Universe Expands, Light moves

Dhiren Sampat

ABSTRACT

This theory establishes that Universe is expanding in shape of sphere and our galaxy is located at mid-point between center of universe and outmost layer of universe. Light moves alongwith universe expansion. $E = mc^2$ is actually a velocity equation ($E = ½ Mv^2$), where c is the velocity at which our galaxy is moving away from center of universe. The reason $E = mc^2$ and not $½ mc^2$ is explained in Section 8. Our Galaxy is moving away at speed of c from center of universe. Hubble's constant, speed of gravitational force equaling speed of light support this proposition as explained in Section 3. Section 5 lists down evidences showing that Theory of relativity and theory of general relativity can not be true. Section 7 explains fundamental propositions why speed of light remains same irrespective of speed of observer, reason why speed of light does not depend on speed of source of light and Reason behind time dilation.

Key Words: $E = mc^2$, Rate of Universe Expansion, Theory of General Relativity, Theory of Special Relativity, Kinetic Energy,

Author Details

Dhiren M. Sampat

Email:- dmsampat@rediffmail.com

sampatdm@gmail.com

Mobile:- + 91 9892105890

Phone: +91 22 28021109

INTRODUCTION

There are three fundamental questions related to speed of light:

1. From where light photon which does not have even **intrinsic mass** gets energy to move at speed of 299,792 km /second.
2. Why the speed of gravitational force which is based on **mass** of an object is same as the speed of light.
3. When mass is released as energy why the energy released is related to speed of light (c) ($E = mc^2$).

What is the significance of speed of light in these cases? or is it that all these are related to one common source (universe expansion) and hence derive speed / energy from the same.

This theory provides explanations for above. This theory also provides explanations for:

1. Speed of light remains constant irrespective of speed of the observer
2. Reason why speed of light does not depend on speed of source of light
3. Reason behind Time Dilatation at higher speed and Gravitational Time Dilatation, and
4. Real reason behind $E = mc^2$

This theory also analyses two fundamental postulates of 'Theory of General Relativity' and 'Theory of Special Relative' i.e. (1) Nothing can travel faster than light and (2) Time is relative and depends on speed of the object and evidences suggesting that these postulates cannot be true.

1. UNDERSTANDING EXPANSION OF UNIVERSE, LOCATION OF MILKY WAY GALAXY AND ITS IMPACT ON SPEED OF LIGHT

A. Understanding Expansion of Universe and location of our ('MILKY WAY') Galaxy in Universe

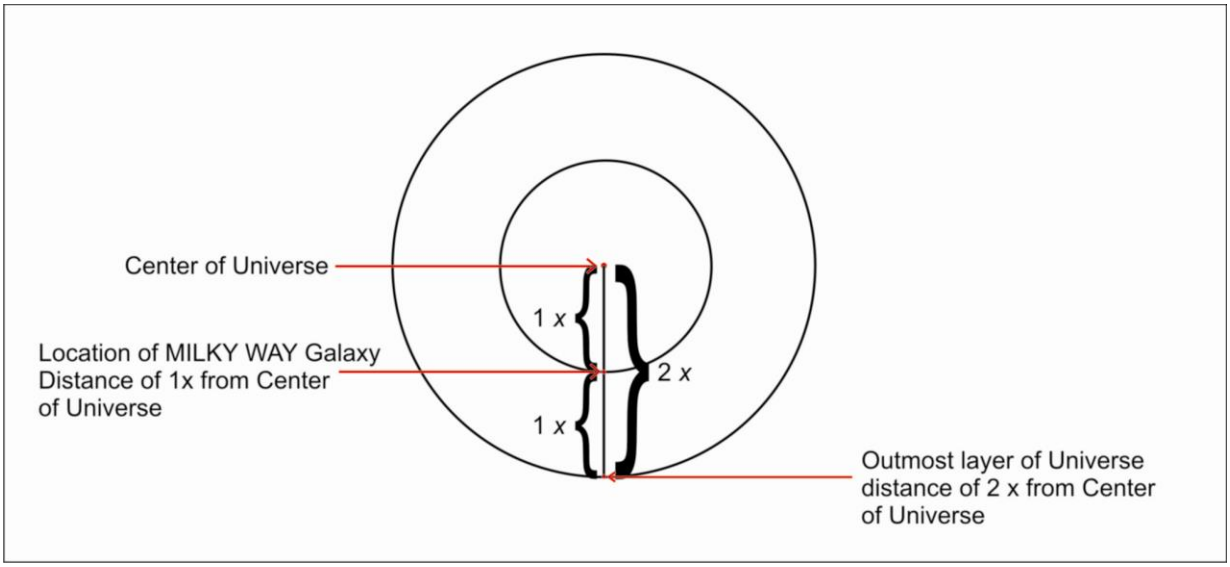
After the big bang universe started expanding in all directions **[1].** We can think of this expansion as a sphere (like rubber ball) which is being stretched in all directions and thus expanding. The galaxies including the galaxy in which we reside move away from the 'center of universe' (i.e. location of the big bang) on account of universe expansion. The speed at which galaxy would be moving away from the center of universe, is related to the rate at which universe is expanding and the position of galaxy with respect to the 'center of universe' and the 'outmost layer of universe'. This can be explained with the help of following figures:

FIGURE 1

UNIVERSE AT THE TIME OF BIG BANG

Figure 1 represents universe at the time of big bang. Now let us analyse Universe after big bang at lapse of time T

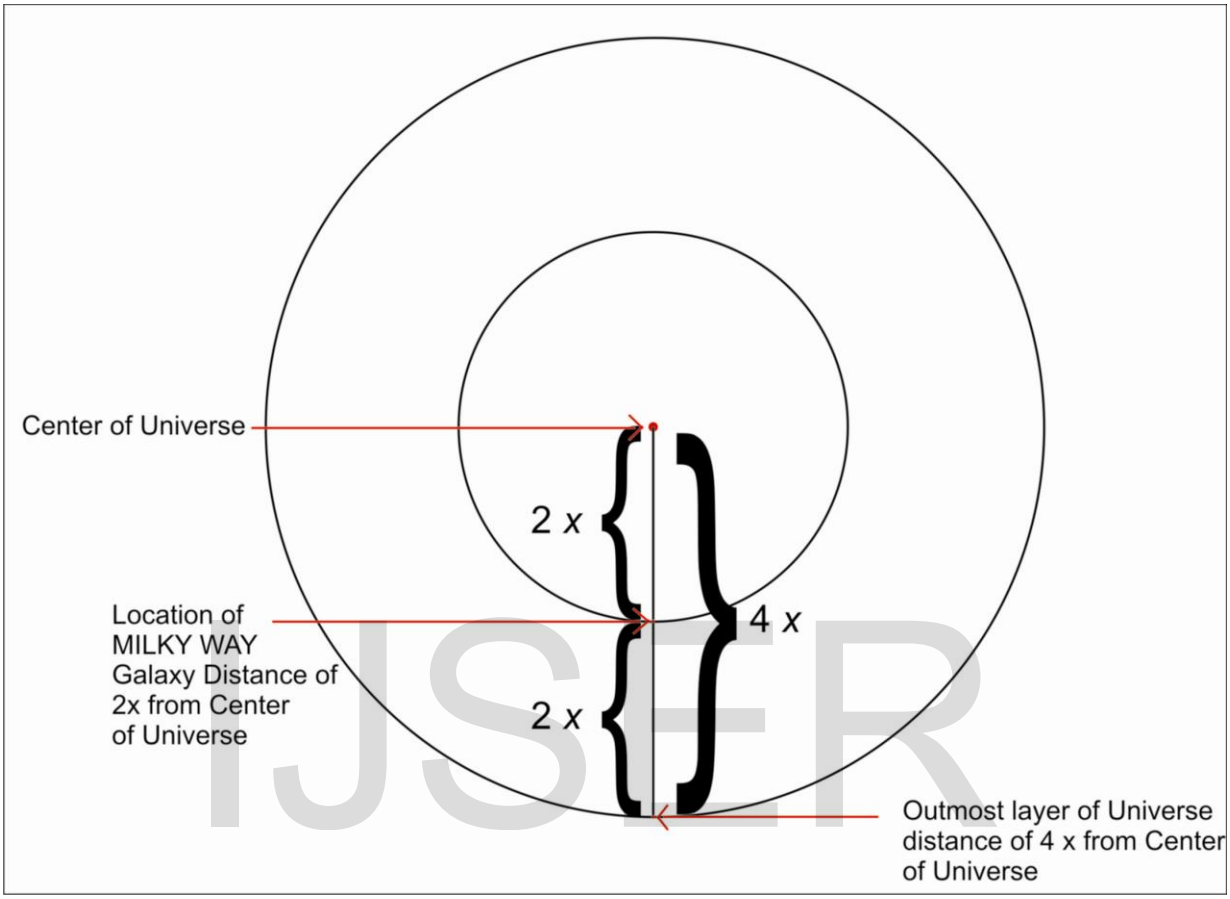
FIGURE 2



UNIVERSE AFTER LAPSE OF TIME T

Figure 2 represent the Universe after lapse of time T where universe is expanding at the rate of 2x per time of T (at this point to keep things simple we will not assign value to x and T). MILKY WAY galaxy which is lying at the mid point of the 'center of universe' and the 'outmost layer of universe' would have moved x on account of expansion of universe by 2x as shown in Figure 2. Let us have figure showing position at the time of 2T.

