THE EVALUATION OF SPACE – TIME: SPACE – TIME IS LINEAR (STRAIGHT HORIZONTAL LINE) AT ABSOLUTE FREE SPACE WHERE AS SPACE – TIME IS NON – LINEAR (CURVATURE) IN THE PRESENCE OF MASSES AND / OR ENERGY.

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https://doi.org/10.26782/jmcms.2019.12.00008

Abstract

An ideal free space or an absolute free space is devoid of any mass and / or energy. According to scientific discovery on astronomy, an ideal free space or an absolute free space does not exist, thus, it is a theoretical abstraction only, can be taken as reference condition (an ideal condition) for evaluation of the nature of space – time. This paper focuses on the evaluation of space – time; space – time is linear (straight horizontal line at an ideal free space or an absolute free space) in space – time plane. Space – time is non – linear (a curvature) in space – time plane. A general space – time equation is proposed and its simulation results are analyzed with proper reasoning and conclusion is derived based on the theory proposed and simulation results outcome.

Keywords : Absolute free space, Astronomy, Space – time plane, Linear and Non – linear, Simulation

I. Introduction

Theory1: Without any mass and / or energy, a free space is an ideal free space or an absolute free space. An ideal free space or an absolute free space is devoid of any mass and / or energy.

Theory2: The space – time is linear (a flat horizontal line at an ideal free space or an absolute free space) in the space – time plane.

Theory3: The space – time is non – linear (a curvature in the presence of mass and / or energy) in the space – time plane.

Theory4: The effect of curvature space – time in the presence of mass and / or energy is that it covers less straight distance compared to the linear space – time. As a result, observer like human being (who can only recognize straight distance) sees that space is contracted and time is slowed down (time dilation).
Theory 5: Space contraction and time dilation are observer dependent realism only. Because observer like human being does not recognize arc distance. The observer like human being can only understand straight distance.

Theory 6: The space – time is a complex plain where space is the real axis and time is the imaginary axis. The space – time can be explained with the help of complex number theory.

The space – time is linear (a straight horizontal line) at an ideal free space or an absolute free space [I, II]. The space – time is a non – linear (curvature) under the influence of mass and / or energy [III, IV]. Thus, mass and / or energy make space contraction as well as time dilation. The space contraction and time dilation is limited by the observer like human being who does not understand arc distance, he only understand straight distance. Due to the limitation of observer, he feels space contraction and time dilation due to influence of mass and /or energy. According to Einstein [V, VI],

\[ ds^2 = -c^2 dt^2 + dL^2 \]

Suppose, the space – time of a mass \( m_e \) is \( dt_{m_e} \), then, the general equation of space – time can be written as

\[ dt_{m_e} = t_0 + K_e \frac{m_e m_e}{d_e^2} ds + K_1 \frac{m_e m_1}{d_1^2} ds + K_2 \frac{m_e m_2}{d_2^2} ds + K_3 \frac{m_e m_3}{d_3^2} ds \] (1)

\[ dt_{m_e} = t_0 + \sum_{i=1}^{M} K_i \frac{m_e m_i}{d_i^2} ds \] (2)

Suppose, \( m_e \) is the mass of the Earth and \( dt_{m_e} \) is the space – time of the Earth. \( m_1, m_2, m_3 \) are the astronomical bodies around Earth at a distance \( d_1, d_2, d_3 \) respectively.

\( d_e \) is the diameter of the Earth.

\( M \) must be a finite number because at \( M \) infinity, \( d_i \) also goes to infinity.

\( K_0, K_e, K_1, K_2, K_3 \) are Universal constants.

The space – time of an ideal free space or an absolute free space is when \( m_e \)is zero, then, the equation 1 becomes

\[ dt_0 = t_0 + K_e \frac{0 \times 0}{d_e^2} ds + K_1 \frac{0 \times m_1}{d_1^2} ds + K_2 \frac{0 \times m_2}{d_2^2} ds + K_3 \frac{0 \times m_3}{d_3^2} ds \] (3)

\[ dt_0 = t_0 \] (4)

Thus, space – time of an ideal free space or an absolute free space is always a constant. It is a horizontal straight line in the space – time plane which suggests that the time is a constant at anywhere in an ideal free space or an absolute free space [VII, VIII, IX].
II. The Space – Time

Suppose, $m_e$ is the mass of the Earth and $dt_{m_e}$ is the space – time of the Earth.

All masses $m_1, m_2, m_3$ are the astronomical bodies around Earth at a finite distance (no mass at a infinite distance)

$d_e$ is the diameter of the Earth.

$K_0, K_e, K_1, K_2, K_3$ are Universal constants.

