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Gravitational Centrifugal Forces – In Space and Time Curvature

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ABSTRACT:

Force is a fundamental quantity which keeps the objects stay in connects with other. Starting with two pieces of stones to millions of galaxies in the universe bounded with each other due to this force. Initially this force considered as Gravitational force and after few contradictions this mysterious force made people to think about its existence. Later on this long range force is assumed to be different in the way of its existence and the phenomenon of explanation. Centuries later, Einstein came up with his special theory of relativity to explain this theory. Among the four fundamental forces; gravitational force is the only force which has only attraction property but not repulsion. Since birth of Newton's law of gravity, it reveals gravitational force is independent of the presence of medium and moreover this law is based on speculative observations.

KEY WORDS:

Inertial mass – Gravitational mass – Black holes – Red shift – Space and Curvature - Centrifugal force

INTRODUTION:

We know that every object in this universe attracted by another object with some force. Just a few centuries difference, two great laws were emerged out with efforts two great persons to explain this force of attraction. The fundamental mathematics are played vital role to understand these laws more precisely. In spite of existence of great theory due to lack of proper mathematical support in those days Newton was unable put light on this theory. Newton mentioned separately that this force is independent of medium later on his named that force as Gravitational force. A well common known fact is that, permeability is an unrelated word for gravity. A theory of gravitation is an explanation of the long range forces that electrically neutral bodies also exert on one other because of their matter in contact. Until the 1920 Sir Isaac Newton's law of universal gravitation, two bodies attract each other with a central force proportional to the product of their masses and inversely proportional to the square of the distance between them was accepted as the correct and a complete theory of gravitation. This theory is highly accurate in its predictions regarding everyday phenomenon. However, high precision measurements of motions in the solar system, the structure of black holes and the expansion of universe can only be fully understood in terms of *relativistic theory of gravitation.* Best known of these is Einstein's general theory of relativity. This theory reduces Newton's theory in a certain limit.

Let us give a glance on the very familiar theory of Newton's gravitational and its mathematical description in different ways and verify the

assumptions of other theories regarding this gravitational force.

The force of attraction between them is directly proportional to the product of their masses an inversely proportional to square of the distance between them.

Consider two particles of masses m_1 and m_2 separated by a distance r. The force of attraction is given by $\mathbf{F \propto \frac{m_1 m_2}{r^2}}$ **or** $\mathbf{F = G\frac{m_1 m_2}{r^2}}$

Where G is the universal gravitational constant with value of $6.67 \times 10^{-11} Nm^2 Kg^{-2}$

The same Newton's law of Gravitation can deduce from ***Kepler's*** law as $\boldsymbol{F = \frac{GMm}{R^2}}$

The above formula can applicable for celestial bodies of mutual interaction. It expresses as the force exerted by the sun directly proportional to the mass of the earth and inversely proportional to the square of the distance between them.

The gravitational force affects the bodies and their masses. The physical quantity "m" (mass) played two different roles in Newton's equations. One is to determine, given force, what the acceleration of the body would be : **F = ma** (the inertial mass). Here "m" tell a body how much to accelerate to given any force. The other is to determine the intensity with which the said body experiences a gravitational force: $\boldsymbol{F = \frac{GMm}{r^2}}$ (the gravitational mass). Here "m" tells the body how much of gravitational force should it experiences and also determines how strong a gravitational force it generates.

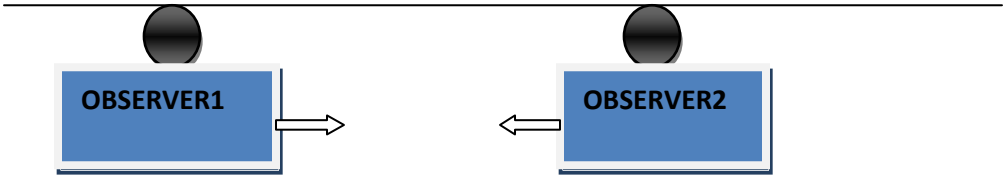
From Newton's equations we get $\boldsymbol{ma = \frac{GMm}{r^2}}$ so that $\boldsymbol{a = \frac{GM}{r^2}}$ **;** this equation determines how a body moves, which trajectory it follows, how long does it take to move from one position to another, etc. So the equality of the two "m" s was improved by Einstein and postulated *Principle of Equivalence.* This Principle of Equivalence states that the inertial and gravitational masses are identical.