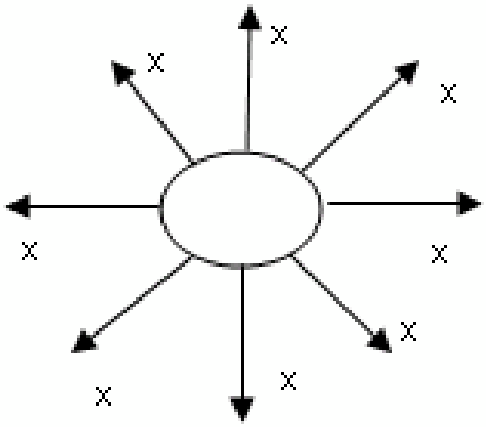
FIGURE 3



UNIVERSE AFTER LAPSE OF TIME 2T

As shown in Figure 3 universe would have expanded to 4x and position of our galaxy would be at 2x. Thus the universe is expanded ('stretched') at the rate of x per T on both sides of MILKY WAY galaxy i.e. side which is towards 'center of universe' as well as side which is towards 'outmost layer of universe'. When we apply this to sphere (like rubber ball) it can be analyzed that universe would have stretched at the rate of x in all directions with respect to galaxy as shown in Figure 4

FIGURE 4



EXPANSION OF UNIVERSE WITH RESPECT TO GALAXY

B. Implication of Universe Expansion on Speed of Light and Speed of Gravitational Force

On account of this expansion (stretching), light photon which does not have any intrinsic mass moves along with universe expansion in all directions. Other objects including us, which have basic mass remain attached to the galaxy on account of gravitational force and hence do not move along with the universe expansion in the manner light photon moves.

As explained above, x is the speed at which universe is expanding in all directions with respect to galaxy, which we measure as speed of light, which is 299,792 km/s. As can be seen from above figures, location of the MILKY WAY galaxy changed from x to 2x per T. Therefore, the MILKY WAY galaxy is also moving at the speed of x per T, which is approximately 299,792 km/s. As explained later in **Section 4 B**, gravitational force of the MILKY WAY galaxy also moves with our galaxy at the same the speed as speed of our galaxy. Thus we observe speed of light and speed of

gravitational force as same.

2. EVIDENCES SUPPORTING SHAPE OF UNIVERSE EXPANSION AND LOCATION OF MILKY WAY GALAXY IN UNIVERSE

In the above section, we made the following propositions regarding Shape of Universe Expansion, location of the MILKY WAY Galaxy and Speed of MILKY WAY galaxy:

1. Universe is expanding in shape of Sphere
2. Our Galaxy is located at the mid-point of center of universe and outmost layer of universe
3. Our Galaxy is moving at speed of approximately 299,792 km/s on account of universe expansion.

In this section we will evaluate evidences supporting Shape of Universe expansion and the location of our galaxy at the mid-point of the center of universe and the outmost layer of universe. In the following section we will evaluate evidences supporting speed of MILKY WAY galaxy.

There are two strong evidences to suggest that universe is expanding in sphere (like rubber ball) and our galaxy is at the mid point of center of universe and outmost layer of universe.

A. Hubble's constant

Newton discovered that when light from the sun passes through a triangular-shaped piece of glass, called a prism, it breaks up into its component colors (spectrum) as in a rainbow. By focusing a telescope on an individual star or galaxy, one can similarly observe the spectrum of the light from that star or galaxy. Moreover, we find that certain very specific colors are missing from stars'

spectra and these missing colors may vary from galaxy to galaxy. In 1920s, astronomers began to look at the spectra of stars in other galaxies, they found something most peculiar: there were the same characteristics sets of missing colors as for stars in MILKY WAY Galaxy, but they were all shifted by the same relative amount toward the red end of the spectrum.

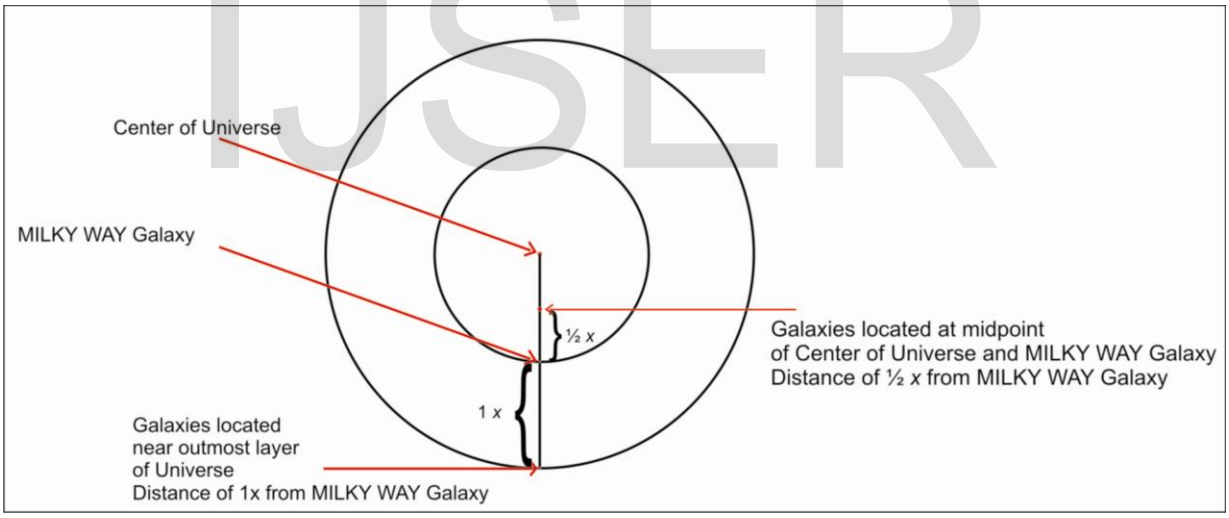
Visible light consists of fluctuations, or waves, in the electromagnetic field. The frequency (or number of waves per second) of light is very high, ranging from four to seven hundred million waves per second. The different frequencies of light are what the human eye sees as different colors, with the lowest frequencies appearing at the red end of the spectrum and highest frequencies at the blue end. Now imagine a source of light at a constant distance from us, such as a star, emitting waves of light at a constant frequency. Obviously the frequency of the waves we receive will be the same as the frequency at which they are emitted. Suppose now that the source starts moving toward us. When the star emits the next wave crest it will be nearer to us, so the time that wave crest takes to reach us will be less when the star was stationary. This means that time between the two wave crests reaching us is smaller, and therefore the number of waves we receive per time (i.e. frequency) is higher than when the star was not moving. Correspondingly, if the source is moving away from us, the frequency of the waves we receive per time will be lower. Therefore, if galaxy is moving towards us then their spectra would be blue-shifted and conversely if galaxy is moving away from us then their spectra would be red-shifted. This relationship between frequency and distance is called **Doppler Effect.**

In the years following proof of existence of other galaxies, Hubble spent his time cataloging their distances and observing their spectra. At that time most people expected the galaxies to be moving around randomly, and so expected to find as many blue-shifted spectra (i.e. galaxies moving towards MILKY WAY Galaxy) as red-shifted (i.e. galaxies moving away from MILKY WAY Galaxy) ones. It was quite a surprise, therefore, to find that most of galaxies appeared red-shifted: nearly all were moving away from our galaxy! More surprising still was the finding that Hubble

published in 1929: even the size of a galaxy's red shift is not random, but it is directly proportional to the galaxy's distance from our galaxy. Or, in other words, the farther a galaxy is, the faster is moving away! **[2]**

Value of Hubble constant being directly proportional to the galaxy's distance from our galaxy reinforce our understanding that universe is expanding in sphere (like shape of rubber ball) and our galaxy is at mid point of 'center of universe' and 'outmost layer of universe' otherwise value of Hubble's constant could not have been constant (i.e uniform). This is only possible in structure like sphere where our galaxy is at midpoint of 'center of sphere' and 'outmost layer of sphere'. This can be further elaborated with the help of following figures

