The slowdown of empty space with time "deceleration" can replace dark energy hypothesis

Mohammed Abdelwhab*

***Correspondence:**
Mohammed Abdelwhab
Husseiny Villa, Station Street,
Edfu 81718, Egypt
Phone number: 01008491085
E-mail: mohamed_abdelwhab1987@yahoo.com

Abstract

It is known that space expands at an increasing rate. In this paper we find that phenomenon of space expansion with accelerated rate can be well explained and understood if we postulate that "empty space have a velocity and its velocity is decreased or slowdown with time, this deceleration makes the meter in past is contracted with respect to the meter in present and second in past is dilated with respect to the second in present. The slowdown of space itself means that length contraction and time dilation are decreased with time, the decreasing in length contraction is observed as space expansion because the light travels from the more contracted space to the less contracted space, while decreasing in time dilation of the universe is observed as time speedup because the light travels from a space with more dilated time to another space with less dilated time. Motion of space itself with different velocities opens the door in front of a new branch of relativity called "empty space relativity" that is refer to change of scales of length and time of the empty space along the timeline of the universe.

Keywords

Expansion of space, accelerating rate of expansion, dark energy, time and length of non inertial frames

Introduction

Edwin Hubble discovered that light from remote galaxies was red shifted, the more remote galaxies, the more shifted was the light coming from them, it is now understood that the space is expanding, carrying the galaxies with it, and causing this observation. Then physicists discovered that space is expanding at an accelerating rate according to advanced observations. The source of acceleration is currently unknown; physicists have postulated the existence of dark energy. Dark energy is unknown form of energy that tends to accelerate the expansion of the universe. The failure of many attempts to find a direct evidence or advanced knowledge about dark energy is considered the motivation of this paper. We find that expansion of space and its acceleration rate can be easily explained if we postulate the two following principles considered herein:

- Space itself moves with a velocity that is decreased with time.
- As speed of light is limited, the observers in the moving space can't observe the current velocity of space itself (that equals zero with respect to the observers), rather it observes the past velocity of the empty space (that equals more than zero with respect to the observers) where the more space interval the more velocity of space.

The two previous postulates refers to that empty space is a non inertial frame. A non inertial reference frame is a frame of reference that is undergoing acceleration or deceleration with respect to an inertial frame, acceleration is the rate of change of velocity with time while the negative acceleration is called deceleration that is refer to slowdown of velocity of the moving body with time. Negative acceleration can refer to speeding up of the moving body if the velocity was already negative to begin where the acceleration points in the same direction as the velocity.

Results

Expansion of space with accelerated rate

Space moved with respect to what? this is the usual question if anyone suppose that space is moving, we find the motion of empty space with decreased velocity with time never be observed or measured by observers exist inside the moving empty space if light have infinity or unlimited speed, but as speed of light is limited, the observer can't observe the current empty space that its velocity equals zero with respect to him, rather he observes the previous or the past version of empty space that its velocity differs from the velocity of the current empty space, thus with respect to the observer in the stationary empty space frame of reference, the past empty space is moving where the more distant empty space is moving with more velocity than the less distant empty space. The change in velocity of the empty space leads to change in values of length contraction of it with respect to the observer at rest and as the velocity of the empty space is decreased with time, length contraction of moving empty space is decreased with time also. By this method, the observer at rest finds the length of the empty space increased with time.

The value of the contracted length of the moving empty space with respect to the stationary empty space (l_c) can be determined as,

$$l_c = l' - l, \quad (1)$$

Where (l') denotes the length of the moving space in its frame of reference, while (l) denotes the length of the moving space with respect to the stationary space frame of reference,

$$l_c = l' - \frac{l'}{\gamma},$$

$$l_c = l'\left(1 - \frac{1}{\gamma}\right), \quad (2)$$

So with respect to the stationary space of reference, the rate of change in length contraction of the moving space with time $(l_c)_{rate}$ is given by,

$$(l_c)_{rate} = \frac{(l_c)_2 - (l_c)_1}{t'}, \quad (3)$$

$$(l_c)_{rate} = \frac{\left[l'\left(1 - \frac{1}{\gamma_2}\right)\right] - \left[l'\left(1 - \frac{1}{\gamma_1}\right)\right]}{t'},$$

$$(l_c)_{rate} = \frac{\left(l' - \frac{l'}{\gamma_2}\right) - \left(l' - \frac{l'}{\gamma_1}\right)}{t'},$$

$$(l_c)_{rate} = \frac{l' - \frac{l'}{\gamma_2} - l' + \frac{l'}{\gamma_1}}{t'},$$

