshiarpur MBA, Former Science Teacher, Punjab Education Department***

***Abstract – The theories of relativity by Albert Einstein revolutionize how the earth thinks about space, time, mass, energy and gravity. Before Einstein, Newton laws were used to understand the physics of motion. In 1687, Newton studied that gravity affects everything in the cosmos. The similar force of gravity that pulls an apple down from a tree kept the Earth in motion around the sun. This paper examines about space structure: Einstein's theory of relativity & universe.***

***Keywords: Space Structure, Einstein's Theory, of Relativity, Earth***

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## 1. INTRODUCTION:

Philosopher **David Hume's 1738** "A Treatise of Human Nature" was a big influence on Einstein's thinking about space and time. Hume was an empiricist and sceptic, believing that scientific concepts must be based on experience and evidence, not the reason alone. He also held that time did not exist separately from the movement of objects.

"It is very well possible that without these philosophical studies I would not have arrived at the solution," Einstein wrote.

In 1905, Albert Einstein launched / based a new theory on two principles. First, the laws of physics appear the same to all observers.

Second, he calculated that the speed of light – 186,000 miles per second (299,338 kilometres per second) – is unchanging. Prior to Einstein, scientists believed that space was filled with aluminiferous aether that would cause the speed of light to change depending on the relative motion of the source and the observer.

As a result of these principles, Einstein deduced that there is no fixed frame of reference in the universe.

Everything is moving relative to everything else, hence Einstein's theory of relativity came in existence.

It is known as special relativity, because it applies only to special cases: frames of reference in constant, unchanging motion. In 1915, Einstein published the general theory of relativity, which applies to frames that are accelerating in regards to each other.

Time does not pass at the same rate for everyone. A fast-moving observer measures time passing more slowly than a (relatively) stationary observer would. This phenomenon is called time dilation.

A fast-moving object appears shorter along the direction of motion, relative to a slow-moving one. This effect is very subtle until the object travels close to the speed of light.

Mass and energy are different manifestations of the same thing. Einstein's famous equation, $E=mc^2$, means "a quantity of energy is equivalent to a quantity of mass times the speed of light squared." This is what enables the release of a huge amount of energy from a nuclear explosion.

As a result of $E=mc^2$, a fast-moving object appears to have increased mass relative to a slow-moving one. This is due to the fact that increasing an object's velocity that increases its kinetic energy and, therefore, its mass (since mass = energy).

The increase in mass is the reason that Einstein says that matter cannot travel faster than the light. The mass increases with velocity until the mass

becomes infinite when it reaches to the light speed. An infinite mass would require infinite energy to move, so this is impossible.

## 2. REVIEW OF LITERATURES:

**Gravity as Curved Space-time [2]**

Einstein in the long run recognized the property of space time which is in charge of gravity as its ebb and flow. Space and time in Einstein's universe are never again level (as certainly expected by Newton) yet can push and pulled, extended and twisted by issue. Gravity feels most grounded where space-time is most bended, and it vanishes where space-time is level. This is the center of Einstein's hypothesis of general relativity, which is frequently summed up in words as takes after: "matter advises space-time how to bend, and bended space-time advises matter how to move". A standard method to show this thought is to put a knocking down some pins ball (speaking to a huge question, for example, the sun) onto an extended elastic sheet (speaking to space-time). In the event that a marble is set onto the elastic sheet, it will move toward the knocking down some pins ball, and may even be put into "space" around the playing ball. This happens, not on the grounds that the littler mass is "pulled in" by a power radiating from the bigger one, but since it is going along a surface which has been twisted by the nearness of the bigger mass. Similarly attractive energy in Einstein's hypothesis emerges not as a power engendering through space-time, but instead as an element of space time itself. As per Einstein, your weight on earth is because of the way that your body is going through distorted space-time!