FIGURE 5

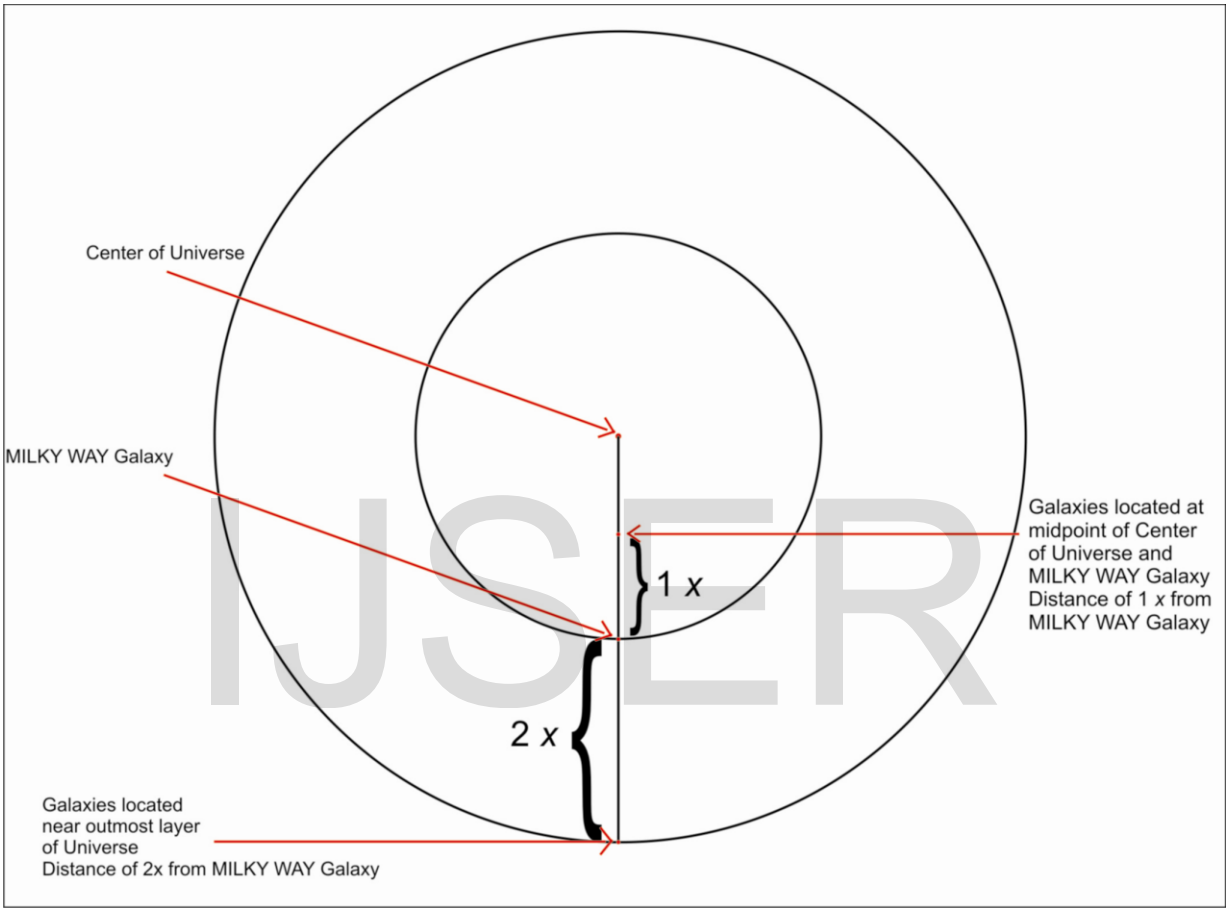


UNIVERSE AFTER LAPSE OF TIME T

Figure 5 represents Universe after lapse of time T (similar to figure 2 as shown above). Here we will analyse distance with respect to two galaxies, one Galaxy located at distance of ½ X from MILKY WAY Galaxy and the other Galaxy located near outmost layer of Universe i.e at distance

of 1 X from MILKY WAY galaxy. Now let us analyse distances of these galaxies from MILKY WAY galaxy after lapse of time 2 T.

FIGURE 6



UNIVERSE AFTER LAPSE OF TIME 2T

Figure 6 represents Universe after lapse of time 2T (similar to figure 3 as shown above). Galaxies which were located at distance of ½ X after lapse of time T are now located at distance of 1 X after lapse of time 2T i.e. distance has increased by ½ X between those Galaxies and MILKY WAY Galaxy. Similarly Galaxies which were located at distance of 1 X after lapse of time T are now at distance of 2 X after lapse of time 2T i.e distance has increased by 1 X between those Galaxies and

MILKY WAY Galaxy. Thus, as noted by Hubble and as stated above in first paragraph Galaxy's red-shift is directly proportional to the galaxy's distance from our ('MILKY WAY') galaxy. When we apply this to sphere shape Universe this would be applicable to all galaxies located in various directions at various distances. We can also derive this by using formula as given below:

We know that

Velocity of recession (v) = Hubble constant (H) x distance (r)

If we assume the value of Hubble constant as 1 at the time of T. Then velocity of recession (v) of galaxies which are at distance of ½ X would be ½ X, similarly, velocity of recession (v) of galaxies which are at distance of X would be X. Thus, Galaxy's red-shift is directly proportional to galaxy's distance from MILKY WAY galaxy.

B. Cosmic Microwave Background Radiation (CMBR)

Cosmic background radiation is well explained as radiation left over from an early stage in the development of the universe, and its discovery is considered a landmark test of the Big Bang model of the universe. With a traditional optical telescope, the space between stars and galaxies (the background) is completely dark. However, a sufficiently sensitive radio telescope shows a faint background glow, almost exactly the same in all directions, that is not associated with any star, galaxy, or other object **[3]**. The CMB temperature on the sky is remarkably uniform. At the level of 1 part in 1000, the CMB temperature varies.

Both Hubble's constant and CMBR strongly support that universe is expanding in sphere (like rubber ball) and our galaxy is at mid point of center of sphere (universe) and outmost layer of

universe. If universe was not expanding like sphere and our galaxy would not have been at mid-point of center of sphere (universe) and outmost layer of universe, these would not have been possible.

3. EVIDENCES SUPPORTING SPEED OF OUR GALAXY

As stated above our Galaxy is moving away from center of universe at the speed of approximately 299,792 km/s. Let us study evidences we have supporting speed of our galaxy:

A. Measuring speed of our Galaxy through Hubble's constant

As stated in Section 3, Hubble discovered that most of galaxies appeared red-shifted i.e. nearly galaxies are moving away from MILKY WAY galaxy! Even the size of a galaxy's red shift is not random, but it is directly proportional to the galaxy's distance from our galaxy. Or, in other words, the farther a galaxy is, the faster is moving away! Hubble's constant gives us rate at which other galaxies are receding from our galaxy. **We can use this data point to calculate rate at which our galaxy is receding from center of universe i.e. speed of our galaxy in universe.**

Presently Hubble's constant value is estimated to be about 70 kms-1 Mpc-1, **[4].** It is stated that distance of our galaxy from center of universe is equal to 1.40×10^{10} light years or about fourteen thousand million light years. Therefore velocity of recession (i.e. speed of our galaxy) from center of universe is given by

Velocity of recession (v) = Hubble constant (H) x distance (r) **[5]**

$$v = \frac{70\ km/s}{1\ Mpc} * 1.4 * 10^{10}\ light\ years$$

We are aware that 1Mpc = 3,260,000 light-years **[6]**

Replacing value of 1 Mpc in above equation we get

$$v = \frac{70\ km/s}{3{,}260{,}000\ light\ years} * 1.4 * 10^{10}\ light\ years$$

v = 70 km /s * 4294.48

v = 300,613.6 km/s

This shows that velocity of recession of our galaxy (i.e speed of our Galaxy) from center of universe is 300,613.6 km/s. This is approximately the same speed as we stated speed of our galaxy above (Refer **Section 2 B**). It may be noted that Hubble's constant is approximate number and hence it may not give exact number.

B. Speed of gravitational force

As stated by 'Theory of General Relativity' the speed of gravitational waves is equal to the speed of light in vacuum **[7].** Even experiments have confirmed speed of gravity approximately equal to speed of light. Gravity is curvature in space. Speed of this curvature should be related to the speed of object ('galaxy') which is causing this curvature. Imagine a heavy ball rolling on rubber mattress. Curvature caused by this ball on rubber mattress is similar to gravity. Speed of the curvature caused by this ball is exactly equal to speed of ball. If ball moves at the speed of 1 km/s

then curvature also will move alongwith ball at the same speed. Similarly speed of gravitational waves is equal to speed of our galaxy.

As stated above, Milky Way galaxy moves at speed of approximately 299,792 km/s on account of universe expansion. Curvature caused by Milk Way also moves at the same speed alongwith Milky Way Galaxy.