$$(l_c)_{rate} = \frac{\frac{l'}{\gamma_1} - \frac{l'}{\gamma_2}}{t'},$$

$$(l_c)_{rate} = \frac{l_1 - l_2}{t'}, \quad (4)$$

And as velocity of space decreased,

$$v_1 > v_2,$$

We find,

$$\gamma_1 > \gamma_2,$$

$$l_1 < l_2, \quad (5)$$

Thus the value of the change in length contraction with time $(l_c)_{rate}$ is always negative,

$$(l_c)_{rate} = negative\ value$$

The negative change in contraction of space with time refers to expansion of space with time so we can replace $(l_c)_{rate}$ with (s_e) that refers to the value of space expansion as in the following equation,

$$s_e = -\frac{l_1 - l_2}{t'} = -\frac{(l_c)_2 - (l_c)_1}{t'}, \quad (6)$$

We define space expansion (s_e) as "the change in space contraction of the moving space itself with time with respect to the stationary space frame of reference".

It is known that space is expanded with accelerated rate as the following,

$$(s_e)_2 > (s_e)_1, \quad (7)$$

Where $(s_e)_2$ denotes the expansion of moving space that is occur after expansion of space with value $(s_e)_1$, so $[(s_e)_1, (s_e)_2]$ refer to change of space expansion with time.

$$(s_e)_2 - (s_e)_1 = positive\ \ value$$

We need first to calculate the velocity of the moving space in case of the constant rate of the space expansion

$$(s_e)_2 = (s_e)_1,$$

$$\frac{l_1 - l_2}{t'} = \frac{l_2 - l_3}{t'},$$

$$l_1 - l_2 = l_2 - l_3,$$

$$\frac{l'}{\gamma_1} - \frac{l'}{\gamma_2} = \frac{l'}{\gamma_2} - \frac{l'}{\gamma_3},$$

$$\frac{1}{\gamma_1} - \frac{1}{\gamma_2} = \frac{1}{\gamma_2} - \frac{1}{\gamma_3},$$

$$\frac{1}{\gamma_1} = \frac{1}{\gamma_2} + \frac{1}{\gamma_2} - \frac{1}{\gamma_3},$$

$$\frac{1}{\gamma_1} = \frac{2}{\gamma_2} - \frac{1}{\gamma_3},$$

$$\frac{1}{\gamma_3} = \frac{2}{\gamma_2} - \frac{1}{\gamma_1},$$

$$\sqrt{1 - \frac{v_3^2}{c^2}} = \frac{2}{\gamma_2} - \frac{1}{\gamma_1},$$

$$1 - \frac{v_3^2}{c^2} = \left(\frac{2}{\gamma_2} - \frac{1}{\gamma_1}\right)^2,$$

$$\frac{v_3^2}{c^2} = 1 - \left(\frac{2}{\gamma_2} - \frac{1}{\gamma_1}\right)^2,$$

$$v_3^2 = c^2\left(1 - \left(\frac{2}{\gamma_2} - \frac{1}{\gamma_1}\right)^2\right),$$

$$v_3 = c\sqrt{1 - \left(\frac{2}{\gamma_2} - \frac{1}{\gamma_1}\right)^2},$$

So to get accelerated rate of expansion, velocity must be lower than that value that is determined by the following equation,

$$v_3 < c\sqrt{1 - \left(\frac{2}{\gamma_2} - \frac{1}{\gamma_1}\right)^2}, \qquad (8)$$

Speed up of time with decelerated rate

The change in velocity of the empty space leads to change in values of time dilation of it with respect to the observer at the stationary space or the present space, and as the velocity of the empty space is decreased with time, time dilation of the moving empty space is decreased with time also. By this method, the observer at the stationary space finds the time of the empty space increased or speedup as the light travels from space with more dilated time to space with less dilated time.

The value of the dilated time of the moving empty space with respect to the stationary empty space can be determined as,

$$t_d = t' - t, \quad (9)$$

Where (t') denotes the time of the moving space in its frame of reference, while (t) denotes the time of the moving space with respect to the stationary space frame of reference,

$$t_d = t' - \gamma t',$$

$$t_d = t'(\gamma - 1), \quad (10)$$

So with respect to the stationary space of reference, the rate of change in time dilation of the moving space with time $(t_d)_{rate}$ is given by,