**General Relativity [2]:**

General relativity is constructing physically in light of the identicalness rule, however the hypothesis likewise has a moment, more scientific establishment; known as the rule of general covariance *{the property of a function of retaining its form when the variables are linearly transformed}*, the necessity the law of attractive energy be the same for all eyewitnesses — notwithstanding quickening ones — paying little mind to the directions in which it is depicted. *(It is hence that Einstein named his new hypothesis "general", instead of "uncommon" relativity — he dropped the prior limitation to consistently moving spectators).* This ended up being the most troublesome test that Einstein at any point confronted. As he later stated, to express physical laws without arranges resembles "portraying considerations without words". Einstein was obliged to ace the dynamic arithmetic of surfaces and their portrayal as far as tensors, a field spearheaded via **Carl Friedrich Gauss (1777-1855)** and summed up to higher measurements and more theoretical spaces by **Georg Friedrich Bernard Riemann (1826-1866)**. In his this work he was helped most importantly by his companion the mathematician **Marcel Grossmann (1878-1936)**. Another mathematician named **David Hilbert (1862-1943)** almost beat him to his last conditions.

Amongst his investigations at the Polytechnic Einstein skirted **Minkowski's** classes. As indicated by Einstein's biographer **Carl Seelig, Minkowski's** "addresses, now and again gravely arranged yet brimming with innovative power".[3]

Einstein went to the accompanying addresses of **Minkowski**: Geometry of Numbers, Function Theory, Potential Theory, Elliptic Functions, Analytical Mechanics, Variational Calculus, Algebra, Partial differential Equations, and Applications of Analytical Mechanics. [4]

Einstein could have become great at scientific preparing from his instructors at the Zürich Polytechnic. "Around then", says **Anton Reiser**, Einstein was less keen on scientific hypothesis than in the noticeable procedure of material science". [5]

Einstein felt that "the most captivating subject at the time that I was an understudy was Maxwell's hypothesis". He thought that it was hard to acknowledge for quite a while the significance of dynamic arithmetic, and discovered high science important just when building up his attraction hypothesis – he found the characteristics of high arithmetic around 1912. [6]

**Scott Walter** states, "This account of **Minkowski's** memory of his experience with Einstein's paper on relativity is interested, in that the possibility of the recognizable proportionality of checks in uniform movement had been proposed by **Poincaré** in one of the papers contemplated amid the principal session of the electron-hypothesis class. It is conceivable, obviously, that **Poincaré's** operational meaning of neighborhood time got away from **Minkowski's** consideration, or that **Minkowski** was thinking about a correct identicalness of timekeepers".[7]

Before 1905 **Poincaré** focused on the significance of the strategy for tickers and their synchronization by light flags. He gave a physical understanding of **Lorentz's** nearby time as far as clock synchronization by light flags, and defined a guideline of relativity. **John Stachel** clarifies: "**Poincaré** had translated the nearby time as that given by times very still in an edge traveling through the ether when synchronized as though – in opposition to the essential presumptions of **Newtonian kinematics** *{**Kinematics** is a branch of classical mechanics that describes the motion of points, bodies (objects), and systems of bodies (groups of objects) without considering the mass of each or the forces that caused the motion. ... The study of how forces act on masses falls within kinetics}* – the speed of light were the same in every single inertial casing. **Einstein** dropped the ether

and the 'as though': one essentially synchronized timekeepers by the **Poincaré** tradition in each inertial edge and acknowledged that the speed of light truly is the same in every single inertial edge when estimated with tickers so synchronized". [8]

In the **Cologne** talk **Minkowski** said quickly in the wake of showing **Lorentz's** nearby time, "Nonetheless, the credit of first perceiving forcefully that the season of the one electron is similarly in the same class as that of the other, i.e., that t and t' are to be dealt with the same, is of A. **Einstein**". Furthermore, **Minkowski** alluded to **Einstein's** 1905 relativity paper and to his 1907 survey article.[9]

Until 1912 **Einstein's** instinct was not sufficiently solid in the field of science, he considered numerical formalism pointless learnedness. **Louis De Broglie** recognized scientific material science and hypothetical material science. [10]

Though in the first place, as indicated by **De Broglie**, is the significant and basic examination of the physical hypothesis set forward by the specialist, who evaluates numerical hypothesis with a specific end goal to enhance these speculations and so as to render their inalienable verifications more thorough. Conversely, hypothetical material science is the development of hypothesis reasonable to fill in as a clarification of the trial actualities and to control crafted by the research facility staff. Broad numerical learning is a pre-essential, despite the fact that it isn't, customarily, crafted by genuine mathematicians; it requires wide information of the test realities, and primarily some sort of instinct in material science, which not all mathematicians have, as did **Poincaré**.