To analyze this further let us have a case where a particular galaxy is moving at speed of 100,000 km/s then speed of curvature ('gravity') caused by that Galaxy would be 100,000 km/s. If the speed of gravity of that galaxy is not 100,000 km/s but is equal to the speed of light i.e. 299,792 km/s then it may lead to situation where galaxy is at one location in universe while curvature caused by that galaxy (gravity) is at different location in Universe which can not be possible. Speed of Gravitational force of our Galaxy which is equal to the speed of light gives us strong evidence that our galaxy is moving at the speed of approximately 299,792 km/s in universe.

C. Energy generated by stars of Milky Way galaxy

As explained in **Section 2B**, velocity of MILKY WAY galaxy on account of universe expansion is approximately 299,792 km /s (v). Kinetic Energy is related to mass (M) and velocity of mass (v). Mass requires energy to attain velocity. Therefore when mass is released as energy, energy generated is related to mass (M) and velocity of mass (v). This is in line with law of conservation of energy which states that **the total amount of energy in an isolated system remains constant over time.** If energy generated is not related to velocity of mass (v) but to speed of light (c), then the above law can not be complied with. Therefore energy generated by Stars of MILKY WAY galaxy is on account of velocity of MILKY WAY galaxy on account of universe expansion i.e. $E = Mv^2$.

If we analyse carefully the way **$E = mc^2$** is derived we can make out that E refers to Energy of **light** photon and m refers to mass of **light** and not the mass of the **object** and c as we are aware refers to speed of **light** in $E = mc^2$. Therefore,

E (Energy of **light** photon) = m (mass of **light**) * c^2 (where c is speed of **light**)

Now replacing **light** with an **object** in above equation we have

E (Energy of **object**) = M (mass of **object**) * v^2 (where v is speed of **object**)

Thus, $E = mc^2$ is nothing but equation of kinetic energy which is

E (Energy of object) = M (mass of object) * v^2 (where v is velocity of object)

This has been explained in detail in **Section 8.**

5. REVIEW OF EXISTING THEORIES (THEORY OF SPECIAL RELATIVITY AND THEORY OF GENERAL RELATIVITY) AND EVIDENCES SUGGESTING WHY THESE THEORIES DO NOT REFLECT CORRECT PICTURE

Two fundamental postulates of 'Theory of Special Relativity' and 'Theory of General Relativity' are

1. Nothing can travel faster than light

2. Time is relative and depends on speed of object

Following evidences/ analysis suggest that these do not reflect correct picture.

A. Time which is measured based independent source will remain universal for all observers irrespective of speed of observers:

To understand this let us have a case of three observers, A, B and C. A – who is staying in New York city and not moving i.e. speed of zero. B – who is traveling in a train which is moving around New York city at 10% of speed of light and C – who is traveling in a space rocket with a speed of 10% of speed of light i.e. same speed as speed of B. Day/ year for A and B, who both are in New York city will be same, **Earth's orbital speed will not change for B even if B is traveling at 10% of speed of light.** Earth will complete one Day/ Year in same time for A and B. Thus **planetary time will run universally** for A and B.

Now let us analyze what will happen to C. If time depends upon speed of observer than time will be same for B and C as both B and C are traveling at the same speed that is 10% of speed of light. As explained above, planetary time for B is same as planetary time for A, which means planetary time for A and C is also same. Thus time **which is measured based on independent source is universal for all observers irrespective of speed of observers.**

To understand this further let us have one more analysis. We know that since ancient time, time is measured based on movement with respect to SUN. Let us have a case of two observers A and B who assemble at centre of New York City. It is obvious that both observers will see SUN at same angle. Post that A decides to sit at that location i.e. speed of zero while B takes train which is rotating that place at speed of 10% of speed of light. Once SUN is exactly overhead at that location

B stops and sits besides A. Now at that point both A and B will observe SUN at same the location even though B in the interim period has traveled at the speed of 10% of speed of light. If both A and B observe SUN at the same location at the time of start of experiment and at the end of experiment despite A not moving while B moving in the interim period at 10% of speed of light, can we say that time is relative and depends on the speed of the observer? Answer is obviously no. Planetary time runs universally for all observers irrespective of speed of observers. **Section 7 D** explains reasons behind time dilation at higher speed.

B. Gravitational Time Dilation argument in support of theory of General Relativity

Following argument is given in support of Theory of General Relativity '*There are identical atomic clocks at the Royal Observatory in Greenwich England and the National Bureau of standards in Boulder Colorado. The one in Greenwich England ticks 5 microseconds / year slower than the one in Boulder Colorado which is predicted by General Relativity given their one mile difference in altitude. The clocks are accurate to 1 microsecond / year so the difference cannot be a result of error.'* **[8]**

However since years, duration of day/ year remains same at both the locations. If this is the case, can we say that time runs differently at both locations? or time runs slower near high gravitational field? The answer as explained in **Section 7 D** is when gravitational mass increases; speed of clock slows down on account of increase in mass. However, **it may be noted that the slower movement would be applicable for that clock only**. This will not have any impact on time which is measured based on independent source.

It is known fact that universe is expanding with time. If time slows down near high gravitational field as per theory of relativity then time should stop near black hole. Therefore, universe should not expand with respect to black holes. It is known fact that there is a large black hole at center of

all galaxies. As a result of universe expansion all galaxies are moving. If time is relative then black hole should remain at the same place in universe since time stops near high gravitational field as per theory of Relativity. But as we are aware entire galaxy (including black holes in galaxies) move with universe expansion at the same rate. This proves that time does not depend on Gravitation.

C. OPERA Experiment which later confirmed that neutrinos did not travel at speed exceeding speed of light

Although this argument is given in support of 'Theory of Special Relativity', if we carefully analyze the above experiment we can make out that fundamental postulates of 'Theory of General Relativity' and 'Theory of Special Relativity' cannot be true. Let us understand this in detail.

We are aware that speed of light is 299,792 km/s. Imagine a particular object (object O) is moving at 99% of speed of light. Therefore speed of object O would be 299,792 km/s * 99% which is 296,794 km/s. If object O starts its journey from point P1 at speed of 296,794 km/s, after one second object O would be at distance of 296,794 kms from point P1, we will refer this as point P2.

If time is relative and depends on speed of object as stated by 'Theory of Special Relativity' then clock which is at rest (speed of zero) will measure different time. We will denote such clock as clock (at rest). Let us calculate time which would be measured by clock (at rest) when Object O traveled from point P1 to point P2 i.e. distance of 296,764 km.

Formula for time dilation as per 'Theory of Special Relativity' is given by

$t = t_0 / (1-v^2/c^2)^{1/2}$ **[9]**

where: t = time observed in the other reference frame

t_0 = time in observers own frame of reference

v = the speed of the moving object

c = the speed of light in a vacuum

In our example, v = 0.99c, t_0 = 1 second

We will solve this for t which will give us time observed by clock (at rest)

$t = 1/(1- (0.99c)^2/c^2)^{1/2}$

$t = 1/(1- 0.99^2)^{1/2}$

t = 1/ 0.141067

t = 7 seconds (approximately)

Therefore, as per clock (at rest) object O travelled distance of 296,764 kms in 7 seconds i.e. at a speed of 42,399 km /s (296,794 kms / 7 seconds).

Thus, as per 'Theory of Special Relativity' different observers who are travelling at different speed will measure different speed. In above case, clock (at rest) will measure speed of 42,399 km/s as the speed of object which is travelling at 99% of the speed of light. In other words if clock (at rest) measures speed of more than 42,399 km/s then actually the object is travelling more than 99% of speed of light.

In OPERA experiment clock (at rest) measured that neutrinos travelled at the speed of light i.e. at speed of 299,792 km/s. Clock measuring neutrino's speed were not moving (clock (at rest)). If clock (at rest) measured speed of neutrino same as speed of light then neutrino's clock should have measured lower time since neutrinos were travelling at high speed. In the above experiment clock (at rest) measured that neutrinos traveled distance of 731.278 kms in 0.00243928457 seconds i.e. speed of 299,792 km/s **[10].**

Let us compute in this case how much time would have been measured as per neutrinos' clock.

$t = t_0 / (1-v^2/c^2)^{1/2}$

$0.00243928457 = t_0 / (1- (0.9999c)^2/c^2)^{1/2}$**(note 1)**

$0.00243928457 = t_0 /(1- .9999^2)^{1/2}$

$0.00243928457 = t_0 / 0.01414$

$t_0 = 0.00003449$

Thus, as per neutrino's clock, neutrino traveled distance of 731.278 km in 0.00003449 seconds, i.e speed of 21,202,609.45 km /s which is far exceeding speed of light, if time is relative as stated by 'Theory of Special Relativity'.

(note 1) It is assumed that neutrinos travelled at the speed of 99.99% of the speed of light and not at 100% of the speed of light, else as per postulates of theory of the special relativity time would be zero and speed would be infinite which is not true in any case.