The space – time of earth with no planet at a finite distance, then, the equation 1 becomes

$$\frac{dt_{m_e}}{d_e^2} = t_0 + K_e \frac{m_0 \times m_e}{d_e^2} ds + K_1 \frac{m_0 \times m_1}{a_0^2} ds + K_2 \frac{m_0 \times m_2}{a_0^2} ds + K_3 \frac{m_0 \times m_3}{a_0^2} ds + (5)$$

$$dt_{m_e} = t_0 + K_e \frac{m_0 \times m_e}{d_e^2} ds$$

(6)

Thus, space – time of Earth with no masses at the finite distance is given by equation 6.
The plot 1 shows space – time in the free space, plot 2 shows space – time on Earth due to earth itself (equation 6), plot 3 shows space – time on earth due to Moon (it is 1/100000 times less than the Earth itself), plot 4 shows the space – time on Earth due to Jupiter (1/100000 times less than the moon), plot 5 and 6 shows space – time on Earth due to Uranus and Neptune which are also 1/100000 times less than the Moon.

The space – time on Earth due to Sun is

\[
dt_{ms} = t_0 + K_s \frac{m_e m_s}{\Delta s^2} ds
\]

(7)

Where, masses \(m_s\) is the mass of Sun and \(m_e\) is the mass of Earth

\(d_s\) is the distance of Sun from Earth

\(K_s\) is Universal constants.

If all universal constants are taken as 1, space – time on Earth due to Sun comes 1/100000 times less than the Moon. (Around \(10^{-34}\) which close to the Jupiter or Uranus or Neptune).
The Space – time of Earth with one mass at a finite distance (say Moon), the space – time looks like

\[ dt_{me} = t_0 + K_e \frac{m_e m_m}{d_e^2} dt + K_1 \frac{m_e m_1}{d_1^2} dt \]

(8)

The Space – time of Earth with two masses at a finite distance (say Moon, Mars), the space – time looks like

\[ dt_{me} = t_0 + K_e \frac{m_e m_m}{d_e^2} dt + K_1 \frac{m_e m_1}{d_1^2} dt + K_2 \frac{m_e m_2}{d_2^2} dt \]

(9)

From equation (1) to (9) and the experimental data of figure 2 & 3, we can observe that smaller distance is the dominant contributor over mass in the shape of space – time. Earth itself is the dominant contributor in the shape of space – time of Earth. Next dominant contributor of space – time on Earth is Moon (1/100000 times less than the Earth itself). The Sun, Jupiter, Uranus, Neptune are almost similar contributor of Space – time on Earth (1/100000 times less than the Moon). It is because of two reasons, generally distance is way more larger than the masses in the Universe. Secondly, distance contributes as square while mass contributes as power one to the shape of space – time. That is why Moon is more effective over Sun, Jupiter or Saturn for the shape of space – time of Earth even Moon has much smaller mass than Sun, Jupiter and Saturn. Because Moon is very near to Earth, even it has smaller mass, it contributes much more than other massive astronomical bodies in the solar system to shape the shape of the space – time of Earth.

Fig 3. The figure shows figure 2 with titles or captions of experiment
If we add all astronomical bodies of solar system to shape the space–time of Earth (by adding all plots of figure 2), it will roughly look like elliptical. Thus not only Earth contributes in shape of space–time on Earth, all astronomical bodies contribute more or less in the shape of space–time on Earth. Even astronomical bodies outside solar system also contributes, but these are very insignificant due to higher distances.

![Fig 4. The flat space–time of free space versus curved space–time of Earth](image)

**III. Conclusion**

Without any mass and/or energy, a free space is an ideal free space or an absolute free space. An ideal free space or an absolute free space is devoid of any mass and/or energy. The space–time is linear (a flat horizontal line at an ideal free space or an absolute free space) in the space–time plane. The space–time is non-linear (a curvature in the presence of mass and/or energy) in the space–time plane. The effect of curvature space–time in the presence of mass and/or energy is that it covers less straight distance compared to the linear space–time. As a result, observer like human being (who can only recognize straight distance) sees that space is contracted and time is slowed down (time dilation). Space contraction and time dilation are observer dependent realism only. Because observer like human being does not recognize arc distance. The observer like human being can only understand straight distance. The space–time is a complex plain where space is the real axis and time is the imaginary axis. The space–time can be explained with the help of complex number theory. If we add all astronomical bodies of solar system to shape the space–time of Earth, it will roughly look like elliptical. Thus not only Earth contributes in shape of space–time on Earth, all astronomical bodies contribute more or less in the shape of space–time on Earth. Even astronomical bodies outside solar system also contributes, but these are very insignificant due to higher distances.
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