## 3. SPACE STRUCTURE:

### EINSTEIN'S THEORY OF RELATIVITY & UNIVERSE:

According to theory of relativity matter & space interact with each other. As it is explained, matter tells the space how to bend & space tells the matter how to move, but the question is how these all interact. There exists a particle, whose speed when at arrest is equal to the speed of light. Let's call this particle Space Particle & in short Sp. These Sp's are everywhere in space. When space & matter interact with each other matter changes the density of these space particles. Density of these particles decreases near the matter & increases as we move away from the matter.

A body moves in space from higher density points to lower density points. Thus it is the structure of the space which is fourth fundamental force from which the gravity is derived. We know that when body falls towards earth its acceleration is equal to the g & when body is thrown away from earth it also de-accelerate with a g. Thus the density of space particles near earth surface is less and increases as we move away from the surface of the earth.

Thus the density of these space particles is inversely proportional to g. Let's call the density of these particles Sd & call this density as space density, This Sd oc (g=G m/f12) Or Sd oc R2/Gm

So the Sd is directly proportional to square of distance from the centre of a body & inversely proportional to mass of the body. Gravitational field- Distribution of space particles around the centre of mass of a body forms the gravitational field of that body. Thus when matter & space interact, matter changes the density of space & due to change in space density a body moves from higher space density towards lower space density.

Let us try to understand the motion of a body with the help of space particles; let's consider that there are six particles on left side of the body & four particles on the right side of a body. Now the four particles on the right side will give four particle push to the body towards left & six particles towards left of the body will give a six particles push towards right. A result net force of two particles will give two particle push to the body towards right & body will move towards the right direction.

Now we can define the laws of motion in the terms of space density

1. A body accelerates towards low density space from higher density space & vice-versa.

2. A body moves with uniform speed along the line of equal space density.

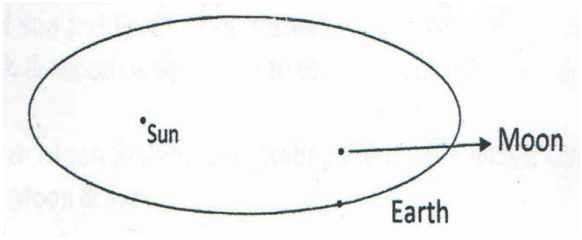
We know that nobody can move with speed of higher than that of light. So, at the horizon line of a body when g is equal or higher than the speed of light nothing can escape from that space. We call that space black hole. So the space density inside the horizon line is zero i.e. there exist no space particles in the black hole & that can be called zero density space. The behavior, which we call is due to 95% invisible matter or dark matter is due to the Space particles *{Sps}*. So the space particles count for the invisible matter or dark matter.

Also an electromagnetic radiation moving away from earth is moving from lower space density to higher space density & feels de-accelerated & thus shows the red shift. A radiation coming towards earth feels accelerated & thus shows blue shift.

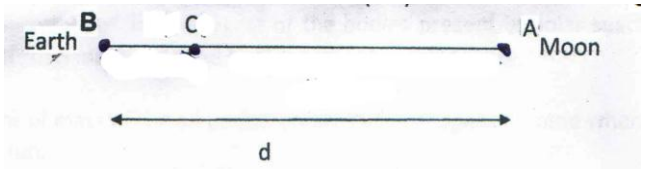
**COUPLED MOTION OF HEAVENLY BODIES:**

As we know earth is orbiting the sun and the moon is Orbiting the Earth. While orbiting the sun, Earth also oscillate. Why earth oscillate?