Let us analysis two fundamental postulates of 'Theory of Special / General Relativity '

1. Nothing can travel faster than light
2. Time is relative and depends on speed of object

In above case, if time is relative and depends on the speed of object then actually neutrinos travelled at speed of 21,202,609.45 km /s which is far exceeding speed of light which cannot be true since as per 'Theory of Special Relativity' nothing can travel faster than light. Thus, it can be analyzed that either of the above postulate is not true.

It can be argued that relativity of time and hence speed should be applicable for light also and hence if measured from light's clock, light also would have travelled at very high speed, however, 'Theory of Special/ General Relativity' mention that speed of light remains uniform for all observers irrespective of speed of observer. In fact, this is one of the basic proposition on which 'Theory of Special Relativity' and 'Theory of General Relativity' are based.

D. Analysis suggesting time is not relative in Universe

If time is relative as stated by Theory of Special/ General Relativity then speed also becomes relative since speed is nothing but distance travelled / time.

As a consequence of the universe expansion all galaxies are moving away from the center of universe (i.e. location of big bang). Say if particular galaxy is moving at speed of 99.99% of the speed of light and if time is related to the speed of the object then time for object (galaxy) moving at such a high speed should slow down. One of the consequences of time, on account of the universe expansion is, galaxy should move away from the 'center of universe' with elapse of time, but if time is relative, time should slow down at such high speed and hence galaxy should move away from 'center of universe' at slow speed. Both these i.e. time getting **slower** on account of the **high speed** of galaxy and simultaneously galaxy moving at **slow speed** on account of time running **relatively slower** are contradictory.

To understand this let us have case of Galaxy G which is moving away from center of universe at speed of 299,792 km / second (i.e. same speed as speed of light) and an observer C who is at center of universe. As per 'Theory of Special Relativity' time should stop for galaxy which is travelling at the speed of light. Therefore, Galaxy G should be at the same location since even one second has not been elapsed for the Galaxy G. Observer C after lapse of one second (for observer C) should

see Galaxy G at the same location since time has stopped for Galaxy G. Hence according to observer C speed of Galaxy is actually zero since even after one second for Observer C, Galaxy G has remained at the same location, however, time has stopped for Galaxy G since it is traveling at speed of light. Both these i.e. time getting **slower** on account of the **high speed** of galaxy and simultaneously galaxy moving at **slow speed** on account of time running **relatively slower** are contradictory and cannot be true.

It is observed that some galaxies are moving away from MILKY WAY galaxy approximately at speed of light. If these galaxies are moving away from our galaxy at speed of light there is no reason to believe that some of these galaxies might have been moving away from the center of universe at the speed of light or higher than the speed of light. As explained above, if time is relative then time should stop when the speed of galaxy equals the speed of light. Consequently, galaxy should stay at the same location, but if Galaxy remains at the same location then speed slows down to zero since speed is nothing but distance travelled / time. Both these i.e. time getting **slower** on account of **high speed** of galaxy and simultaneously galaxy moving at **slow speed** on account of time running **relatively slower** are contradictory and cannot be true.

The above analysis / evidences suggests postulates of 'Theory of Special Relativity / Theory of General Relativity' are not correct.

6. EXPERIMENTS ON SPEED OF LIGHT

Physics theories of the late 19th century assumed that just as surface water waves must have an intervening substance, i.e. a "medium", to move across (in this case water), and

audible sound requires a medium to transmit its wave motions (such as air or water), so light must also require a medium, the "luminiferous aether", to transmit its wave motions. Because light can travel through a vacuum, it was assumed that even a vacuum must be filled with aether. Since the speed of light is so great, and as material bodies pass through the aether without obvious friction or drag, the aether was assumed to have a highly unusual combination of properties. Designing experiments to test the properties of the aether was a high priority of 19th century physics.

Earth orbits around the Sun at a speed of around 30 km/s or over 108,000 km/hr. The Sun itself is travelling about the Galactic Center at an even greater speed, and there are other motions at higher levels of the structure of the universe. Since the Earth is in motion, it was assumed that, Earth and the aether are in relative motion, implying that a so-called "aether wind" should exist. Although it would be possible, in theory, for the Earth's motion to match that of the aether at one moment in time, it was not possible for the Earth to remain at rest with respect to the aether at all times, because of the variation in both the direction and the speed of the motion. At any given point on the Earth's surface, the magnitude and direction of the wind would vary with time of day and season. By analysing the return speed of light in different directions at various different times, it was thought to be possible to measure the motion of the Earth relative to the aether. The expected relative difference in the measured speed of light was quite small, given that the velocity of the Earth in its orbit around the Sun was about one hundredth of one percent of the speed of light.

During the mid-19th century it was thought that it should be possible to measure aether wind effects of first order, i.e. effects proportional to v/c (v being Earth's velocity, c the speed of light). But no direct measurement of the speed of light was possible with the accuracy required.

Michelson-Morley Experiment

The Michelson–Morley experiment was performed in 1887 by Albert Michelson and Edward

Morley. It attempted to detect the relative motion of matter through the stationary luminiferous aether ("aether wind"). Michelson calculated that an aether windspeed of only one or two miles a second would have observable effects in this experiment, so if the aether windspeed was comparable to the earth's speed in orbit around the sun, it would be easy to see. In fact, nothing was observed. The light intensity did not vary at all. Some time later, the experiment was redesigned so that an aether wind caused by the earth's daily rotation could be detected. Again, nothing was seen. Finally, Michelson wondered if the aether was somehow getting stuck to the earth, like the air in a below-decks cabin on a ship, so he redid the experiment on top of a high mountain in California. Again, no aether wind was observed.

The only possible conclusion from this series of very difficult experiments was that the whole concept of an all-pervading aether was wrong from the start. In fact, new theoretical insight into the nature of light had arisen in the 1860's from work of Maxwell, who had written down a set of equations describing how electric and magnetic fields can give rise to each other. He had discovered that his equations predicted there could be waves made up of electric and magnetic fields, and the speed of these waves, deduced from experiments on how these fields link together, would be 299,792 km /second. This is, of course, the speed of light, so it is natural to assume that light is made up of fast-varying electric and magnetic fields. But this leads to a big problem: Maxwell's equations predict a definite speed for light, and it is the speed found by measurements. But what is the speed to be measured relative to? The whole point of bringing in the aether was to give a picture for light resembling the one we understand for sound, compressional waves in a medium. The speed of sound through air is measured relative to air. If the wind is blowing towards you from the source of sound, you will hear the sound sooner. If there isn't an aether, though, this analogy doesn't hold up. So what does light travel at 299,792 km /second relative to?

There is another obvious possibility, which is called the emitter theory: the light travels at 299,792

km /second relative to the source of the light. The analogy here is between light emitted by a source and bullets emitted by a machine gun. The bullets come out at a definite speed (called the muzzle velocity) relative to the barrel of the gun. If the gun is mounted on the front of a tank, which is moving forward, and the gun is pointing forward, then relative to the ground the bullets are moving faster than they would if shot from a tank at rest. The simplest way to test the emitter theory of light, then, is to measure the speed of light emitted in the forward direction by a flashlight moving in the forward direction, and see if it exceeds the known speed of light by an amount equal to the speed of the flashlight. Actually, this kind of direct test of the emitter theory only became experimentally feasible in the nineteen-sixties. It is now possible to produce particles, called neutral pions, which decay each one in a little explosion, emitting a flash of light. It is also possible to have these pions moving forward at 185,000 miles per second when they self destruct, and to catch the light emitted in the forward direction, and clock its speed. It is found that, despite the expected boost from being emitted by a very fast source, the light from the little explosions is going forward at the usual speed of 299,792 km /second. In all experiments it was observed that **speed of light does not depend on speed of source of light**.

All experiments on speed of light concluded following fundamental propositions with respect to speed of light

1. Speed of light remains constant irrespective of speed of observer
2. Speed of light does not depend on speed of source of light

In the following Section we will understand reasons behind these fundamental propositions.

7. UNDERSTANDING FUNDAMENTAL PROPOSITIONS

Following propositions have always posed challenges and couple of theories (including ‘Theory of

Special Relativity' and 'Theory of General Relativity') were developed explaining these propositions. Let us understand each of these propositions:

A. Speed of light remains constant irrespective of speed of observer

As explained above, presently universe is expanding approximately at the rate of 2x (599,584kms) per T (second). Milky Way galaxy on account of universe expansion moves approximately at the rate of 299,792 km/s. Further universe around our galaxy expands at the rate of 299,792 km/s in all directions. As a result, light moves in all directions at the speed of 299,792 km/s. Speed of universe expansion with respect to galaxy would be same irrespective of speed of observer therefore the speed of light remains constant irrespective of the speed of observer.