As we know Newton's expression for the gravitational force between two objects depends on their masses and existence of the distance between them. But this law not added the time as another measuring parameter. The famous law of Newton's gravitation is not strictly correct but it is not accurate under some strict circumstances.

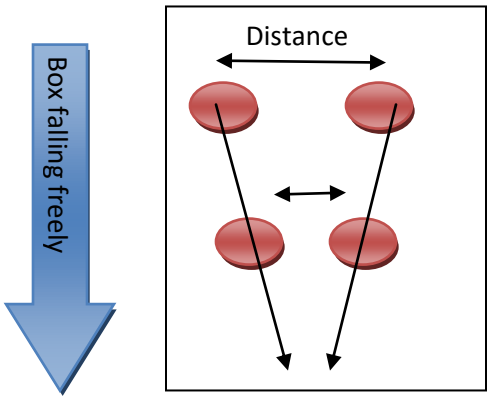
EXPERIMENTAL EXPLNATION OF EXISTANCE OF GRAVITY:

Is Gravitational force is a feeling or really existed. The following examples explain why gravitation is not a feeling. Consider a person in a room size box high above the moon. We Selected moon because, there is no air and hence no air friction on the moon. This box is taken high above the lunar surface and then let the box to fall from certain height freely. The observer inside the box does not find himself of his free fall. Observer will not feel any gravitational force of his frame of reference. He still considers himself in rest position inside the box but actually it's an assumption of him. He will realize the effect of gravitational force when the box touches the ground. According to the mentioned experiment a question arises that the gravitation is a feeling? and the answer is

NO. It is a psychological feeling of the observer in that box. A point to remember here that, apart from gravitational force, the three fundamental forces will exhibit both attraction and repulsion but come to gravitational force it's an attraction force only. To confirm gravitational force is not a feeling, lets explain an another experiment with magnetic forces with small modifications of above experiment. Let us consider two cabins are moving oppositely with each other by means of wheel on a frictionless cable (fig 1).

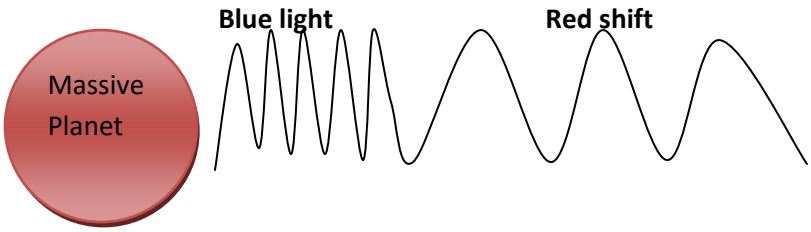


One of the cabins attached with a strong magnets with North Pole and other cabin with South Pole. Due to opposite magnetic poles of attraction, these cabins will move over the cable oppositely (forward direction). The two observers in each cabin will feel themselves in rest position and their feeling remains similar if the cabins move forwards or backwards with each other. So from above experiment we can conclude that gravitational force is not an illusion. Newton said every object in this universe will attract with each other regardless of its shape and size. To prove this, take two objects and keep them separately with each other and let them fall from certain height. Remember this experiment must conduct in a box which is at certain height from the ground. Before the box hit the ground the distance between two objects will decreases gradually, (fig2).



The gravitational force will also influence the light. According to Mass – Energy equivalence, the mass of the body obviously possess energy and vice versa. If light is an energy then it must

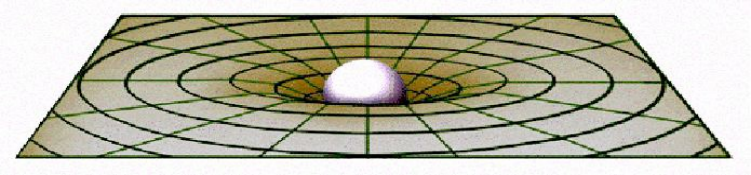
have some mass and it will bend due to gravitational force when it move towards any object. According to Einstein, he predicted that, our universe is expanding and the distances between galaxies are increasing drastically. To strengthen Einstein's prediction, scientists are assuming that either our Milky Way galaxy going far from the neighboring galaxies or all galaxies are sliding simultaneously with each other. The reason behind this prediction is due to lack of getting light from the neighboring galaxies to our galaxy. But the same time there is another reason is also came out that our universe is accompanied with many black holes. The light from the other galaxies is being absorbed by these black holes due to their huge gravitational force. Once entering the vicinity of black holes no light can escape. There is an example for bending of light due to gravity. A beam of light coming from a distant star towards earth which along the way coming close to a very massive dark object. Suppose that the star and the opaque object (massive object) are both perfect spheres. Then an observer on the earth will see, not the original star, but a *ring of stars*. This effect has been called *gravitational lensing*. Here the light from star is bending at massive object due to gravitational force. The clocks will slow down whenever gravitational force is present. The gravitational red shift takes place when frequency of the laser is larger on the planet than in deep space. The light leaving a region where strong gravity present is reddens. Here laser light maintain with long wavelength in deep space away from the massive object, fig(3).