This is because earth alone is not orbiting the sun. Earth and Moon as a system orbit the sun. The point which is orbiting sun is the point which is the centre of mass of earth moon system. The centre of mass of earth moon system can be found as follows:-




| | | |
|---|---|---|
| Let mass of Earth | = | e (m) |
| Mass of moon | = | m (m) |
| Distance b/w Earth and Moon | = | d (AB) |
| Centre of mass of Earth moon system | = | C (EM) |
| Distance b/w centre of mass of earth and C(EM) | = | CB |




Distance b/w centre of mass of moon and C(EM) = AC

d=AC+CB

m(m) X AC= e(m) X CB

d=AC+CB
m(m) X AC= e(m) X CB
$CB = \frac{m(m) \times AC}{e(m)}$
AC=d-CB
e(m) X CB = m(m) X (d-CB)
=m(m) X d-m(m) X CB
e(m) X CB + m(m) X CB = m(m) X d
CB (e(m)+m(m))=m(m) X d
$CB = \frac{m(m) \times d}{e(m)+m(m)}$

Now earth and Moon are in coupled motion and these both are rotating about their common centre of mass point which is C (EM). This C (EM) is point which is orbiting the sun.

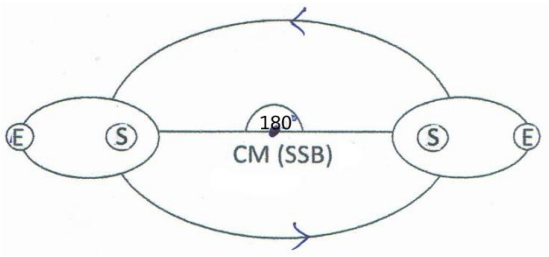
Then comes the motion of earth moon system with the sun, as Earth and Moon are in coupled motion; similarly sun is in coupled motion with Earth & Moon System.

As the mass of sun is very large in comparison with Earth, Moon System the Centre of mass of Sun and Earth moon system as a whole (i.e. common centre of mass of sun, Earth & Moon) is very close to the centre of mass of the sun.

Both Sun and Earth Moon System are rotating the point which is common centre of mass of Earth, Moon & Sun.

Similarly the Sun is also in coupled motion with other planets and other heavenly bodies present in Solar System. Solar space is the space where the influence of nearest star centauri {***Centauri*** *may refer to: Any of the stars (or star systems), in the constellation Centaurus, including: Alpha* ***Centauri****, a binary star including the brightest star of Centaurus. Beta* ***Centauri****, the second brightest star of Centaurus, at a much greater distance from the Sun}*. And the bodies present in Centauri space ends and the influence of sun and the bodies present in solar space starts. Though the mass of Sun is largest of the bodies present in solar space, it is the fraction of total mass of all the bodies present in solar space. The Centre of mass of the all bodies present in solar space is somewhere far away from the sun.

Let Centre of mass of all the bodies present in solar space = CM (SSB)




Sun with its family members and all the other bodies present in Solar Space are orbiting the CM (SSB). Sun is at the one of the two epicenter of Earth's orbit. Also we know that after 47000/- years earth changes its epicenter of sun comes at the SECOND epicenter of earth's orbit. This happens because the sun with its family members completes half circle around CM (SSB) in 47000/- years and one circle in 94000/ years.

As it was believed that there is a big mass body may be big black hole at the centre of our galaxy which is rotating the galaxy around itself is not true. Galaxy is rotating around the point which is the centre of mass of Galaxy. We know that 90% of visible stars are coupled star. It was believed that these are rotating around some invisible big mass body. That is also not true. These coupled stars are rotating around the common centre of mass, similarly three stars or group of stars also rotate around their common centre of mass.

The point which is common centre of Mass of earth and moon is below the surface of the earth. That is why the circular motion of the earth around that

point is not visible and is visible in the form of oscillatory motion when earth is moving in the orbit around the sun & the circular motion of moon around the point, which is common centre of mass of earth and moon appears as the moon is circling the earth.

## CONCLUSION:

In Einstein's mathematics, space has three dimensions, and the fourth dimension is time. More recent theories presume extra dimensions that we do not perceive. Space-time can be thought of as a grid or fabric. The presence of mass distorts space-time, so the rubber sheet model is a popular visualization. Relativity explains where gravity comes from. The rubber sheet model shows that gravity results from massive objects warping space-time. [1]

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