To understand this, let us have an experiment where speed of light is measured as light travels from point A to point B. As explained above, on account of universe expansion (stretching), space between points A to B is being stretched at the rate of 299,792 km/s. All objects including us, which have basic mass remain attached to galaxy on account of gravitational force and hence do not move along with universe expansion. However, light photons which do not have intrinsic mass moves along with this expansion(stretching) at the same rate. As a result, rate of the universe expansion with respect to galaxy would be measured as speed of light irrespective of the speed of point A and / or point B.

B. Speed of light does not depend on speed of source of light

We are aware that the speed of light in vacuum is 299,792 km/s. If any object is moving at the speed of say 100 km/s then the speed of light emitting from object remains at 299,792 km/s and

does not increase or decrease depending on direction to 299,892 km/s or 299,692 km/s respectively. Let us understand reason for the same.

When we say that an object is moving, actually mass of that object is moving. Light photon does not have intrinsic mass. A particle which is not having intrinsic mass will not carry attributes (such as speed) of object which are related to mass. To understand this, say if mass object is wet, light photon emitting from that object will not be wet. If mass has a particular odor, mass less particle (light photon) will not carry that odor (odor is spread through air which has mass and not through light photon). In case of color also there is contrast in attribute between object and light photon emitting from the object. Wavelength of color which is **not absorbed** by object ('mass') is seen as color of the object. In the same manner, massless light photons do not carry speed attribute of mass. In fact none of the attribute of mass like (shape, taste, vibration, color, odor, etc) would be carried by massless light photon. Accordingly speed of light does not depend on speed of source of light.

C. Dual Characteristics of Light Photons

A mystery surrounding light in nineteenth century was whether light is particle or wave. Now it is settled that light has dual characteristics i.e both particle and wave. Let us understand why dual characteristics. Light is made up of large number of photons. A I-watt night light emits a billion billion each seconds. These photons move alongwith universe expansion in all directions. This explains dual character of light which are particle and move as wave alongwith universe expansion in all directions.

D. Reason behind Time Dilatation at higher speed and Gravitational Time Dilatation

With increase in speed of clock, gravitational mass of clock increases **[11],** resulting in relatively slower movements of clock. However, **it may be noted that the slower movement would be applicable for that clock only**. This will not have any impact on time which is measured based on independent source.

The phenomenon is same as with increase in weight more energy is required to achieve the same speed. However, if energy is kept constant than the speed slows down. This can be explained with the help of the following example. Say if two motors – motor A and motor B are running at the speed of 50 kms per hour. If weight of motor A is increased while keeping other factors constant, speed of motor A slows down compared to speed of motor B. Similarly, in case of two clocks, clock A and clock B, when the mass of clock A is increased, the speed of clock A slows down.

To analyse this further let us have a case where we are measuring time based on a traditional clock which has a minute arm and an hour arm. Mechanics of the clock is built such that at set interval particular energy moves minute arm and an hour arm. If mass of the clock is increased then obviously energy falls short and accordingly the speed of the clock slows down. Similarly in atomic clock due to increase in mass; the speed of oscillation slows down. However, it cannot be construed as time slows down.

The same effect is also observed near high gravitational field where on account of the increase in gravitational mass, the speed of clock slows down; however, as explained in **Section 5A** this will not have any impact on the time which is measured based on independent source. Therefore, time at the top of mountain will be same as at bottom of mountain even though speed of clock may slow down at bottom of mountain on account of increase in gravitational mass. If we measure time at both locations based on solar clock, time will exactly be the same. Day / Year would be same at

both locations and will not differ even by fraction of second although speed of clock at respective locations may differ on account of change in the gravitational mass.

8. UNDERSTANDING $E = mc^2$ AND EVALUATING WHETHER ENERGY GENERATED IS ON ACCOUNT OF $E = Mv^2$ OR ON ACCOUNT OF $E = mc^2$

A. Implication of Universe Expansion on Energy Generation

As explained in **Section 2B**, our galaxy is moving on account of universe expansion at the rate of approximately 299,792 km /s (v). Kinetic Energy is related to mass (M) and velocity of mass (v). Mass requires energy to attain velocity. Therefore when mass is released as energy, energy generated is related to mass (M) and velocity of mass (v). This is in line with law of conservation of energy which states that **the total amount of energy in an isolated system remains constant over time.** If energy generated is not related to velocity of mass (v) but to the speed of light (c), then the above law can not be complied with. Thus above equation needs to be changed to $E = Mv^2$ where v is velocity of mass. It may be noted that result would be same since as explained above masses (our galaxy) on account of universe expansion are moving at speed of approximately 299,792 km/s.

If we read carefully the way $E = mc^2$ is derived we can make out E refers to Energy of **light** photon and m refer to mass of **light** and not mass of object in $E = mc^2$ and c as we are aware refers to speed of **light**. Therefore $E = mc^2$ is nothing but $E = Mv^2$ this is explained further in **Section 7 B.**

B. $E = mc^2$ is nothing but kinetic energy formula

(i) Deriving Kinetic energy formula

Newton's Second Law states that 'The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.'

This verbal statement can be expressed in equation form as follows:

$$\mathbf{A = F_{net} / M}$$

Where

A = Acceleration

F = Force

M = Mass

We can rearrange above equation as

Force = Mass * Acceleration **[12]**

$$F = M * A$$

Where F represents net force, M = Mass of object

and A = Acceleration which is Velocity (v)/ time (t) i.e. $A = v / t$

We know that, Distance (D) is velocity (v) * time (t) i.e. $D = v * t$

Kinetic Energy ('E') is force multiplied by distance, therefore,

$$E = F * D$$

$$E = M * A * D \text{ (since } F = M * A \text{ as stated above)}$$

Therefore,

$$E = M * v / t * vt \text{ (replacing value of A and D stated above)}$$

$$E = M * v^2$$

(ii) Why $E = Mv^2$ and not $½ Mv^2$

A question may arise that formula for kinetic energy is $½ Mv^2$ and not Mv^2. Let us understand why in this case Mv^2 and not $½ Mv^2$. Kinetic energy formula of $½ Mv^2$ is arrived based on average velocity, that is, velocity starting with zero and velocity reaching its peak and thus average velocity is ½. Thus value of D in such case is ½ * v * t. However in this case, velocity of our galaxy continues to be same i.e. approximately 299,792 km/s and hence average velocity is also v and not ½ v. Hence in this case kinetic energy equation would be Mv^2.

(iii) Test for $E = Mv^2$ and not $E = mc^2$

Energy generated by a star is related to $E = Mv^2$ where v is speed of object ('galaxy'). As explained above speed ('velocity') of galaxy is related to rate at which universe is expanding and position of galaxy with respect to the 'center of universe' and the 'outmost layer of universe'. Velocity of stars located near center of universe should be low since their position is near the center (Refer Figure 2 and Figure 3 as shown above), conversely, velocity of

stars which are located near the outmost layer of the universe should be high in fact it would be approximately 599,584 km/s (i.e. 2x as explained in **Section 2**) and hence energy generated in such case also should be higher.

Eridanus Supervoid or Great Void may be pointing towards the center of universe since Cosmic Microwave Background Radiation (CMBR) might have spread from this region to other regions of universe on account of universe expansion. If Eridanus Supervoid region represents area near center of universe in that case energy generated by stars of galaxies in that region should be very low on account of low velocity of galaxies of that region from center of universe. However, presently we do not have much data point by which we can conclude the proposition that energy generated is different for different galaxies based on velocity of galaxy. May be in future when we have data pertaining to rate of energy generated by stars from different galaxies we will actually be able to confirm that actually energy generated is on account of Mv^2 and not on account of $E = mc^2$.

C. Analyzing how $E = mc^2$ was derived

If we read carefully the way **$E = mc^2$** is derived we can make out that E refers to Energy of **light** photon and m refers to mass of **light** and not mass of object and c as we are aware refers to the speed of **light** in $E = mc^2$. Therefore,

E (Energy of **light** photon) = m (mass of **light**) * c^2 (where c is thespeed of **light**)

Now replacing **light** with an **object** in the above equation we have

E (Energy of object) = M (mass of **object**) * v^2 (where v is speed of **object**)

Thus, $E = mc^2$ is nothing but equation of kinetic energy which is

E (Energy of object) = M (mass of object) * v^2 (where v is velocity of object)

I am listing below in *italic*s derivation of $E = mc^2$ as given by Einstein based on stationary box example **[13]**

'First, imagine a stationary box floating in deep space. Inside the box, a photon is emitted and travels from the left towards the right. Since the momentum of the system must be conserved, the box must recoils to the left as the photon is emitted. At some later time, the photon collides with the other side of the box, transferring all of its momentum to the box. The total momentum of the system is conserved, so the impact causes the box to stop moving.