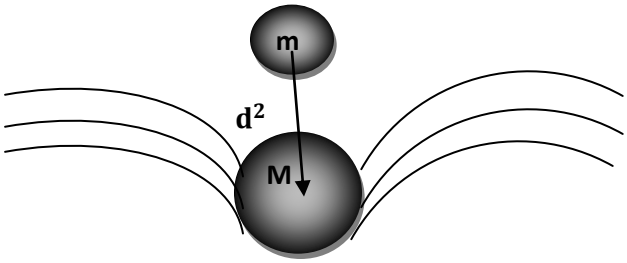
EINSTEIN'S SPACE AND TIME CURVATURE:

Space and time is in fact very far from unchanging arena envisaged by Newton's. They are dynamical objects whose properties are affected by matter and energy. The deformations of space and time in turn determine the subsequent motion of the bodies in space and time. Matter explains the curvature of the space time and space time decides how the matter moves. According Einstein's general relativity our universe is covered with space and time curvature. He explained about the space and time. It is an imaginary fabric type four dimensional medium in which all the celestial bodies will move around a massive object. Every object in this universe is wrapped with space and time curvature and by depending upon the size and mass of the object the curvature take place space. Some of the planets in our universe exist with very ignorable

space and time curvatures with ignorable gravitational forces. For simple explanation, keep a heavy metal ball at middle of the starched rubber sheet. A curved area takes place where the ball touched the rubber sheet. By leaving some small sized spheres on the curvature they move circularly around the massive object and hit that object after some time. If that rubber sheet is polished with oil then spheres takes more rotations around the massive object. But here we have to observe that the spheres will surly hit that massive object after some time. The new idea regarding gravity by Einstein's was revolutionary and it is played a vital role for newly emerging ideas about existence and clear explanation of gravitational forces. An imaginary Einstein's space and time curvature diagram is shown below fig (4).



From the previous diagram of space and time curvature it is appearing clearly that the objects around the massive object will move continuously without any collision with centered massive object. With some clear observations, the spheres around the massive object simultaneously apply an opposing force to constraint themselves to move center of the curvature. That opposing force is called *centrifugal forces* according classical mechanics. Since gravitational force is an attraction force, then the centrifugal force also acts as a gravitational force i.e., repulsion forces from other direction. To come Einstein's general theory of relativity, the earth must affected by the curvature and should fell into the deep curvature (towards the sun) but earth moving stationary along with all the other planets. Einstein and Newton's imparted their own assumptions about gravity with appropriated examples and ideas. According to my consideration the gravitation is a mixed theory of both Einstein's special theory of relativity and Newton's law of gravitation. When a heavy massive object forms a curve in space then the objects its surroundings will attracted by this curve and move around it. Let us consider the massive object with mass, M and the other objects its surroundings as $m_1, m_2, m_3 \ldots\ldots m_n$ with distance "d", then the formula forms as usual like Newton's law of gravitation. Point to remember here that, the centrifugal forces takes an action by objects on the other massive object is nothing but gravitational force from opposite side. The concept related diagram shown in below.



Bending of the Space due to massive object

CONCLUSION:

Here I am concluding that, the attraction force between the celestial bodies or any micro and macro neutral charged objects is nothing but gravitational force. But the gravitational force was assumed by Albert Einstein in different way like; it's a bent taken place in the space due to placing of heavy massive object. This heavy mass creates a curvature in which all the bodies including celestial bodies come in contact with each other. In spite of number of theories I concluded that Newton's law of gravitation is correlates with Einstein's theory of relativity. By gluing Newton's law of gravitation formula with Einstein's theory of relativity it forms an says gravitational force is not only a attraction force but also repulsion.

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