$$(t_d)_{rate} = \frac{(t_d)_2 - (t_d)_1}{t'}, \quad (11)$$

$$(t_d)_{rate} = \frac{[t'(\gamma_2 - 1)] - [t'(\gamma_1 - 1)]}{t'},$$

$$(t_d)_{rate} = \frac{(t_2 - t') - (t_1 - t')}{t'},$$

$$(t_d)_{rate} = \frac{t_2 - t' - t_1 + t'}{t'},$$

$$(t_d)_{rate} = \frac{t_2 - t_1}{t'}, \quad (12)$$

And as velocity of space decreased,,

$$v_1 > v_2,$$

We find,

$$t_1 > t_2,$$

Thus, $(t_2 - t_1)$ have negative value, so the value of the change in time dilation with time $(t_d)_{rate}$ is always negative,

$$(t_d)_{rate} = negative\ value$$

The negative change in dilation of time along timeline of the universe refers to contraction of time or speed up of time along timeline of the universe so we can replace $(t_d)_{rate}$ with (t_s) that refers to the value of time speed up as in the following equation,

$$t_s = -\frac{t_2 - t_1}{t'} = -\frac{(t_d)_2 - (t_d)_1}{t'}, \quad (13)$$

We define time speed up (t_s) as "the change in time dilation of the moving space itself along timeline of the universe with respect to the stationary space frame of reference".

And as,

$$(s_e)_2 > (s_e)_1,$$

We can get

$$\frac{l_2 - l_3}{t'} > \frac{l_1 - l_2}{t'},$$

$$\frac{l_2}{t'} - \frac{l_3}{t'} = \frac{l_1}{t'} - \frac{l_2}{t'},$$

$$\frac{l'}{\gamma_2 . t'} - \frac{l'}{\gamma_3 . t'} > \frac{l'}{\gamma_1 . t'} - \frac{l'}{\gamma_2 . t'},$$

$$\frac{l'}{t_2} - \frac{l'}{t_3} > \frac{l'}{t_1} - \frac{l'}{t_2},$$

Thus,

$$t_2 - t_3 < t_1 - t_2,$$

So,

$$\left(t_s\right)_2 < \left(t_s\right)_1, \quad (14)$$

$\left(t_s\right)_2$ denotes the speed up of time of the moving space that is occur after speed up of time of that space with value $\left(t_s\right)_1$, where $\left[\left(t_s\right)_1, \left(t_s\right)_2\right]$ refer to change of speed up of time along history of the universe.
By that Equ{14}, time speedup of the moving empty space is decreased with time. "If space is expanded with accelerated rate, time must be speed up with decelerated rate".

Methods

The theoretical analysis of this paper was performed in accordance with the observations of space expansion with accelerated rate and constancy of the speed of light, regardless of the light source motion.

References

[1] Einstein, A. Zur elektrodynamik bewegter körper.*Annalen der Physik*. **17**, 891 (1905). English translation: On the Electrodynamics of Moving Bodies by George Barker Jeffery and Wilfrid Perrett (1923); another English translation: On the Electrodynamics of Moving Bodies by Megh Nad Saha(1920).

[2] Einstein, A. Die Grundlage der allgemeinen Relativitätstheorie[The foundation of the general theory of relativity], *Annalen Der Physik* [Theory of general relativity].**49** (1916).

[3] Schwarzschild, K. Über das GravitationsfeldeinesMassenpunktesnach der Einsteinschen Theorie [On the gravitational field of a mass point according to Einstein's theory], *Sitzungsber. K. Preuss. Akad.Wiss.Phys.-Math* [Schwarzschild metric]. **Kl**, 189-196 (1916).

[4] Einstein, A., Podolsky, B. & Rosen,N. Can quantum-mechanical description of physical reality be considered complete? *Phys. Rev*.**47**,777-780 (1935).

[5] Abbott, B.P., *et al.* Tests of general relativity with GW150914 (LIGO Scientific and Virgo Collaborations). *Phys. Rev. Lett*. **116**, 221101 (2016).

[6] Minkowski, H. Raum und zeit (Space and time). *Physikalische Zeitschrift [Physical Journal]*. **10**, 75-88 (1908-1909).

[7] McEvoy, P. *Classical Theory (Theory of Interacting systems)* (MicroAnalytix, 2002).

[8] Ryder, P. *Classical Mechanics* (Shaker Verlag, GmbH, Germany, 2007).

[9] Einstein, A. *Relativity: The Special and General Theory Paperback*. Part 2 (Digireads.com; Reprint edition, 2012).

[10] Cushing, J. T. Vector Lorentz transformations. *Am. J. Phys*.**35**, 858-862 (1967).

[11] Darrigol, O. The genesis of the theory of relativity. *SéminairePoincaré [Poincaré Seminar]*, **1**, 1-22 (2005).

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of Interest

There are no conflicts of interest to declare.

Author contributions

I was responsible for all the sections in this paper. I designed the study, discussed the results, derived the equations, and wrote the manuscript.