Unfortunately, there is a problem. Since no external forces are acting on this system, the centre of mass must stay in the same location. However, the box has moved. How can the movement of the box be reconciled with the centre of mass of the system remaining fixed?
There must be a 'mass equivalent' to the energy of the photon. In other words, the energy of the photon must be equivalent to a mass moving from left to right in the box. Furthermore, the mass must be large enough so that the system centre of mass remains stationary.

For the momentum of photon, we will use Maxwell's expression for the momentum of an electromagnetic wave having a given energy. ***If the energy of the photon is E*** *and the speed of light is c, then the momentum of the photon is given by:*

$$p_{photon} = \frac{E}{c} \tag{1.1}$$

The box, of mass M, will recoil slowly in the opposite direction to the photon with speed v. The momentum of the box is:

$$p_{box} = Mv \tag{1.2}$$

The photon will take a short time, Δt, to reach the other side of the box. In this time, the box will have moved a small distance, Δx. The speed of the box is therefore given by

$$v = \frac{\Delta x}{\Delta t} \tag{1.3}$$

By the conservation of momentum, we have

$$M\frac{\Delta x}{\Delta t} = \frac{E}{c} \tag{1.4}$$

If the box is of length L, then the time it takes for the photon to reach the other side of the box is given by:

$$\Delta t = \frac{L}{c} \tag{1.5}$$

Substituting into the conservation of momentum equation (1.4) and rearranging:

$$M\Delta x = \frac{EL}{c^2} \tag{1.6}$$

Now suppose for the time being that the photon has some mass, which we denote by m. *In this case the centre of mass of the whole system can be calculated. If the box has position x_1 and the photon has position x_2, then the centre of mass for the whole system is:*

$$\bar{x} = \frac{Mx_1 + mx_2}{M + m} \tag{1.7}$$

We require that the centre of mass of the whole system does not change. Therefore, the centre of mass at the start of the experiment must be the same as the end of the experiment. Mathematically:

$$\frac{Mx_1 + mx_2}{M + m} = \frac{M\left(x_1 - \Delta x\right) + mL}{M + m} \tag{1.8}$$

The photon starts at the left of the box, i.e. $x_2 = 0$. So, by rearranging and simplifying the above equation, we get:

$$mL = M\Delta x \tag{1.9}$$

Substituting (1.4) into (1.9) gives:

$$mL = \frac{EL}{c^2} \tag{1.10}$$

Rearranging gives the final equation:

$$E = mc^2$$

Now see the two lines highlighted above in Underlined and Bold '***If the energy of photon is E'*** and '***now suppose for the time being that the photon has some mass, which we denote by m'.***

Thus E refers to Energy of **light** photon and m denotes mass of **light** in $E = mc^2$. Therefore equation can be explained as below:

E (Energy of **light**) = m (mass of **light**) * c^2 (where c is speed of **light**)

Now replacing light with an object in above equation we have

E (Energy of **object**) = M (mass of **object**) * v^2 (where v is the speed of **object**)

Thus, $E = mc^2$ is nothing but equation of kinetic energy which is

Energy of **object** = M (mass of **object**) * v^2 (where v is the velocity of **object**)

D. Analyzing components of $E = mc^2$

i. Analyzing m in $E = mc^2$

As explained above m in $E = mc^2$ refers to mass of light and not mass of the object. To analyze further let us have a case where we have two objects M1 (large mass) and M2 (small mass) if energy generated is related to mass of light and not mass of the object then when mass is released as energy, energy generated by M1 and M2 should be equal since m in $E = mc^2$ refers to mass of light and not mass of the object. However, it is known fact that when large mass is released as energy,

energy generated is higher compared to small mass.

ii. Analyzing c in $E = mc^2$

To analyze c in $E = mc^2$ let us have case of two objects, object A (with velocity of 10% of speed of light and object B with velocity zero). If energy generated is as per $E = mc^2$ then in both cases energy generated should be equal since $E = mc^2$ states that energy generated is related to mass of light and speed of light, irrespective of velocity of object. If energy generated for object A and object B is same despite velocity of object A being higher then where does extra energy on account of high velocity go to? In this case it may be argued that with increase in velocity gravitational mass increases and hence actually object A would generate higher energy, however, in above para we analyzed that m in $E = mc^2$ does not refer to mass of object but actually it refers to mass of light.

The above analysis suggests that actually energy released is on account of $E = Mv^2$ and on account of velocity of our galaxy which is approximately 299,792 km/s and not on account of speed of light.

9. UNDERSTANDING GRAVITY

A. Newtonian gravitation

Newton described gravity as a force that attracts things that have mass. Newton's idea was that planets are held in their orbits around the Sun by a force due to the mass of the Sun and the planets, and that force is always pointing inwards (i.e. planets get pulled in the direction of the Sun, and the Sun gets pulled in the directions of the planets). His famous formula (F=Gm1m2/r^2), has been

successfully used for hundreds of years to describe the (approximate) orbits of the planets around the Sun, and the (approximate) trajectories of things like spacecraft. Newton's formulation of a gravitational force law requires that each particle with mass respond **instantaneously** to every other particle with mass irrespective of the distance between them. Therefore the theory assumes the speed of gravity to be **infinite**. This assumption was adequate to account for all phenomena with the observational accuracy of that time. It was not until the 19th century that an anomaly in astronomical observations which could not be reconciled with the Newtonian gravitational model of instantaneous action was noted: the French astronomer Urbain Le Verrier determined in 1859 that the elliptical orbit of Mercury precesses at a significantly different rate than is predicted by Newtonian theory. **[14]**

B. Gravity as per Einstein

Einstein, on the other hand, stated that all things with mass (including the Sun, Earth, and the rest of the planets) cause spacetime to curve and that this curvature is an alteration in the geometry of spacetime. The direction of the curvature tends to point toward the center of the largest nearby mass. Additionally, if there are no external forces acting upon an object (even those without any mass such as photons) then that object will simply follow its natural path (geodesic) through the altered geometry of the local spacetime - regardless of the degree of curvature of that local spacetime. Planets are merely following the curvature of spacetime caused mostly by the mass of the Sun and to a lesser degree the mass of the planets. Further, the speed of gravitational waves in the general theory of relativity is equal to the speed of light in vacuum, c.

With these propositions precession of Mercury was accurately predicated by 'Theory of General Relativity'. Accordingly, now it is settled proposition that Gravity as per theory of general relativity reflects proper picture rather than Newtonian Gravity.

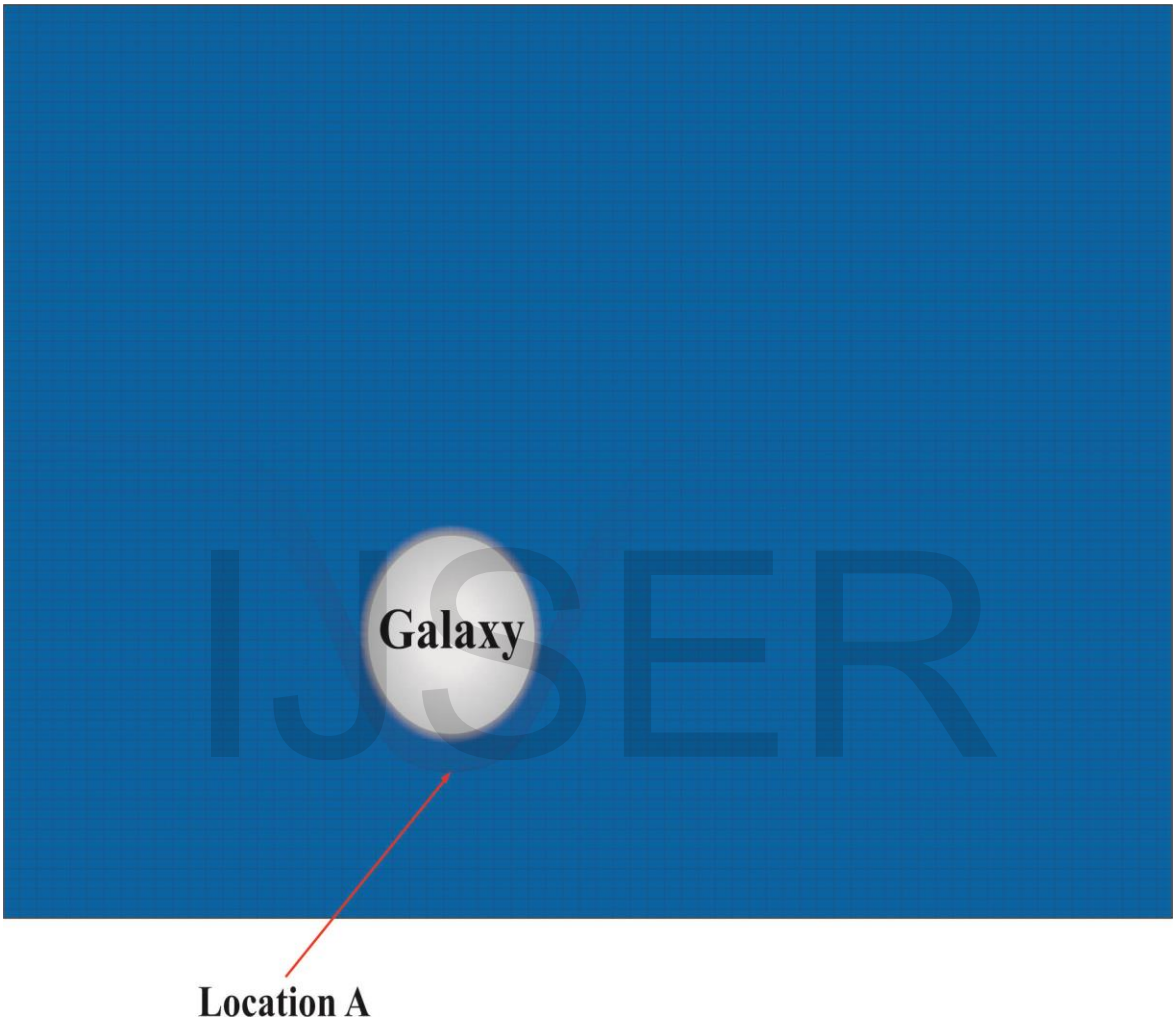
C. Analysing Gravity

There are two elements in Gravity. One element is object causing curvature and the other element is matter on which curvature is caused. Take the example of heavy ball moving on rubber mattress. In such case we have heavy ball which is causing curvature and rubber mattress on which curvature is formed.

As stated above since there are two elements in gravity, Speed of gravity is related to two aspects. One speed of object causing gravity and the other elasticity of matter on which gravity is formed. Let us understand elasticity of gravity, in case of a heavy ball moving on rubber mattress, Elasticity of gravity can be understood as time rubber mattress will take to get back to original shape once ball is removed from rubber mattress. Similarly, in case of gravity caused by Galaxy on space, elasticity of gravity can be understood as time within which curvature will disappear once object causing curvature disappears.

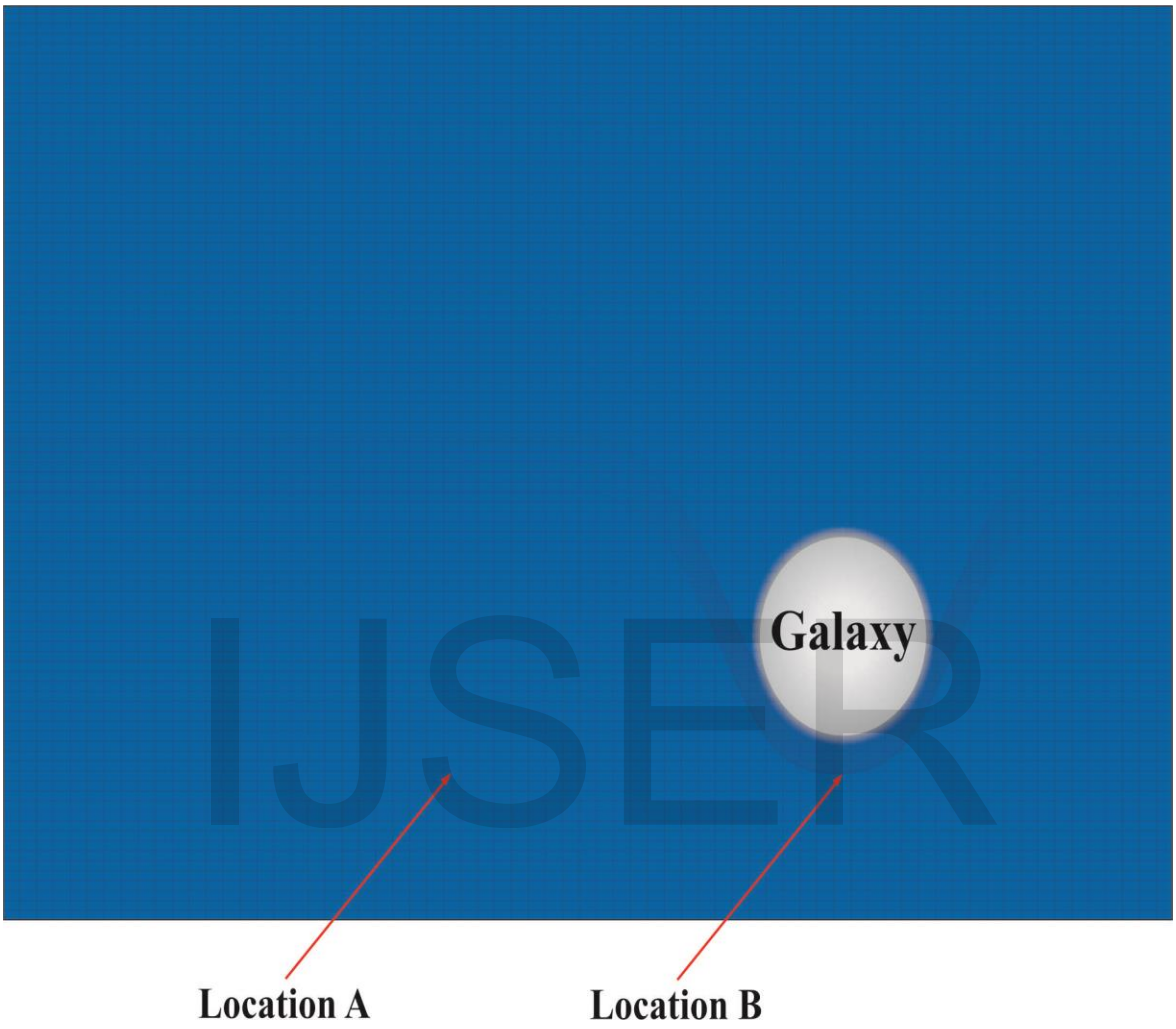
This can be elaborated with following figures

FIGURE 7



As shown in figure 7, Galaxy is at Location A and gravity i.e 'curvature caused by galaxy' is also at Location A. Now let us analyse location of gravity once Galaxy moves from Location A to Location B as shown in Figure 8.

FIGURE 8



It can be observed that curvature has shifted from Location A to Location B. Time taken by curvature to move from Location A to Location B is exactly equal to time taken by Galaxy to move from Location A to Location B. Thus, Speed of gravity is exactly equal to speed of Galaxy. Further, in Figure 8 we can observe that there is no curvature at Location A. Time taken for curvature to disappear depends on elasticity of matter on which curvature is formed. In case of perfect (infinite) elasticity, curvature will disappear as soon as object causing gravity disappears.

There are two strong evidences which suggest that elasticity of space is infinite:

1. Uniform Cosmic Microwave Background Radiation (CMBR) CMBR as stated in **Section 3 B** suggests that elasticity of space is infinite. In early days universe expanded at speed far exceeding speed of light despite this CMBR is uniform in universe. This strongly suggests that elasticity of space is infinite.

2. If elasticity of space would not have been infinite, movement of object on Space would have caused frictions (resistance). Take example of a heavy ball moving on mattress 1 and mattress 2. Mattress 1 is perfectly elastic and mattress 2 is less elastic. If other things are equal, Ball which is rolling on mattress 2 will observe some friction and will slow down faster compared to ball rolling on mattress 1. In case of our galaxy / planetary objects if elasticity of space would not have been infinite, resistance would have slowed down movement of galaxy / planetary objects a long ago. However, as this is not the case, we can conclude that elasticity of space is infinite.

Thus we can conclude that Elasticity of space is infinite i.e. as soon as object causing curvature disappears, curvature will disappear **instantaneously.** Newton was correct when he stated that gravitational field instantaneously adjusts. The other aspect of gravity i.e. Speed of gravity refers to speed at which gravitational force is moving. In our above example, of heavy ball moving on rubber mattress, speed of curvature caused by ball is exactly equal to speed of ball. Similarly, in case of MILKY WAY Galaxy, since MILKY WAY Galaxy is moving at speed of approximately 300,000 km/s on account of universe expansion gravitational force of MILKY WAY galaxy is also moving at same speed i.e. 300,000 km/s.

It may be noted that elasticity of gravity is not related to speed of gravity. Imagine a stationary heavy ball on rubber mattress. Since ball is not moving curvature is also not moving, however, if ball is removed from rubber mattress, mattress will go back to original shape. The time rubber mattress will take to go back to original shape depends on elasticity of the mattress.

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Author Details

Dhiren M. Sampat

604, Krishana Heights,

Mathuradas Ext Road,

Kandivali (w)

Mumbai – 400 067

Maharashtra, India

Email:- dmsampat@rediffmail.com

sampatdm@gmail.com

Mobile:- + 91 9892105890

Phone: +91 22 28021109